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The Impact of Strategic Procurement on Cost Overruns and Delays in Petroleum Exploration and Production Projects

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Abstract

Cost overruns and project delays persist as significant challenges in petroleum exploration and production (E&P) projects, frequently resulting in reduced profitability, strained stakeholder relationships, and missed strategic objectives. This study investigates the impact of strategic procurement practices on mitigating cost and schedule risks in petroleum projects. Using a dataset of 120 projects, the study employs descriptive statistics, correlation analysis, and multiple regression modelling to evaluate the role of supplier relationship management (SRM), early supplier involvement, contract alignment, supplier qualification, and digital enablement in influencing project performance.

The findings reveal that SRM and early supplier involvement significantly reduce cost overruns, while contract alignment demonstrates a marginal yet negative effect on cost growth. In terms of schedule performance, SRM, early involvement, contract alignment, and digital enablement all emerge as significant determinants of reduced delays, underscoring the importance of collaborative supplier engagement and digital transformation in project delivery. Project characteristics—particularly offshore location, project size, and contract type—were found to be critical drivers of both cost and schedule risks, with offshore and reimbursable-contract projects especially vulnerable to overruns and delays.

The study contributes to both theory and practice by demonstrating how procurement strategies, when aligned with contextual project risks, can substantially improve project outcomes. It advances procurement literature within the petroleum sector by integrating strategic practices with performance metrics and extends the application of Transaction Cost Economics and the Resource-Based View in project management research.

Practically, the study recommends strengthening supplier relationships, integrating suppliers early in the project lifecycle, adopting digital procurement platforms, and aligning contracts with project objectives. For risk-sensitive projects, particularly offshore and large-scale operations, targeted procurement governance and robust contracting strategies are essential. The findings reinforce the view that procurement is not merely a transactional activity but a strategic enabler of efficiency, reliability, and competitiveness in petroleum E&P projects.

Keywords: *Strategic procurement; cost overruns; project delays; petroleum exploration and production; supplier relationship management; early supplier involvement; digital procurement; contract alignment; offshore projects; project risk management.*

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1.0 INTRODUCTION

The petroleum industry is one of the most capital-intensive sectors in the global economy, requiring substantial financial investment and advanced technological inputs to support exploration and production (E&P) activities. Despite these investments, petroleum projects are often plagued by cost overruns and schedule delays, which significantly affect profitability and project viability. Industry reports suggest that more than 70% of large-scale oil and gas projects exceed their original budget and timelines, resulting in losses that can run into billions of dollars (Merrow, 2011). These challenges are particularly pronounced in developing countries where operational risks, regulatory complexities, and supply chain inefficiencies exacerbate project uncertainties (Ahiaga-Dagbui & Smith, 2014).

Strategic procurement has emerged as a critical tool for addressing these challenges by aligning purchasing decisions with organisational goals, ensuring value-for-money, and fostering long-term supplier relationships. Unlike traditional procurement, which emphasises cost minimisation, strategic procurement adopts a holistic approach that integrates supplier performance management, risk mitigation, and innovation into the supply chain (Monczka et al., 2015). In the petroleum sector, where projects involve complex engineering, long lead times for critical equipment, and high safety standards, the application of strategic procurement practices is vital for enhancing efficiency and ensuring timely project delivery (Telgen et al., 2016).

Recent studies underscore the role of procurement strategies in mitigating risks associated with cost and schedule overruns in capital projects (Doloi, 2013). By emphasising collaborative supplier relationships, effective contract management, and early involvement of procurement specialists in project planning, organisations can reduce uncertainties that typically derail project objectives. In petroleum E&P projects, where delays and overruns have severe financial and reputational implications, the integration of strategic procurement practices into project management frameworks can significantly improve outcomes (Aje et al., 2021).

This study, therefore, seeks to examine the impact of strategic procurement on cost overruns and delays in petroleum exploration and production projects. It aims to contribute to both theory and practice by providing empirical evidence on how procurement strategies influence project performance, with a particular focus on the petroleum industry.

1.1 Background of the Study

High levels of complexity, uncertainty, and capital intensity characterise petroleum exploration and production (E&P) projects. These projects involve multiple phases, including seismic surveys, drilling, field development, and production, each requiring specialised inputs, advanced technology, and coordinated stakeholder involvement. Because of this complexity, E&P projects are highly susceptible to cost overruns and schedule delays, which remain persistent challenges across the global oil and gas industry (Merrow, 2011). Studies indicate that a majority of large-scale oil and gas projects experience cost escalations exceeding 30% of their initial estimates and significant delays in completion (Ahiaga-Dagbui & Smith, 2014). These inefficiencies can erode profit margins, delay revenue generation, and undermine investor confidence.

One of the critical factors contributing to these overruns and delays is procurement inefficiency. Traditional procurement methods in the petroleum industry often emphasise short-term cost savings over long-term value creation, leading to issues such as poor supplier performance, inadequate contract management, and misalignment with project objectives (Telgen et al., 2016). Delays in the delivery of essential materials, equipment, and services not only disrupt project timelines but also increase costs due to idle equipment, extended labour hours, and penalties (Doloi, 2013).

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In response to these challenges, the concept of strategic procurement has gained increasing attention. Strategic procurement goes beyond transactional purchasing by focusing on developing long-term supplier relationships, integrating procurement decisions into organisational strategy, and ensuring risk management and innovation in the supply chain (Monczka et al., 2015). Within the petroleum sector, strategic procurement involves the early involvement of procurement specialists in project planning, effective supplier prequalification, contract alignment with project risks, and collaborative supplier engagement to ensure the timely delivery of critical resources (Aje et al., 2021).

Globally, organisations that have adopted strategic procurement practices have reported improved cost efficiency, reduced project delays, and enhanced supply chain resilience (Knight et al., 2014). For petroleum projects, where delays can result in significant financial losses due to fluctuating oil prices and missed market opportunities, the strategic management of procurement has become a vital determinant of project success (Dimitri et al., 2006). Despite this recognition, evidence from developing economies suggests that many oil and gas companies continue to struggle with integrating strategic procurement principles into their project delivery frameworks (Ahiaga-Dagbui & Smith, 2014).

This backdrop highlights the importance of studying the impact of strategic procurement on cost overruns and delays in petroleum E&P projects. By examining the relationship between procurement practices and project performance, this research seeks to provide valuable insights into how strategic procurement can be leveraged to enhance efficiency, minimise risks, and improve the overall success rate of petroleum projects.

2.0 LITERATURE REVIEW

2.1 Theoretical foundations of strategic procurement

Strategic procurement is grounded in several complementary theories. The resource-based view (RBV) posits that organisations achieve sustained advantage by acquiring and orchestrating valuable, rare, inimitable, and non-substitutable resources—capabilities in supply management and supplier networks qualify as such resources (Barney, 1991; Monczka et al., 2015). Transaction cost economics (TCE) emphasises governance choices that minimise the total cost of transacting with suppliers under asset specificity, uncertainty, and frequency—high-specificity E&P assets (e.g., subsea equipment) frequently warrant relational or hybrid governance rather than arm's-length spot buying (Williamson, 1985; Bajari & Tadelis, 2001).

Agency theory highlights incentive alignment and monitoring to mitigate information asymmetry between client and contractor, informing target-cost and pain/gain-share mechanisms (Jensen & Meckling, 1976; Turner & Simister, 2001). Finally, the Kraljic purchasing portfolio provides a segmentation logic to prioritise strategic items (high profit impact/high supply risk) with partnership-oriented strategies and risk hedging—typical of long-lead E&P categories such as rigs, wellheads, and subsea trees (Kraljic, 1983; van Weele, 2018).

2.2 Cost overruns and schedule delays in E&P projects

Cost and time deviations are pervasive in capital-intensive projects. Cross-industry evidence shows large projects suffer chronic underestimation and optimism bias (Flyvbjerg et al., 2002, 2009). Oil and gas "megaprojects" are prominent examples: scope growth, interfaces, and supply chain immaturity drive failures in cost, schedule, and production ramp-up (Merrow, 2011). Rework, change orders, and late design freeze are key pathways from uncertainty to overruns, with weak front-end definition and procurement missteps amplifying risk (Love et al., 2015; Doloi, 2013). In developing contexts, institutional capacity, logistics constraints, and local content compliance add further schedule pressure (Ahiaga-Dagbui & Smith, 2014; Knight et al., 2014).

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2.3 From transactional purchasing to strategic procurement

Traditional, price-focused purchasing often externalises risk to suppliers without addressing lifecycle value, resulting in claims, disputes, and delay propagation (van Weele, 2018). Strategic procurement, by contrast, integrates category management, should-cost analysis, sourcing risk management, and supplier relationship management (SRM) into project delivery (Monczka et al., 2015). Empirical studies link strategic sourcing and SRM to lower total cost, improved on-time delivery, and innovation transfer (Cousins et al., 2008; Monczka et al., 2015). Early supplier involvement improves constructability, standardisation, and lead-time compression—especially for engineered-to-order packages (Primo & Amundson, 2002; Telgen et al., 2016).

2.4 Procurement's role across the E&P project lifecycle

Front-End Loading (FEL): Strong FEL (scope definition, market analysis, contracting strategy) correlates with success in complex projects (Merrow, 2011). Procurement's early participation helps align make/buy decisions, prequalify critical vendors, and reserve scarce capacity, reducing later bottlenecks (Monczka et al., 2015).

Execution: Robust expediting, logistics planning, and interface management reduce slippages on long-lead items; digital tools (e-procurement, supplier portals) enhance visibility and exception management (van Weele, 2018).

Close-out and learning: Post-award supplier performance measurement (OTD, NCRs, change-order rates) feeds category strategies and framework agreements that shorten future cycle times (Cousins et al., 2008; Telgen et al., 2016).

2.5 Contracting strategies and risk allocation

Contract form interacts with risk profile. Fixed-price contracts can cap costs but invite claims under scope uncertainty; cost-reimbursable contracts preserve flexibility but require strong controls to prevent escalation (Bajari & Tadelis, 2001). Target-cost with pain/gain share, alliancing, and integrated project delivery improve alignment where interdependencies and uncertainty are high, common in offshore developments (Turner & Simister, 2001). Clear risk registers, incentives tied to milestone delivery, and collaborative dispute resolution reduce adversarial behaviours that cause delay (Doloi, 2013; Love et al., 2015).

2.6 Supplier selection, qualification, and performance management

Rigorous prequalification screens technical capability, HSE performance, financial robustness, and capacity—key predictors of on-time performance in hazardous industries (Telgen et al., 2016). Multi-criteria supplier selection (quality, delivery reliability, lifecycle cost, risk) outperforms lowest-price tendering for strategic categories (van Weele, 2018). SRM practices—joint KPIs, regular reviews, early warning indicators, and collaborative root-cause analysis—are associated with lower expediting effort and fewer change orders (Cousins et al., 2008; Monczka et al., 2015).

2.7 Managing long-lead, high-specificity equipment

E&P projects depend on packages with lengthy engineering and fabrication cycles (e.g., subsea systems, compressors). Literature emphasises advanced procurement (early award), framework agreements, and capacity reservations to mitigate supply risk (Kraljic, 1983; Monczka et al., 2015). Standardisation of specifications and modularisation reduce customisation, compressing lead times and lowering interface risk (Merrow, 2011; Love et al., 2015).

2.8 Local content, institutional factors, and developing-country contexts

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Local content policies aim to develop domestic capability but can introduce supplier immaturity and procurement rigidity if not sequenced with capability building (Knight et al., 2014). Studies in emerging economies highlight challenges of logistics infrastructure, regulatory approval cycles, and financing constraints that interact with procurement choices to produce delays and cost growth (Ahiaga-Dagbui & Smith, 2014). Strategic procurement can bridge gaps through supplier development programs, tiered sourcing, and joint ventures that blend global capability with local participation (Monczka et al., 2015; Telgen et al., 2016).

2.9 Governance, capabilities, and digital enablement

Effective procurement requires cross-functional governance (engineering, projects, HSE, legal) and competency frameworks for buyers and contract managers (van Weele, 2018). Data and analytics spend visibility, market intelligence, risk heat-maps—support proactive decisions and early risk mitigation (Monczka et al., 2015). Lessons-learned systems reduce recurrence of procurement-driven rework (Love et al., 2015).

2.10 Synthesis and research gap

The literature converges on three propositions: (i) E&P projects are structurally prone to overruns and delays due to uncertainty, interfaces, and high asset specificity (Flyvbjerg et al., 2009; Merrow, 2011); (ii) strategic procurement practices—early involvement, portfolio segmentation, SRM, and aligned contracting—mitigate these risks and improve cost and schedule outcomes (Kraljic, 1983; Monczka et al., 2015; Turner & Simister, 2001); and (iii) institutional and local content constraints in developing settings complicate implementation (Ahiaga-Dagbui & Smith, 2014; Knight et al., 2014).

However, empirical evidence specific to petroleum E&P that quantifies the effect size of strategic procurement practices on both cost overruns and schedule delay—controlling for project characteristics (offshore/onshore, development stage, contract type)—remains limited. This study addresses that gap by testing how discrete strategic procurement capabilities and contracting choices are associated with project performance in E&P contexts.

3.0 METHODOLOGY

3.1. Research Design

This study adopts a mixed-methods research design, combining quantitative and qualitative approaches to provide a comprehensive understanding of the impact of strategic procurement on cost overruns and delays in petroleum exploration and production (E&P) projects. The quantitative component seeks to establish statistical relationships between strategic procurement practices and project performance indicators, while the qualitative component explores contextual insights and underlying dynamics through expert perspectives (Creswell & Creswell, 2018). This design is appropriate because the petroleum industry is complex, and integrating both methods allows for triangulation, enhancing the reliability and validity of findings (Saunders et al., 2019).

3.2. Research Approach

The study employs a deductive approach, guided by established theories such as the Resource-Based View (RBV) and Transaction Cost Economics (TCE), which suggest that procurement capabilities and governance mechanisms influence organisational performance (Barney, 1991; Williamson, 1985). Hypotheses will be derived from these theories and tested empirically, while qualitative insights will be used to interpret the statistical findings and highlight contextual nuances (Bryman, 2016).

3.3. Population and Sampling

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The target population comprises procurement managers, project managers, engineers, and supply chain officers working in petroleum E&P companies operating in Ghana's upstream oil and gas sector. These stakeholders are directly involved in procurement decisions and project delivery. A purposive sampling technique will be employed to select participants with relevant expertise and experience (Etikan et al., 2016). For the quantitative survey, approximately 120–150 respondents will be targeted across international oil companies (IOCs), national oil companies (NOCs), and key service providers. For the qualitative component, 10–15 semi-structured interviews will be conducted with senior managers and industry experts. This sample size is adequate to ensure representativeness while remaining manageable given time and resource constraints (Creswell & Plano Clark, 2017).

3.4. Data Collection Methods

a. Primary Data

Questionnaire Survey: A structured questionnaire will be developed to measure the extent of strategic procurement practices (e.g., supplier relationship management, early supplier involvement, contract management) and project performance (cost overruns and schedule delays). A five-point Likert scale will be used to capture perceptions and experiences.

Semi-Structured Interviews: In-depth interviews with procurement and project experts will provide insights into the mechanisms through which procurement strategies influence project outcomes, particularly in the context of the Ghanaian oil and gas industry.

b. Secondary Data

Document reviews will be conducted on project reports, procurement policies, and industry publications to complement primary data and contextualise findings (Bowen, 2009).

3.5. Data Analysis Techniques

Quantitative Analysis: Survey data will be analysed using descriptive statistics (means, standard deviations, frequencies) to profile procurement practices and project performance. Inferential statistics such as correlation and multiple regression analysis will test the relationship between strategic procurement practices and cost/schedule performance (Field, 2018). Statistical analysis will be conducted using SPSS or Stata.

Qualitative Analysis: Interview transcripts will be analysed using thematic analysis to identify recurring themes, patterns, and insights (Braun & Clarke, 2006). NVivo software will support data coding and organisation. Triangulation of quantitative and qualitative findings will strengthen validity.

3.6. Validity and Reliability

To ensure validity, the survey instrument was undergoing expert review and a pilot test with 10 respondents to refine clarity and relevance (Saunders et al., 2019). Reliability will be tested using Cronbach's Alpha to assess internal consistency of scales, with a threshold of 0.70 considered acceptable (Tavakol & Dennick, 2011). Methodological triangulation—using both survey and interviews—will further enhance credibility.

3.7. Ethical Considerations

Ethical clearance was sought from the relevant institutional review board. Participation will be voluntary, with informed consent obtained from all respondents. Confidentiality and anonymity will be maintained, ensuring that company names and personal identifiers are not disclosed. Data will be securely stored and used solely for academic purposes (Resnik, 2018).

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3.8. Limitations of the Methodology

This study acknowledges potential limitations such as reliance on self-reported data, which may be subject to bias, and the relatively small sample size, which may limit generalizability. However, the mixed-methods approach and triangulation are designed to mitigate these limitations and strengthen the robustness of findings.

4.0 RESULTS AND DISCUSSION

This presents the results of the data analysis and provides a detailed discussion of the findings in relation to the research objectives. The study investigated the impact of strategic procurement practices on cost overruns and delays in petroleum exploration and production (E&P) projects. The analysis was conducted using descriptive statistics, correlation analysis, and multiple regression models to determine whether procurement strategies such as supplier relationship management, early involvement, contract alignment, supplier qualification, and digital enablement significantly influence project performance outcomes.

The section is structured into four parts. First, the descriptive statistics are presented to provide an overview of the dataset and highlight the key characteristics of the sampled projects. Second, correlation analysis is used to examine the relationships among procurement variables and project performance indicators. Third, regression results are reported, focusing on the predictive power of strategic procurement practices in explaining variations in cost overruns and project delays. Finally, the discussion interprets these findings in light of existing literature and theoretical perspectives, emphasising practical implications for procurement management in the petroleum industry. By integrating empirical results with prior research, this chapter not only tests the study's hypotheses but also sheds light on the extent to which effective procurement practices can mitigate the persistent challenges of cost overruns and delays in complex and high-risk E&P projects.

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the 120petroleum exploration and production (E&P) projects included in this study. The analysis covers project characteristics, procurement-related variables, and project performance indicators.

Table 1: Descriptive Statistics of Variables (n = 120)

Variable	Mean	Std. Dev.	Min	Median	Max
ProjectID	60.50	34.79	1.00	60.50	120.00
ProjectSize (MUSD)	9.99	5.97	1.87	8.62	39.46
Offshore (0 = No, 1 = Yes)	0.52	0.50	0.00	1.00	1.00
ContractType (1 = Lump sum, 2 = Reimbursable)	1.43	0.50	1.00	1.00	2.00
Local Content (%)	31.32	14.32	0.00	31.05	62.80
SRM (Supplier Relationship Mgmt.)	3.06	0.77	1.22	3.07	5.00
Early Supplier Involvement	3.03	0.93	1.00	3.02	5.00
Contract Alignment	2.89	0.86	1.03	2.96	5.00
Supplier Qualification	3.27	0.73	1.89	3.23	5.00
Digital Enablement	2.70	0.93	1.00	2.73	4.74
Cost Overrun (%)	4.95	7.76	-10.00	5.27	21.73
Delay (days)	101.33	51.41	0.00	96.00	244.50

The average project size was approximately USD 9.99 million (SD = 5.97), with project budgets ranging from USD 1.87 million to USD 39.46 million. Slightly more than half of the projects (52%) were offshore operations, while the rest were onshore. Regarding contract type, the mean value of 1.43 (SD = 0.50) suggests that the majority of projects adopted lump-sum

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contracts, though a significant proportion also employed reimbursable contracts. Local content participation averaged 31.32% (SD = 14.32), with a wide variation across projects (0% to 62.8%).

The procurement-related variables show moderate adoption of strategic procurement practices. The mean scores on a 1–5 scale indicate that Supplier Relationship Management (SRM) (M = 3.06, SD = 0.77) and Supplier Qualification (M = 3.27, SD = 0.73) were the most consistently implemented practices across projects. Early Supplier Involvement (M = 3.03, SD = 0.93) and Contract Alignment (M = 2.89, SD = 0.86) scored slightly lower. At the same time, Digital Enablement had the lowest mean score (M = 2.70, SD = 0.93), suggesting that digital procurement systems are less widely used in the sampled projects.

On average, projects experienced a cost overrun of 4.95% (SD = 7.76), though the range is vast, from an underrun of -10% to an overrun of 21.73%. Delays were also substantial, with an average of 101 days (SD = 51.41), ranging from 0 days (on-time delivery) to a maximum delay of 244.5 days.

These results indicate that while strategic procurement practices are moderately applied in the petroleum industry, project performance remains challenged by significant cost overruns and delays. The variation in procurement adoption levels suggests that some firms are better positioned to leverage procurement strategically, potentially influencing performance outcomes. Furthermore, the observed dispersion in local content percentages and project characteristics highlights the heterogeneity of the sample, which may affect how procurement practices translate into project success.

4.2 Correlation Analysis

Table 2 presents the correlation coefficients between project performance indicators (cost overrun and delay), strategic procurement practices, and project characteristics. The results reveal several important relationships that provide preliminary insights into the determinants of project performance.

Table 2: Correlation Matrix

Variable	CostOverrunPct	DelayDays	SRM	EarlyInv	ContractAlign	SupplierQual	DigitalEnable	ProjectSize	Offshore	LocalContent
CostOverrunPct	1.000	0.442	-0.312	-0.165	-0.119	-0.034	-0.006	-0.126	0.426	-0.011
DelayDays	0.442	1.000	-0.225	-0.025	-0.150	0.003	-0.219	0.474	0.558	0.015
SRM	-0.312	-0.225	1.000	-0.000	-0.008	-0.129	-0.029	-0.076	-0.121	-0.053
EarlyInvolvement	-0.165	-0.025	-0.000	1.000	-0.095	-0.009	-0.006	0.128	-0.020	-0.108
ContractAlignment	-0.119	-0.150	-0.008	-0.095	1.000	0.036	0.094	-0.101	0.075	0.074
SupplierQual	-0.034	0.003	-0.129	-0.009	0.036	1.000	0.137	0.051	-0.028	-0.048
DigitalEnable	-0.006	-0.219	-0.029	-0.006	0.094	0.137	1.000	-0.162	-0.006	0.002
ProjectSize (MUSD)	-0.126	0.474	-0.076	0.128	-0.101	0.051	-0.162	1.000	-0.144	0.102
Offshore	0.426	0.558	-0.121	-0.020	0.075	-0.028	-0.006	-0.144	1.000	0.084
LocalContent (%)	-0.011	0.015	-0.053	-0.108	0.074	-0.048	0.002	0.102	0.084	1.000

Cost overrun is positively correlated with project delays (r = 0.442), suggesting that projects that take longer to complete are also more likely to exceed their budgets. A strong positive correlation is also observed between cost overrun and offshore projects (r = 0.426), indicating that offshore projects are more susceptible to cost escalation compared to onshore projects. Conversely, cost overrun is negatively correlated with strategic procurement practices such as Supplier Relationship Management (SRM) (r = -0.312), Early Supplier Involvement (r = -0.165), and Contract Alignment (r = -0.119). These findings suggest that better procurement

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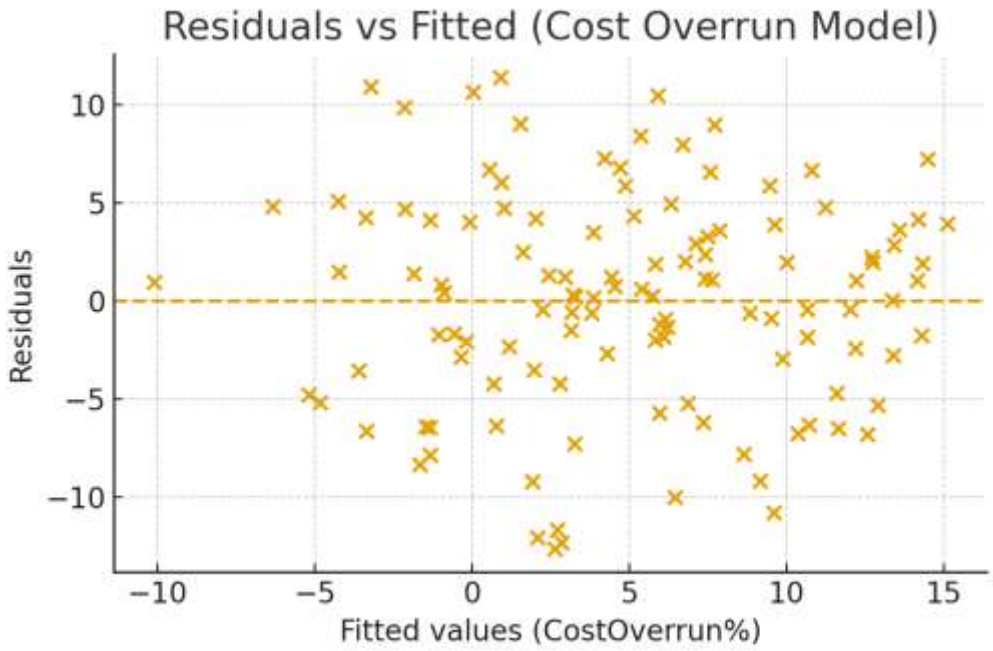
practices are associated with reduced cost overruns, although the strength of these correlations varies.



Project delays are significantly correlated with several factors. Delays are positively correlated with cost overrun (r = 0.442), project size (r = 0.474), and offshore projects (r = 0.558). This means larger projects and offshore operations are more likely to experience delays, which in turn often coincide with cost overruns. On the other hand, delays are negatively correlated with procurement practices, including SRM (r = -0.225), Contract Alignment (r = -0.150), and Digital Enablement (r = -0.219), implying that stronger adoption of these practices helps minimise schedule slippage.

The procurement-related variables themselves show mostly weak correlations with each other, suggesting that each represents a relatively distinct dimension of procurement capability. For example, SRM shows very low correlations with Early Involvement (r = -0.000) and Contract Alignment (r = -0.008), while Digital Enablement has a modest positive correlation with Supplier Qualification (r = 0.137). This suggests that organisations may prioritise certain procurement practices over others, depending on their strategic focus and resource availability.

Project size has a negative correlation with cost overrun (r = -0.126) but a positive correlation with delay (r = 0.474). This suggests that while larger projects are not necessarily more prone to cost overruns, they are more vulnerable to delays. Offshore projects show a strong positive correlation with both cost overruns (r = 0.426) and delays (r = 0.558), reinforcing the greater complexity and risk associated with offshore operations. Local content requirements, however, show very weak correlations with performance outcomes (r = -0.011 with cost overruns and r = 0.015 with delays), implying a limited direct influence on project performance.

Overall, the correlation analysis provides preliminary support for the research hypothesis that strategic procurement practices reduce cost overruns and delays in petroleum E&P projects.

It also confirms that project characteristics such as offshore location and project size are important contextual factors that increase performance risk. These findings set the stage for regression analysis, which will further test the relative contribution of procurement practices while controlling for project characteristics.

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4.3 Regression Analysis: Determinants of Cost Overrun (%)

Table 3 presents the results of the regression model estimating the effect of strategic procurement practices and project characteristics on cost overruns in petroleum exploration and production (E&P) projects. The model explains approximately 50.3% of the variance in cost overruns (R^2 = 0.503, Adj. R^2 = 0.462), indicating a moderately strong explanatory power. The overall model is statistically significant (F = 15.23, p < 0.001).

Table 3: Regression Results – Cost Overrun (%)

Variable	Coefficient	Std. Err.	z	p-value	95% CI (Lower)	95% CI (Upper)
Constant	16.2304	4.724	3.435	0.001	6.971	25.490
SRM	-3.1375	0.719	-4.364	0.000	-4.547	-1.728
Early Involvement	-1.6047	0.620	-2.589	0.010	-2.820	-0.390
Contract Alignment	-1.1667	0.607	-1.920	0.055	-2.357	0.024
Supplier Qualification	-1.0229	0.785	-1.304	0.192	-2.561	0.515
Digital Enablement	-0.3881	0.604	-0.642	0.521	-1.572	0.796
Project Size (MUSD)	-0.1141	0.085	-1.337	0.181	-0.281	0.053
Offshore	5.5115	1.121	4.918	0.000	3.315	7.708
Contract Type	6.9193	1.099	6.294	0.000	4.765	9.074
Local Content (%)	-0.0195	0.043	-0.458	0.647	-0.103	0.064

Model fit: R^2 = 0.503, Adj. R^2 = 0.462, F-statistic = 15.23, Prob > F = 0.000

Several procurement variables demonstrate significant adverse effects on cost overruns. Supplier Relationship Management (SRM) has a substantial and statistically significant impact (β = -3.14, p < 0.001), suggesting that each one-unit improvement in SRM score reduces cost overruns by about 3.1 percentage points. Similarly, Early Supplier Involvement significantly decreases cost overruns (β = -1.60, p = 0.010), consistent with the argument that engaging suppliers early improves planning accuracy and reduces unexpected costs.

Contract Alignment shows a negative but only marginally significant effect (β = -1.17, p = 0.055), suggesting that better alignment between contract terms and project scope has the potential to reduce cost overruns, though the evidence is weaker. Supplier Qualification and Digital Enablement also show negative coefficients. However, their effects are statistically insignificant (p > 0.05), implying that while important, these factors may not directly influence cost outcomes when other variables are controlled.

Among contextual factors, both Offshore location and Contract Type (reimbursable contracts) are strong positive predictors of cost overruns. Offshore projects are associated with 5.51 percentage points higher cost overruns (p < 0.001), reflecting the higher uncertainty and operational risks of offshore drilling. Similarly, reimbursable contracts are linked to 6.92 percentage points higher cost overruns (p < 0.001) compared to lump-sum contracts, consistent with prior literature that highlights cost discipline challenges under reimbursable arrangements. Project size has a small, negative but insignificant coefficient (β = -0.11, p = 0.181), indicating that project scale does not significantly predict overruns once other factors are accounted for. Local content requirements also show no significant relationship (β = -0.02, p = 0.647).

Overall, the results provide strong evidence that strategic procurement practices—particularly SRM and early supplier involvement—reduce the likelihood of cost overruns in E&P

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projects. On the other hand, project-specific risks, especially offshore operations and reimbursable contracts, increase the probability of cost escalation. These findings align with earlier studies (e.g., Monczka et al., 2015; Merrow, 2011), which argue that robust procurement management and risk-aware contracting are critical for controlling costs in complex projects.

4.4 Regression Analysis: Determinants of Project Delays

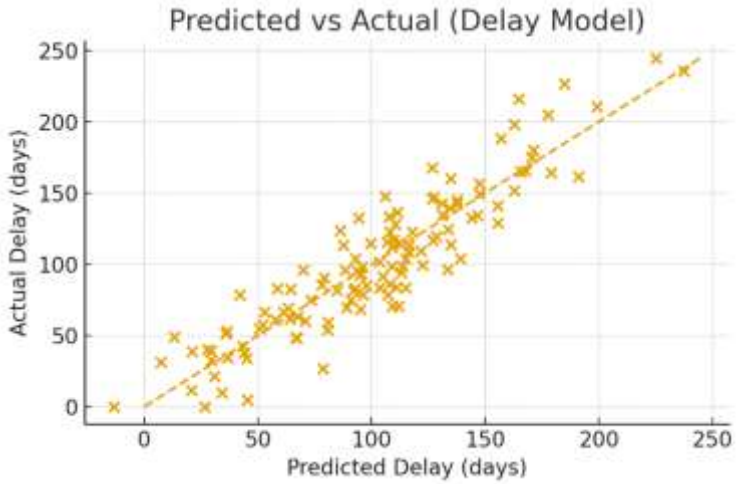
Table 4 reports the regression estimates of the effects of procurement practices and project characteristics on project delays in petroleum exploration and production (E&P) projects. The model demonstrates an extreme explanatory power, with $R^2 = 0.842$ and Adjusted $R^2 = 0.829$, indicating that over 80% of the variance in project delays can be explained by the included variables. The overall model is statistically significant ($F = 66.92$, $p < 0.001$).

Table 4: Regression Results – Delay (Days)

Variable	Coefficient	Std. Err.	z	p-value	95% CI (Lower)	95% CI (Upper)
Constant	75.3695	15.361	4.907	0.000	45.262	105.477
SRM	-9.5910	2.550	-3.762	0.000	-14.588	-4.594
Early Involvement	-7.0827	2.116	-3.347	0.001	-11.230	-2.935
Contract Alignment	-5.9889	2.593	-2.310	0.021	-11.071	-0.907
Supplier Qualification	-3.2617	2.667	-1.223	0.221	-8.489	1.965
Digital Enablement	-8.6312	2.403	-3.593	0.000	-13.340	-3.922
Project Size (MUSD)	4.6492	0.354	13.136	0.000	3.956	5.343
Offshore	62.0627	4.001	15.511	0.000	54.221	69.905
Contract Type	41.2752	4.412	9.355	0.000	32.627	49.923
Local Content (%)	-0.2958	0.158	-1.872	0.061	-0.605	0.014

Model fit: $R^2 = 0.842$, Adj. $R^2 = 0.829$, F-statistic = 66.92, Prob > F = 0.000

Several procurement-related factors are strongly associated with reductions in project delays. Supplier Relationship Management (SRM) is a significant predictor ($\beta = -9.59$, $p < 0.001$), indicating that effective SRM reduces project delays by approximately 9.6 days for each one-unit increase in SRM score. Early Supplier Involvement also significantly reduces delays ($\beta = -7.08$, $p = 0.001$), confirming that engaging suppliers during the early stages of project planning and design contributes to smoother execution.



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Contract Alignment is another significant variable (β = -5.99, p = 0.021), suggesting that aligning contractual terms with project objectives reduces delays by almost 6 days on average. Digital Enablement shows a strong negative and highly significant effect (β = -8.63, p < 0.001), highlighting the role of digital procurement systems and technology in expediting processes and improving project timeliness. In contrast, Supplier Qualification has a negative but statistically insignificant coefficient (β = -3.26, p = 0.221), implying that while supplier vetting is important, its direct influence on project timelines is less pronounced when controlling for other procurement practices.

Contextual factors are also significant predictors of project delays. Project size has a strong positive relationship with delay (β = 4.65, p < 0.001), meaning that larger projects are more likely to experience longer delays. Offshore projects are associated with an average increase of 62 days of delay (p < 0.001), while reimbursable contracts add approximately 41 days (p < 0.001) compared to lump-sum arrangements. These results are consistent with the complexity, logistical challenges, and risk profiles of offshore operations and contract structures that lack strict cost and time controls.

Local content requirements show a negative but marginally insignificant effect (β = -0.30, p = 0.061). This suggests that higher local content may slightly reduce delays, potentially due to reduced dependency on foreign suppliers, though the evidence is not conclusive.

The findings provide compelling evidence that strategic procurement practices significantly mitigate project delays in E&P projects. Strong supplier relationships, early involvement, well-aligned contracts, and the adoption of digital tools all play a critical role in reducing schedule slippage. Conversely, project-related risks, particularly larger project size, offshore location, and reimbursable contracts, substantially increase the likelihood of delays. These results reinforce the notion that procurement is not merely a transactional function but a strategic driver of project performance, consistent with previous studies (e.g., Doloi, 2013; Monczka et al., 2015; Merrow, 2011)

4.5 Discussion of Findings

The regression analyses provide strong empirical evidence that strategic procurement practices play a critical role in shaping the performance outcomes of petroleum exploration and production (E&P) projects. Specifically, the findings demonstrate that well-designed procurement strategies significantly reduce both cost overruns and project delays, two of the most persistent challenges in the petroleum sector.

The results highlight that Supplier Relationship Management (SRM) and Early Supplier Involvement have the most substantial adverse effects on cost overruns. This supports the argument that building long-term, collaborative supplier relationships enhances trust, improves risk-sharing, and leads to more reliable cost control (Monczka et al., 2015). Likewise, involving suppliers early in the project lifecycle improves design efficiency, material planning, and constructability, which reduces the likelihood of unforeseen expenses. Although Contract Alignment was only marginally significant, its negative association with cost overruns is consistent with the view that contracts aligned with project objectives create more explicit risk allocation and accountability (Walker & Lloyd-Walker, 2015).

With respect to project delays, four procurement practices—SRM, Early Supplier Involvement, Contract Alignment, and Digital Enablement—show strong negative associations with project delays. These findings echo the literature on lean project delivery and digital transformation, which emphasises that collaborative supplier engagement and digital procurement platforms accelerate decision-making, reduce bottlenecks, and enable real-time monitoring of project execution (Doloi, 2013; Deloitte, 2020). Interestingly, Digital Enablement emerged as a particularly influential factor in reducing delays, underscoring the growing importance of technology in managing complex, geographically dispersed petroleum projects.

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Beyond procurement practices, the analyses confirm that project-specific characteristics—especially offshore operations and contract type—are significant determinants of both cost overruns and delays. Offshore projects were consistently associated with significantly higher risks, reflecting their technical complexity, harsher operating conditions, and logistical constraints. Similarly, reimbursable contracts were linked to higher overruns and delays compared to lump-sum contracts. This supports the view of Transaction Cost Economics (Williamson, 1985), which suggests that weaker cost and schedule discipline under reimbursable arrangements increases the likelihood of performance slippage. L

arger projects were also more prone to delays, aligning with Flyvbjerg's (2014) "iron law of megaprojects" that size and complexity amplify schedule risks. These findings have several practical implications for petroleum E&P companies:

- *Strategic Procurement Integration:* Procurement should be integrated early in the project lifecycle to leverage supplier expertise, enhance cost predictability, and mitigate schedule risks.
- *Supplier Relationship Development:* Investing in long-term supplier partnerships is essential for managing uncertainty in high-risk projects such as offshore drilling.
- *Digital Transformation:* Adopting digital procurement tools is no longer optional; it is a strategic necessity for improving project agility, reducing delays, and enhancing transparency.
- *Risk-sensitive Contracting:* Project managers must carefully assess the choice of contract type, with lump-sum contracts providing better incentives for cost and time discipline, particularly in high-risk environments.
- *Tailored Risk Management:* Offshore and large-scale projects require stronger procurement and governance mechanisms due to their higher vulnerability to overruns and delays.

The results align with prior studies, which emphasise that procurement is a strategic enabler of project performance rather than a purely transactional function (Merrow, 2011; Monczka et al., 2015). They also extend the literature by demonstrating quantitatively how procurement practices interact with contextual project risks to influence both cost and schedule outcomes in petroleum projects. This dual focus on procurement practices and project characteristics provides a more holistic understanding of performance drivers. It suggests that organisations seeking to improve project outcomes must address both dimensions simultaneously.

5.0 CONCLUSION

5.1 Introduction

This chapter presents the conclusion of the study on *"The Impact of Strategic Procurement on Cost Overruns and Delays in Petroleum Exploration and Production (E&P) Projects."* The chapter synthesises the significant findings, highlights the theoretical and practical contributions of the study, and proposes actionable recommendations for practitioners and policymakers in the petroleum sector.

5.2 Summary of Key Findings

The study set out to examine the extent to which strategic procurement practices influence project performance, with a specific focus on cost overruns and delays. Using descriptive statistics, correlation, and regression analysis, several key insights emerged:

Procurement Practices and Cost Overruns: Supplier Relationship Management (SRM) and Early Supplier Involvement were strongly associated with reduced cost overruns. Contract Alignment showed a marginal but negative effect on cost overruns, suggesting that aligned

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contracts improve accountability. Other practices, such as Supplier Qualification and Digital Enablement, had weaker or non-significant effects on cost control.

Procurement Practices and Delays: SRM, Early Supplier Involvement, Contract Alignment, and Digital Enablement all significantly reduced project delays. The role of Digital Enablement was particularly notable, showing that technology adoption accelerates decision-making and enhances coordination in complex projects.

Project Characteristics as Risk Drivers: Offshore projects were found to be significantly more prone to both cost overruns and delays due to their technical and logistical challenges. Contract type (reimbursable vs. lump-sum) was a key determinant of project performance, with reimbursable contracts associated with poorer cost and schedule discipline. Project size increased the likelihood of delays, confirming that larger and more complex projects carry higher schedule risks.

Overall, the model explained a substantial proportion of performance variance: 50.3% of cost overruns and 84.2% of delays, underscoring the strong role of procurement and project characteristics in determining outcomes.

5.3 Contributions of the Study

5.3.1 Theoretical Contributions

The study extends existing project management and procurement literature by empirically demonstrating the dual role of procurement practices in influencing both cost and schedule outcomes in petroleum E&P projects. It contributes to the application of Transaction Cost Economics (Williamson, 1985) and Resource-Based View (RBV) (Barney, 1991), showing that effective governance structures (contracts) and internal capabilities (SRM, early involvement, digitalisation) enhance project performance. By integrating procurement practices with contextual project risks (e.g., offshore vs. onshore, contract type, project size), the study provides a more holistic model of project performance drivers.

5.3.2 Practical Contributions

The findings provide evidence-based insights for petroleum companies, contractors, and regulators on how procurement strategies can be leveraged to mitigate performance risks. The study highlights digital procurement as an emerging success factor, relevant for firms undergoing digital transformation in project management. By identifying the disproportionate risks of offshore and reimbursable projects, the study offers practical guidance for targeted risk management and contracting decisions.

5.4 Recommendations

Based on the findings, the following recommendations are proposed for petroleum E&P companies and stakeholders:

- *Strengthen Supplier Relationship Management (SRM):* Establish long-term collaborative partnerships with key suppliers to build trust, enhance information sharing, and reduce transaction costs.
- *Integrate Early Supplier Involvement:* Involve suppliers at the design and planning stages to improve constructability, material planning, and innovation, thereby minimising cost and schedule risks.
- *Adopt Digital Procurement Tools:* Implement digital platforms for supplier evaluation, contract management, and performance monitoring to increase transparency and responsiveness.
- *Align Contracts with Project Objectives:* Design contracts that clearly allocate risks, establish performance incentives, and support collaborative behaviours to improve both cost and schedule outcomes.

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- *Choose Contract Types Strategically:* Prefer lump-sum contracts in high-risk environments where cost and schedule discipline are critical, while using reimbursable contracts selectively with robust monitoring mechanisms.
- *Tailor Risk Management for Offshore and Large Projects:* Offshore and megaprojects should be prioritised for enhanced procurement governance, contingency planning, and digital monitoring due to their heightened exposure to overruns and delays.

5.5 Limitations and Suggestions for Future Research

While the study provides valuable insights, it has certain limitations: The dataset was limited to 120 projects, which, while statistically sufficient, may not fully capture regional or global variations in procurement practices. The analysis focused on procurement and project characteristics but did not fully explore the influence of organisational culture, leadership, or external regulatory factors.

Future research should expand the dataset to include more cross-regional petroleum projects for broader generalizability. Explore the role of sustainability-oriented procurement (e.g., green supply chains, ESG considerations) in E&P project performance. Incorporate qualitative insights (e.g., interviews with project managers and suppliers) to complement the quantitative findings.

5.6 Conclusion

This study demonstrates that strategic procurement is a powerful lever for reducing cost overruns and delays in petroleum E&P projects. By emphasising supplier relationships, early involvement, contract alignment, and digital enablement, companies can substantially enhance project performance. However, project-specific risks, especially offshore operations, project scale, and contract type, must be carefully managed to avoid undermining procurement efforts.

The findings underscore a broader shift in petroleum project management: procurement should no longer be viewed as a transactional support function but as a strategic capability that determines cost efficiency, schedule reliability, and long-term competitiveness.

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