STRATEGIC ANALYSIS IN INTEGRATING THE DEVELOPMENT WELLS SPUD READINESS WITH DRILLING PROJECT MANAGEMENT OFFICE (DPMO) AT PT. SINERGI HULU HEBAT (SHH)

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Abstract

The upstream oil and gas sector in Indonesia face structural production declines of 3–7% annually while domestic energy demand continues to rise. PT. SHH, a sub-holding of PT. PH, contributes significantly to national oil and gas output, yet its development wells spud realization has consistently fallen below annual targets, causing inefficiencies in capital utilization and reduced production. This study investigates the root causes of delays in development wells spud readiness and evaluates strategic solutions to accelerate well preparation and optimize delivery. A mixed-methods approach was employed, combining quantitative analysis of historical performance data, including Critical Path Method (CPM) and Pareto analysis, with qualitative insights from semi-structured interviews and Current Reality Tree (CRT) assessment. Failure Mode and Effects Analysis (FMEA) was used to quantify risk, and the Analytic Hierarchy Process (AHP) evaluated alternative strategies. The findings reveal that delays are primarily driven by fragmented governance, land acquisition and permitting bottlenecks, site and road construction constraints, and limited cross-functional coordination. Among evaluated alternatives, the implementation of a Drilling Project Management Office (DPMO) emerged as the most effective business solution, integrating oversight across subsurface, drilling, project, procurement, logistics, and permit functions. Post-implementation results demonstrate that spud realization increased to 95% of the WP&B target, delivery performance exceeded RKAP expectations at 101%, and capital efficiency improved, reducing potential revenue losses by an estimated USD 10–35 million. This study highlights that centralized governance, proactive monitoring, and structured cross-functional coordination are critical for enhancing well spud readiness, optimizing resource utilization, and supporting national energy security.

Keywords: Wells Spud Readiness, Strategic Decision, Critical Path Method, Analytical Hierarchy Process, Drilling Project Management Office (DPMO)

INTRODUCTION

The upstream oil and gas sector remains a cornerstone of national energy security and economic stability, particularly in emerging markets such as Indonesia. Between 2019 and 2025, Indonesia has experienced a structural decline in oil and gas production ranging from 3% to 7% annually, while domestic energy consumption has steadily increased by 2% to 4% per year. This divergence between supply and demand has underscored the critical importance of efficient upstream operations, particularly drilling and well intervention activities, which contribute approximately 68% of national oil production and 33% of gas production.

Development wells in upstream operations are not only technical undertakings but strategic investments aimed at sustaining production, optimizing reserve monetization, and maximizing return on capital. Delays in well spud readiness and subsequent delivery can significantly reduce production outcomes, affect capital efficiency, and result in substantial financial losses. In the case of PT. SHH, aggressive drilling targets outlined in the annual Work Planning & Budgeting (WP&B) have consistently been underachieved, with wells spud realization reaching only 81–85% of planned targets during 2021–2025. This shortfall directly impacts production lifting, delays revenue generation, and increases the risk of underutilized capital expenditure, estimated at USD 12.3 billion annually (Firnanto & Supriadi, 2020; Basak & Perrone, 2021).

The complexity of upstream oil and gas operations contributes to persistent schedule slippages. Delays in early-stage processes - such as land acquisition, regulatory approvals, permitting, site construction, and material mobilization - propagate through the project timeline, affecting drilling schedules and well delivery performance. Furthermore, fragmented coordination across multiple business functions, including Drilling, Subsurface, Land & Permit, Project, Procurement, and Logistics, has been identified as a significant factor in operational inefficiencies. These systemic challenges underscore the need for integrated governance mechanisms and decision-making frameworks to improve spud readiness and reduce deviations from planned schedules (Atin & Lubis, 2019; Petrovskiy & Ivanov, 2015).

Project management methodologies provide critical tools for addressing such challenges. Techniques such as the Critical Path Method (CPM) and Pareto analysis enable the identification of key bottlenecks and critical activities within complex, interdependent operations. Concurrently, Current Reality Tree (CRT) and Failure Mode and Effects Analysis (FMEA) allow for systematic root cause identification and prioritization of risks, facilitating evidence-based decision-making in complex operational environments (Iqbal & Silvianita, 2025; Shera et al., 2025). Integrating these analytical tools into a structured governance model - specifically through the implementation of a Drilling Project Management Office (DPMO) - can centralize coordination, standardize procedures, and institutionalize best practices, thereby reducing schedule variability, improving campaign success ratios, and optimizing capital efficiency (Goodwin & Wright, 2004).

Recent research in drilling project management emphasizes the importance of multi-criteria decision-making frameworks, such as the Analytic Hierarchy Process (AHP), to evaluate strategic alternatives and select optimal business solution. By quantifying the relative importance of factors such as time, cost, technical complexity, and potential consequences, organizations can objectively prioritize interventions and allocate resources efficiently.

The present study employs a mixed-methods research approach to address persistent underperformance in development wells spud. Quantitative analyses of historical drilling data, including deviation patterns and non-productive time, are combined with qualitative insights from semi-structured interviews with cross-functional teams. This approach enables a comprehensive understanding of both systemic and operational constraints, providing a robust foundation for identifying strategic interventions. The study's objectives are threefold: (1) to identify the root causes of delays in development wells readiness, (2) to evaluate strategic alternatives using AHP and risk analysis frameworks, and (3) to assess the effectiveness of the selected DPMO model in improving well spud performance, capital efficiency, and overall production outcomes.

By addressing the critical gap in integrated project governance, this research contributes to the broader literature on strategic decision-making in complex oil and gas operations and provides actionable insights for enhancing national energy security.

REVIEW OF LITERATURE

Development Wells in Upstream Oil and Gas

The spud readiness of development wells, encompassing planning, preparation, and execution phases, is a critical determinant of operational and financial performance. Delays at any stage, including land acquisition, permitting, or material readiness, propagate downstream, affecting the delivery of wells, production targets, and the net present value of projects. Hence, development wells spud readiness is treated as a measurable performance indicator in modern project-based oilfield management (Petrovskiy & Ivanov, 2015). The upstream development process is inherently complex, involving multiple interdependent phases from subsurface evaluation, well design, procurement, construction, drilling, and completion, culminating in hydrocarbon production and eventual facility handover. Failure in early-stage readiness often leads to schedule slippage, cost overruns, and lost production opportunities.

Project Management Office (PMO) and Drilling Governance

Project management frameworks, especially the establishment of a Project Management Office (PMO), have been widely recognized as critical for controlling complex projects and ensuring alignment with strategic objectives. A PMO centralizes standards, tools, and governance, facilitating monitoring, reporting, and decision-making across multiple projects (Goodwin & Wright, 2004). In upstream oil and gas, a DPMO is particularly relevant, providing end-to-end oversight of well readiness, integrating cross-functional teams, and institutionalizing operational excellence (Shera et al., 2025). Key components of a successful PMO include competent human resources, clear project scope, effective project management tools, stakeholder engagement, financial control, and strong top management support. Studies indicate that higher maturity in PMO implementation correlates with improved schedule adherence, cost efficiency, and quality outcomes in drilling projects (Atin & Lubis, 2019).

Critical Path Method (CPM) and Schedule Optimization

The Critical Path Method (CPM) is an essential project scheduling technique used to identify the sequence of activities that determines the overall project duration. In drilling operations, CPM enables managers to focus on schedule-critical activities and allocate resources to prevent delays (Iqbal & Silvianita, 2025). By modeling interdependencies between activities - such as land acquisition, well design, permitting, and rig mobilization -

CPM provides visibility into potential bottlenecks and supports proactive mitigation strategies. Application of CPM in upstream oil and gas allows for the quantification of schedule slippage risk, prioritization of corrective actions, and synchronization of complex cross-functional workflows, ultimately enhancing well spud readiness and improving project execution efficiency (Atin & Lubis, 2019; Firnanto & Supriadi, 2020).

Risk and Root Cause Analysis in Drilling

Risk assessment and root cause analysis are critical for identifying the underlying factors affecting development wells readiness. The Current Reality Tree (CRT) methodology, derived from the Theory of Constraints, maps cause-effect relationships among undesirable effects to determine systemic bottlenecks (Rocky Charles, 2026). CRT enables drilling organizations to distinguish between superficial symptoms and true root causes, such as fragmented governance, poor coordination, and delayed decision-making. Failure Mode and Effects Analysis (FMEA) complements CRT by systematically evaluating potential failure modes and quantifying risk via the Risk Priority Number (RPN), considering severity, occurrence, and detectability. FMEA integration into project management allows prioritization of mitigation measures, ensuring that high-impact risks - such as land acquisition delays, rig availability issues, and site construction constraints - receive adequate attention (Petrovskiy & Ivanov, 2015; Tokede et al., 2018).

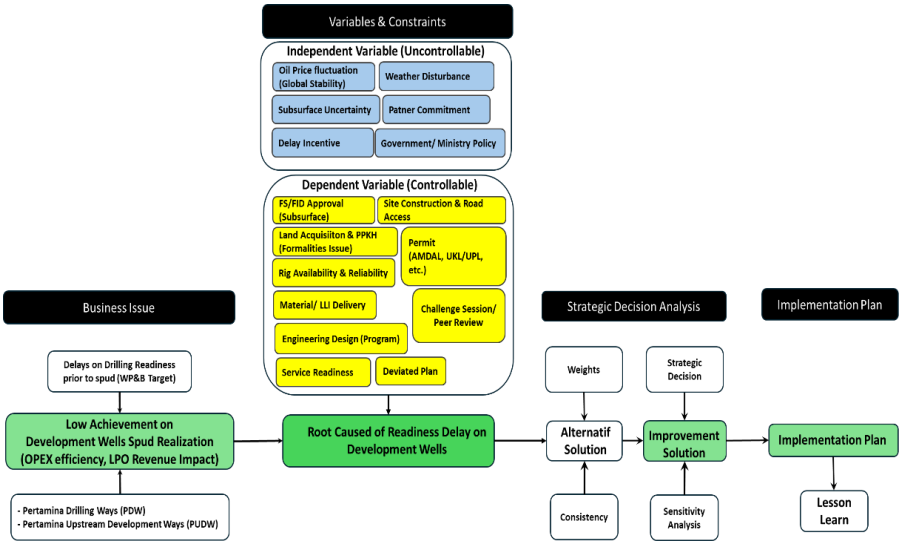
Multi-Criteria Decision-Making (MCDM) and Analytic Hierarchy Process (AHP)

Strategic decision-making in complex drilling operations requires consideration of multiple conflicting criteria, including cost, time, technical complexity, and potential consequences. The Analytic Hierarchy Process (AHP), developed by Saaty (2008), provides a structured framework for evaluating alternatives against such criteria, enabling objective prioritization and transparent decision-making (Goodwin & Wright, 2004). By combining qualitative insights from interviews with quantitative assessments from historical performance data, AHP facilitates systematic comparison of alternative strategies, ensuring alignment with organizational objectives and stakeholder priorities. Sensitivity analysis further strengthens decision robustness, identifying potential risks and trade-offs associated with each alternative.

Conceptual Integration of Literature

The literature reviewed highlights a consistent theme: effective drilling performance in upstream oil and gas requires an integrated approach combining project governance, schedule optimization, risk management, and data-driven decision-making. While CPM and Pareto analysis provide quantitative visibility into critical delays, CRT and FMEA enable identification of systemic issues and risk prioritization. A DPMO, supported by MCDM tools such as AHP, institutionalizes these processes, ensuring sustainable improvement in well spud readiness and delivery performance. Collectively, these methodologies address both operational and strategic dimensions, offering a comprehensive framework for enhancing drilling efficiency and national energy security.

Figure 1.
Conceptual Framework



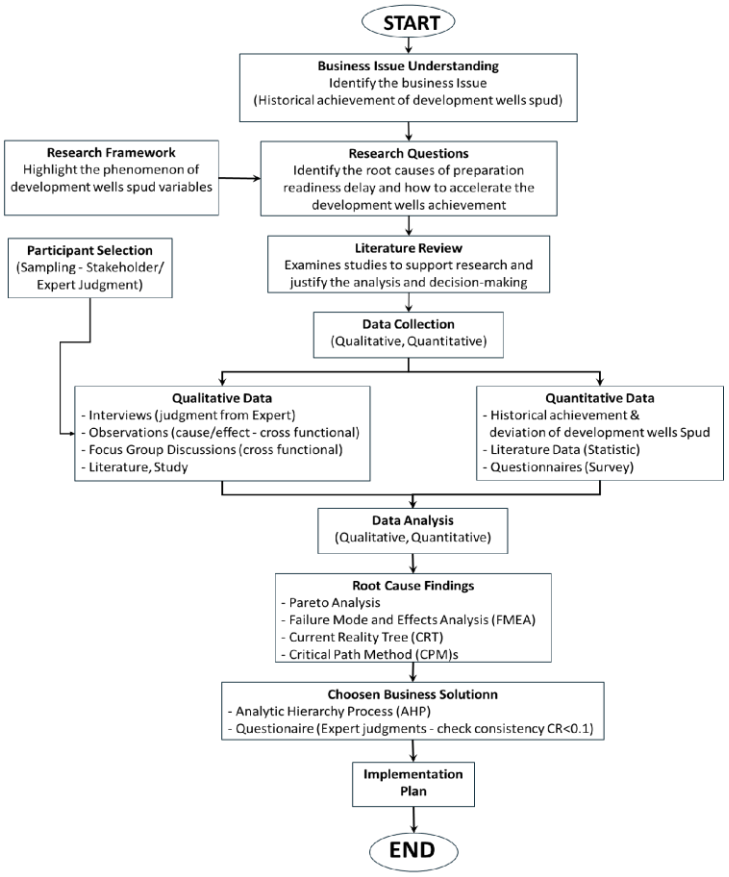
The identified business issue that already mentioned on the previous chapter for PT. SHH focused to accelerate the development wells spud readiness of yearly wells spud target and to reduce the dependent indicator issue during wells readiness related to the improve the development wells delivery. Development wells spud deviation between WP&B/ Workload Planning target to the actual realization, directly affects to the target lifting production delivery for each year and impacting the capital CAPEX efficiency and Loss of Potential (LoP) Revenue include to profit/loss impact, which is indirect impact to national resilience of national Oil & Gas contribution.

RESEARCH METHOD

Research Design

This study employs a mixed-methods sequential exploratory design, combining quantitative and qualitative approaches to address delays in development wells spud readiness at PT. SHH. The research aims to identify the root causes of operational delays, evaluate strategic alternatives, and assess the effectiveness of the chosen business solution in enhancing well spud and delivery performance. The research framework integrates historical quantitative data analysis with qualitative insights from cross-functional personnel. Quantitative analysis includes evaluation of well spud deviations, non-productive time (NPT), and resource utilization, while qualitative analysis incorporates semi-structured interviews and focus group discussions (FGD) to capture experiential knowledge and organizational constraints. The design enables triangulation of data sources, ensuring robustness and validity of findings.

Figure 2.
Research Design



The methodological sequence follows three stages: (1) problem identification and contextual understanding, (2) root cause analysis of delays, and (3) evaluation and selection of strategic business solution using multi-criteria decision-making frameworks such as the Analytic Hierarchy Process (AHP) (Goodwin & Wright, 2004; Rocky Charles, 2026).

Understanding the Context and Problem

The first stage focuses on the identification of critical operational bottlenecks in development wells readiness. Analysis of PT. SHH's performance records between 2021–2025 indicates that well spud realization consistently falls below WP&B targets, resulting in subsequent underperformance in well delivery and production output. Key constraints include land acquisition delays, permitting bottlenecks, insufficient cross-functional coordination, and limited visibility into real-time readiness data (Firnanto & Supriadi, 2020; Basak & Perrone, 2021). Understanding these constraints requires mapping the end-to-end drilling process, from well candidate selection and subsurface evaluation to site preparation, rig mobilization, drilling execution, and well handover. This process mapping highlights interdependencies among technical, regulatory, and logistical activities that influence overall project performance (Atin & Lubis, 2019).

Defining Root Causes

Root cause identification is conducted using Current Reality Tree (CRT) analysis and FMEA, complemented by qualitative insights from cross-functional interviews. CRT provides a structured cause-and-effect analysis of repeated delays, identifying systemic constraints such as fragmented governance and misaligned KPIs. FMEA quantifies the risk associated with each failure mode using the Risk Priority Number (RPN), prioritizing interventions on high-impact areas such as land acquisition, well site readiness, and rig

availability (Petrovskiy & Ivanov, 2015; Tokede et al., 2018). Quantitative assessment includes Pareto analysis to rank the frequency and impact of each delay factor and Critical Path Method (CPM) to determine sequence dependencies critical to project timelines. The integration of CRT, FMEA, Pareto, and CPM provides a comprehensive understanding of the structural and delay drivers (Iqbal & Silvianita, 2025; Rocky Charles, 2026).

Data Collection Methods

Quantitative Data

Those data were obtained from historical records from 2021 to 2025, including:

1. Wells spud and delivery realizations
2. Deviations from WP&B and RKAP targets
3. Non-productive time (NPT) of rigs
4. Material and resource availability

Data were analyzed to identify delay patterns, enabling statistical prioritization of constraints using Pareto analysis and CPM scheduling (Atin & Lubis, 2019; Iqbal & Silvianita, 2025).

Qualitative Data

Those data were collected through semi-structured interviews and observations with cross-functional personnel, which the interviews focused on:

1. Operational challenges affecting well readiness
2. Observed root causes of delays
3. Coordination practices and governance structures
4. Proposed alternative solutions and strategic interventions

A total of 8 key respondents representing multiple hierarchical levels were interviewed to ensure comprehensive coverage of perspectives. Interview responses were coded thematically and cross-referenced with quantitative findings to validate observed constraints (Rocky Charles, 2026).

Data Analysis Methods

Quantitative Analysis

1. Pareto Analysis: Identifies the most frequent and impactful delay causes, highlighting the “vital few” factors that contribute to the majority of readiness delays.
2. Critical Path Method (CPM): Determines sequences of interdependent activities that govern the overall well spud readiness timeline, providing guidance for schedule prioritization and resource allocation.
3. FMEA and RPN Scoring: Quantifies the severity, occurrence, and detection of each failure mode, supporting evidence-based prioritization of mitigation strategies.

Qualitative Analysis

1. CRT Analysis: Maps cause-effect relationships among operational challenges and identifies systemic constraints beyond surface-level symptoms.
2. Thematic Coding of Interviews: Extracts recurrent patterns related to coordination gaps, planning inaccuracies, and governance inefficiencies.
3. Triangulation: Integrates quantitative and qualitative findings to validate root causes and inform strategic alternative solutions selection.

Strategic Decision-Making

The Analytic Hierarchy Process (AHP) is applied to evaluate alternative strategic interventions (DPMO, RBP-SGS, LMF-TF) based on criteria including cost, time,

complexity, and potential consequences. Pairwise comparisons and consistency checks ensure objective weighting of decision criteria.

RESULTS AND DISCUSSION

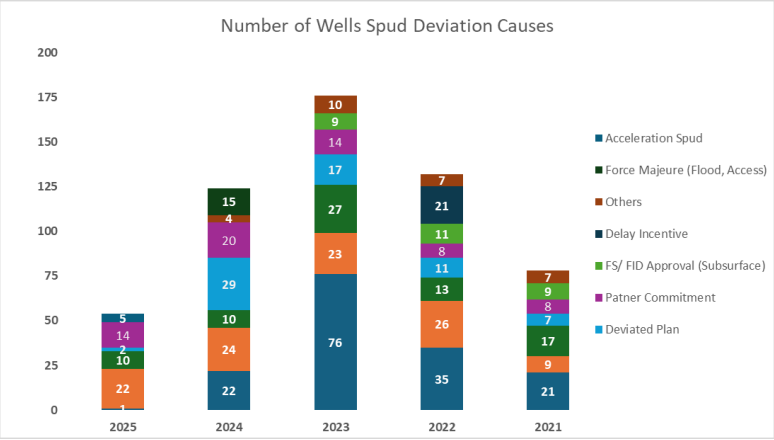
Analysis

The analysis of PT. SHH's development wells spud readiness between 2021 and 2025 reveals persistent underperformance relative to the WP&B targets. Quantitative data show that spud realization fluctuated between 81% and 87% of the planned target, with incremental improvements observed in 2025 due to the implementation of a structured governance model (Rocky Charles, 2026). These deviations have direct consequences on well delivery performance, production lifting, and capital efficiency, resulting in estimated losses of USD 10–35 million annually.

A Pareto analysis was conducted to identify the primary causes of delays in well spud readiness. The analysis indicates that approximately 60% of total delays were attributable to three key factors: (1) rig availability and reliability, (2) land acquisition and permit processing, and (3) site and road access construction (Firnanto & Supriadi, 2020; Basak & Perrone, 2021). Rig availability was heavily impacted by increased workload from aggressive drilling campaigns and periodic operational shutdowns for safety inspections, resulting in sequential delays across multiple wells. Land acquisition and permitting delays, particularly for forestry and private land, were compounded by complex regulatory requirements and inter-agency coordination, highlighting the systemic nature of readiness constraints. Site and access construction delays further reinforced the critical path bottleneck, delaying subsequent mobilization and spud activities.

Based on quantitative data of 2021-2025, this data will highlight the repetitive cause of wells spud deviation and will be ranked based on the most occurred during that period. The recap of wells spud deviation refers to yearly DWI performance reports as described based on number of wells spud deviation causes graph as Figure 3 and pareto chart as Figure 4, as below:

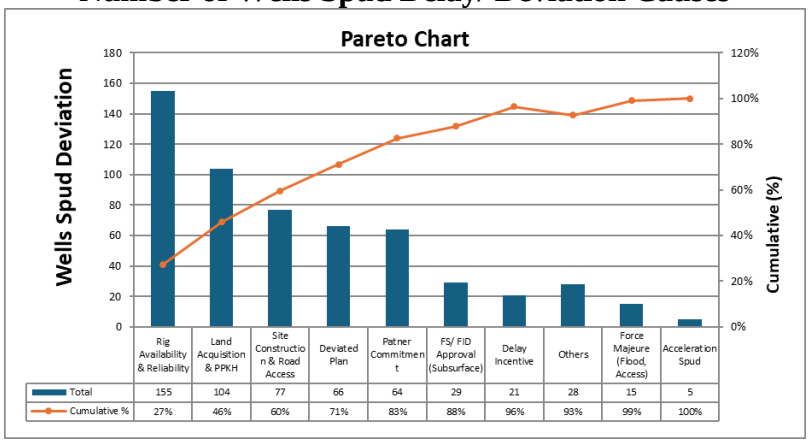
Figure 3.
Number of Wells Spud Delay/ Deviation Causes



*reference: Drilling & Well Intervention Performance Reports

Year	2025	2024	2023	2022	2021	Total	%	Total %	Ranked
Rig Availability & Reliability	1	22	76	35	21	**155**	**27,5%**	**27,5%**	1st
Land Acqusition & PPKH	22	24	23	26	9	**104**	**18,4%**	**45,9%**	2nd
Site Constructuin & Road Acc	10	10	27	13	17	**77**	**13,7%**	**59,6%**	3rd
Deviated Plan	2	29	17	11	7	**66**	**11,7%**	**71,3%**	4th
Patner Commitment	14	20	14	8	8	**64**	**11,3%**	**82,6%**	5th
FS/ FID Approval (Subsurface)			9	11	9	**29**	**5,1%**	**87,8%**	
Delay Incentive				21		**21**	**3,7%**	**91,5%**	
Others		4	10	7	7	**28**	**5,0%**	**96,5%**	
Force Majeure (Flood, Access)		15				**15**	**2,7%**	**99,1%**	
Acceleration Spud	5					**5**	**0,9%**	**100,0%**	
Plan WP&B	**54**	**124**	**176**	**132**	**78**	**564**			

Figure 4.
Number of Wells Spud Delay/ Deviation Causes



Based on pareto chart, there are 5 delay/ deviation causes contribute 82.6% of total and the remaining 5 delay/ deviation causes contribute only 17.4%. The data means the 50% of total causes (5 of total 10) drives more than 80% of the business issue.

The 1st largest contribution as critical one is related to rig availability & reliability, which is influenced by higher aggressive workload of development wells spud - significant incremental during 2020 to 2021, from 200 wells increased to 400 wells - impacted on more than new rig utilized. Continuously, based on the agreed WP&B for wells spud in 2022, there is aggressive development wells spud from 412 wells becoming 804 wells (2 times from previous), and in parallel problem issue related the rig availability in domestic couldn't meet the rig demand to cover all aggressive spud workload. This impact to utilization of old rigs/ unspec rigs/ unreliable rigs including any spare parts/ logistics issues and those spare parts issue result to delay on wells spud on fulfilling the critical parts in accordance with PT. SHH's requirements prior to spud the execution. In facts, in 2023 & 2024, there are occurred fatality in drilling & well intervention activities on result management's guidance to stop all operation activities and focus to re-inspection on all operating rig for further category III and IV inspection as the mandatory task prior as technical justification to obtain management approval prior to continue the operation. This inspection impacted on almost 2 months delay on operation, which impacted to slip the next well spud schedule approximately total 30-50 wells/ month in sequential.

The 2nd largest bottleneck (18%) is land acquisition & PPKH, almost occurs repeatedly on period 2021-2025. This data focuses on this delay cause because this bottleneck is sequentially influencing to the next activity Well Site & Road Access Construction as other bottleneck that appeared as the 3rd largest causes (14%) which need to be solved properly and impacted to preparation issue. If land acquisition & PPKH is combined with Well Site & Road Access Construction will significantly total of 32% and make that activity (Land Acquisition & PPKH and Well Site & Road Access Construction) bottleneck as critical path dependency.

For the 4th causes deviated plan and 5th causes partner commitment indicates execution inconsistency rather than external factors, and need management intervention alignment with internal DWI Regional/ Zone leader, cross-function leader and external stakeholder because of any misalignment planning and priority.

Based on Pareto principle (80/20), the most contributor cause of the problem are driven by the combined of Rig availability & reliability, Land acquisition & PPKH and Well Site & Road Access Construction (score more 60%) which need to be got any optimal business solution to integrating and accelerating the development wells spud readiness. Therefore, the business solution should address on reducing delay because of those variables as well.

The Critical Path Method (CPM) was applied to quantify the impact of these delays on overall project duration. CPM analysis revealed that early-stage activities -subsurface evaluation, well design, and land acquisition- governed the timeline for subsequent operations, with any deviation propagating downstream to rig mobilization and execution. Specifically, land acquisition and permit delays extended the preparatory phase by 2–4 months, directly affecting the spud schedule and contributing to cascading delivery delays (Atin & Lubis, 2019; Iqbal & Silvianita, 2025). This finding underscores the importance of proactive scheduling and early mitigation of critical-path constraints to optimize well readiness.

Qualitative insights from structured interviews corroborate these findings, revealing recurring patterns of fragmented coordination and limited real-time monitoring. Respondents consistently highlighted that delays were exacerbated by siloed decision-making across functional units, insufficient visibility of readiness metrics, and delayed escalation of risks to higher management levels. The integration of cross-functional oversight and structured governance through the proposed Drilling Project Management Office (DPMO) was perceived by interviewees as a pivotal intervention to align planning, monitoring, and execution responsibilities across subsurface, drilling, land & permit, project, procurement, and logistics teams (Rocky Charles, 2026).

Failure Mode and Effects Analysis (FMEA) was conducted to quantify the risk severity and prioritize mitigation measures. The top three contributors to high-Risk Priority Numbers (RPN) corresponded to rig availability, land acquisition, and site construction, reinforcing the quantitative and qualitative observations. By focusing mitigation efforts on these high-risk factors, PT. SHH can substantially reduce schedule slippage and improve spud performance, directly impacting production outcomes and financial returns (Petrovskiy & Ivanov, 2015; Tokede et al., 2018).

The integrated analysis demonstrates that addressing systemic governance issues, rather than isolated operational inefficiencies, is critical for improving well spud readiness. Among the evaluated alternatives, the implementation of a DPMO emerged as the most

effective intervention to centralize decision-making, streamline coordination, and accelerate readiness, thereby enhancing the achievement of both spud and delivery targets.

Alternative Solution

In response to the persistent underperformance in development wells spud readiness, three strategic alternatives were evaluated to address systemic delays and optimize operational efficiency. These alternatives were derived from the root cause analysis, which identified fragmented governance, delayed land acquisition, permitting bottlenecks, and site construction delays as critical constraints (Rocky Charles, 2026). The evaluation incorporated four key criteria: time efficiency, cost implications, technical complexity, and potential consequences.

Alternative 1: Drilling Project Management Office (DPMO)

The first alternative involved establishing a dedicated DPMO to centralize governance, coordination, and decision-making across all phases of well readiness. The DPMO was designed to integrate subsurface evaluation, drilling planning, land acquisition, permit processing, procurement, logistics, and rig mobilization under a single oversight structure. Its primary functions include real-time monitoring of readiness metrics, early identification of bottlenecks, escalation of critical issues, and structured facilitation of cross-functional collaboration.

The selection of DPMO as a candidate business solution was informed by the AHP analysis, which assigned the highest priority to time efficiency (weight = 0.308), followed by complexity (0.293), cost (0.287), and potential consequences (0.112) (Rocky Charles, 2026). By centralizing control and accountability, the DPMO is expected to reduce delays arising from dispersed decision-making, streamline approvals, and accelerate the preparation of wells for spud. Interview insights emphasized that the lack of a unified governance mechanism contributed substantially to repeated delays, particularly in land acquisition and site readiness. Respondents consistently indicated that a DPMO would enable proactive planning and timely interventions, preventing cumulative downstream effects on drilling schedules and production delivery.

Alternative 2: Readiness-Based Planning and Stage-Gate System (RBP-SGS)

The second alternative focuses on implementing a stage-gate framework, where progression to subsequent stages of well preparation is contingent upon verified readiness criteria. This approach ensures that wells do not proceed to drilling until mandatory preparatory steps -subsurface evaluation, permits, construction, and procurement- are completed. While this strategy provides structured control over process integrity, it may initially appear to slow operations due to gating requirements. However, it mitigates the risk of schedule slippage and ensures that wells entering the drilling phase are technically and operationally prepared. Quantitative analysis of RBP-SGS indicated moderate efficiency in time reduction. However, qualitative feedback suggested that reliance solely on gate approvals without centralized decision authority may not adequately address cross-functional coordination challenges. As such, RBP-SGS could serve as a complementary mechanism to the DPMO rather than a standalone business solution, ensuring readiness verification while central governance drives acceleration (Firnanto & Supriadi, 2020; Petrovskiy & Ivanov, 2015).

Alternative 3: Land Acquisition and Formalities Task Force (LMF-TF)

The third alternative targeted the largest individual delay factor identified through Pareto and FMEA analysis: land acquisition and permitting. A dedicated LMF-TF would

focus exclusively on accelerating approvals, coordinating with government agencies, and resolving site-specific issues. This approach directly addresses the root cause of access and permit delays, ensuring that site and road construction can commence according to planned schedules. While LMF-TF provides high efficiency in the specific domain of land readiness, its scope is limited and does not address coordination across the broader drilling readiness process. AHP scoring for this alternative indicated medium to high complexity and moderate cost implications. Interview feedback highlighted that while this targeted task force could accelerate critical land-related processes, it could not fully mitigate delays arising from fragmented planning, rig scheduling conflicts, or procurement dependencies (Rocky Charles, 2026; Shera et al., 2025).

Comparative Evaluation and Justification

The alternatives were compared using multi-criteria decision-making with explicit weighting of criteria relevant to operational goals. DPMO emerged as the highest-ranked solution with a priority score of 56.94%, followed by LMF-TF at 26.84%, and RBP-SGS at 16.23%. The superiority of DPMO arises from its comprehensive scope, ability to integrate cross-functional decision-making, and capacity to systematically reduce both direct and indirect causes of delay. By combining centralized governance, proactive monitoring, and structured escalation pathways, DPMO addresses the systemic root causes identified through CRT and FMEA analyses.

The DPMO implementation is expected to generate multiple benefits, including increased spud readiness (targeting 95–100% achievement), improved capital efficiency, reduction in idle rig time, and higher synchronization during preparation phases. Sensitivity analyses indicate that even under variations in resource availability and unforeseen operational challenges, DPMO maintains robust performance, highlighting its resilience as a strategic business solution. Furthermore, interview insights affirm that structured and centralized governance would foster accountability, enhance communication, and accelerate decision-making across HQ, regional, and zone.

Table 1.
Risk Analysis Comparison based on assessment criteria

	Cost Increment	Time Efficiency	Complexity Impact	Consequences
Alternative 1 (Drilling Project Management Office)	Cost may arise from dedicated function PMO resources (None cost, based on responsibilities), develop report/ dashboard & periodic coordination with management. Mainly organizational & system cost. (Low to Medium CAPEX)	Improves time efficiency by reducing slow decision-making, late escalation and fragmented communication. Issues can be identified and resolved faster through periodic monitoring and follow up during the coordination. (Medium to High Efficient)	High complexity comes from integrating cross-functions with clear authority and management commitment into one governance structure, which improves alignment/ decision, and escalation effectiveness across all critical path. (High Complexity Impact)	Give the Integrated DPMO on clear decision rights, escalation authority, management support, and ownership of the integrated synchronization schedule. (Low Consequences)

Alternative 2 (Readiness-Based Planning and Stage-Gate System)	Low cost (mainly requires checklist and readiness criteria). Cost may increase if prioritized wells readiness not pass the readiness criteria and impact on a lot stage-gate decision introduced. (Low to Medium CAPEX)	Improves time efficiency by preventing premature scheduling. However, in the short term, it may appear to slow progress because activities cannot proceed without gate approval (even for prioritized wells) (Medium Efficient)	Moderate complexity (readiness-based schedule). The criteria is not highly complex, but discipline and compliance are required. Ensures spud schedules are realistic and reduces schedule changes, and execution uncertainty. (Low Complexity Impact)	Make gate approval mandatory before spud and link it directly to milestones not based on aggressive target, management review, and dashboard reporting. (High Consequences)
Alternative 3 (Land Acquisition and Formalities (Permit) Task Force)	Cost increase due to dedicated task force resources, stakeholder engagement, liaison activities, field monitoring, legal support, and possible acceleration costs for permits and land clearance. (Medium to High CAPEX)	Provides strong time efficiency because it directly targets land and permitting, which are major delay contributors. Parallel processing can reduce waiting time significantly. (High Efficient)	Complexity on external& government agencies, communities,legal requirements, environmental approvals, and unpredictable stakeholder responses), output to accelerate readiness earlier, depend on extl approval. (Medium Complexity Impact)	Establish early stakeholder mapping, parallel permit processing, escalation channels, and weekly monitoring of land and permit progress. (Medium Consequences)

Based on assessment criteria (cost incremental, time efficiency, complexity impact, potential consequences), alternative solution 1 (DPMO) was selected as the the chosen strategic alternative (low to medium CAPEX, Medium to High Efficient, High Complexity Impact, Low consequences) considering to comparative analysis with others. This approach will also be tested using the AHP, along with a response questionnaire from the cross-function team. The DPMO provides the most comprehensive and sustainable approach to accelerate well spud readiness, optimize capital efficiency, and support PT. SHH's objective of enhancing production and capital productivity. Its integration framework ensures systemic improvement and long-term resilience in wells readiness.

Business Solution

Following the evaluation of alternative strategies, the implementation of DPMO was selected as the business solution for accelerating development wells spud readiness. The DPMO provides a centralized governance structure that integrates cross-functional responsibilities across subsurface, drilling, land and permits, project, procurement, logistics, and rig management teams, thereby addressing both operational and systemic root causes of delay (Rocky Charles, 2026).

The DPMO functions as a decision-making hub, establishing standardized procedures, performance metrics, and escalation pathways to ensure timely and coordinated execution of all activities required for well readiness. PT. SHH can reduce redundant efforts by consolidating oversight, prevent fragmented decision-making, and accelerate corrective actions when delays are detected (Shera et al., 2025; Firnanto & Supriadi, 2020).

Integrated Implementation Approach

The DPMO implementation plan was structured according to a three-level hierarchy: Zone-level, HQ-level, and Board-level coordination. The Zone-DPMO serves as the operational level, conducting weekly reviews of well readiness metrics, identifying bottlenecks, and implementing corrective measures. The HQ-DPMO consolidates reports from all zones, evaluates performance against WP&B targets, and facilitates resource allocation and decision escalation. Finally, the BOD-level DPMO provides strategic oversight and alignment with corporate objective and compliance, and authorizing interventions when systemic delays threaten spud targets (Rocky Charles, 2026). The DPMO also integrates a Well Readiness Monitoring (WRM) system, a digital platform designed to quantify readiness indicators, track critical dependencies, and provide real-time visibility into the progress of each well. WRM allows management to identify high-priority issues, assess risk exposure, and implement interventions proactively, rather than reactively addressing delays after they occur. This platform supports data-driven decision-making and provides a feedback loop for continuous improvement across all drilling regions.

Operational and Strategic Benefits

The implementation of DPMO demonstrates multiple tangible and strategic benefits:

1. Enhanced Spud Readiness: By synchronizing preparatory activities and monitoring progress against predefined criteria, DPMO improves the probability that wells reach spud readiness on schedule. Historical analysis indicates that with DPMO integration, development wells spud achievement increased from 81–87% to 95% of the WP&B target in 2025, representing a significant recovery from previous underperformance.
2. Optimized Capital Utilization: Accelerated readiness reduces idle rig days and prevents resource underutilization, enhancing CAPEX efficiency. The alignment of project schedules with resource allocation enables PT. SHH to maximize the return on drilling investments, mitigating financial losses associated with delays.
3. Improved Cross-Functional Coordination: DPMO formalizes accountability across relevant teams, reducing fragmented communication and siloed decision-making. Interviews indicate that integrated governance significantly decreases response time to unforeseen issues and ensures that decisions are made in a timely and transparent manner.
4. Risk Mitigation and Decision Consistency: By leveraging the AHP and RPN-based prioritization, DPMO ensures critical delays -such as land acquisition and rig availability- receive immediate attention. Sensitivity analysis demonstrates that DPMO maintains performance robustness even under variable conditions, confirming its strategic resilience.
5. Alignment with Corporate and Regulatory Objectives: DPMO ensures that activities align with corporate KPIs and national energy security objectives, integrating compliance with SKK Migas regulations, and WP&B approvals. This centralized governance mitigates reputational risks associated with underperformance and enhances corporate oversight.

Strategic Justification

The selection of DPMO is further justified by its capacity to address systemic root causes identified through CRT and FMEA analysis. While other alternatives such as RBP-SGS and LMF-TF address specific aspects of readiness, only DPMO provides an end-to-end business solution that integrates planning, monitoring, and control. The strategic decision to implement DPMO reflects a paradigm shift from reactive to proactive governance, ensuring

that readiness gaps are identified and resolved prior to spud execution. In summary, the DPMO functions not only as a tactical coordination but also as a strategic enabler for upstream excellence. By consolidating decision-making authority, providing real-time monitoring, and institutionalizing best practices, DPMO strengthens ability to meet spud targets, optimize capital, and enhance production resilience.

Implementation Plan & Result

The implementation of the DPMO at PT. SHH was designed as a comprehensive governance mechanism to integrate all phases of development wells preparation and execution. By centralizing oversight across HQ, regional, and zone-level operations, the DPMO ensured that cross-functional teams were aligned in addressing bottlenecks related to land acquisition, permitting, site and road construction, procurement, and rig mobilization. The DPMO established structured workflows and escalation mechanisms, enabling management to mitigate delays proactively rather than reactively, thereby minimizing cumulative effects on spud and delivery schedules (Rocky Charles, 2026).

To support this centralized coordination, the Well Readiness Monitoring (WRM) system was deployed as a real-time digital platform. WRM quantified readiness indicators across multiple dimensions, provided visual dashboards for monitoring, and allowed management to track progress. By visualizing critical dependencies and highlighting high-risk activities, WRM facilitated interventions and strengthened accountability throughout the operational hierarchy.

Following the implementation of DPMO, substantial improvements were observed in well spud and delivery performance. The spud achievement rate increased to 95% of the WP&B target, representing a significant improvement over the 81–87% achieved in prior years. Delivery performance exceeded RKAP expectations, reaching 101% of the target, which demonstrates that the proactive management and monitoring approach effectively mitigated delays and enhanced production outcomes. These operational improvements directly translated into financial benefits by reducing idle rig days and optimizing CAPEX utilization, resulting in an estimated reduction in potential revenue losses of USD 10–35 million annually.

Discussion

The findings of this study are consistent with a broad stream of literature documenting the complexity and inherent risk factors that impede schedule performance in upstream oil and gas operations. As shown in the integrated analysis, delayed well spud readiness at PT. SHH arises from both technical and non-technical constraints, including fragmented governance, land acquisition bottlenecks, limited cross-functional coordination, and resource scheduling conflicts. These results echo global evidence that project delays in the oil and gas sector are pervasive and systemic, often transcending technical planning to encompass organizational, regulatory, and coordination challenges (Santos, Hamacher, & Oliveira, 2021).

Project delays in upstream contexts are frequently attributed to the multidimensional Rig Scheduling Problem (RSP), which involves decisions on rig assignment, well prioritization, and temporal sequencing under uncertainty (Santos et al., 2021). Empirical research further suggests that integration of planning with real-time operational control, as realized through the DPMO and WRM systems, is critical in mitigating RSP-like complications that degrade schedule reliability.

Risk analysis studies also reinforce the centrality of delay risk in oil and gas project outcomes. The interaction between non-technical and technical risks has been empirically shown to disproportionately affect schedule performance in upstream projects, where non-technical risks (e.g., regulatory, socio-political, communication failures) influence technical delay drivers more strongly than vice versa (Nwapi et al., 2021).

From a project management perspective, global reviews of oil and gas schedule performance identify that poor planning and lack of effective control mechanisms are recurring causes of delay, requiring strategic interventions rather than isolated tactical fixes (Basalim, Waluyo, & Efendi, 2026). This supports the present study's conclusion that solutions focused solely on individual delay factors (e.g., land task forces or gating systems) are insufficient unless embedded within holistic governance frameworks such as DPMO. Strategic project management research in upstream sectors highlights the importance of alignment between strategy, governance structures, and operational execution (Basalim, Waluyo, & Efendi, 2026; Davies & Mackenzie, 2014). The WRM system implemented directly operationalizes such risk-based planning and control, providing an empirical demonstration of how structured risk metrics can improve spud readiness.

Finally, broader project management underscores that upstream projects' complexity, coupled with external stakeholder and regulatory pressures, increases the need for agile governance and dynamic managerial capabilities. The DPMO acts as an organizational agile mechanism that supports adaptation to uncertainty and enhances managerial discretion in decision-making, validating the study's strategic approach. In sum, the discussion situates this study demonstrating strong alignment between the empirical findings in Indonesia and international evidence on risk, scheduling, governance, and organizational dynamics. The successful improvement of spud performance through DPMO not only confirms theoretical expectations but also contributes novel insights into how integrated governance structures can be practically applied in high-risk, capital-intensive upstream environments.

CONCLUSION

This study addressed the persistent delays in development wells spud readiness at PT. SHH by identifying root causes, evaluating alternative solutions, and implementing a DPMO as the strategic business solution for intervention. Analysis of historical quantitative data between 2021 and 2025 revealed that well spud realizations consistently fell short of WP&B targets, resulting in cascading effects on well delivery, production lifting, and capital efficiency.

The implementation of DPMO centralized governance across HQ, regional, and zone-level operations, integrating all cross-functional teams involved in the development wells process. Real-time monitoring through the Well Readiness Monitoring application allowed management to identify potential bottlenecks proactively, coordinate remedial actions, and maintain alignment with WP&B targets. Following the implementation, development wells spud achievement increased to 95% of the target, while delivery performance exceeded expectations at 101%, demonstrating a substantial improvement in operational efficiency. The optimized coordination reduced idle rig time, improved CAPEX utilization, and mitigated estimated financial losses of USD 10–35 million, confirming the strategic value of integrated project governance.

Beyond operational improvements, the DPMO strengthened organizational accountability, enabling cross-functional teams to collaborate more effectively and respond to emerging challenges with greater speed and transparency. This structural transformation not only resolved immediate bottlenecks but also institutionalized a systematic approach to managing well readiness, aligning operational activities with both corporate objectives and national energy security goals. The findings underscore that sustainable improvement in drilling performance is achieved not solely through technical solutions but through the integration of governance, monitoring, and decision-making frameworks that span the full lifecycle of well development.

In conclusion, the establishment of a DPMO represents a strategic shift from reactive problem-solving to proactive operational management, addressing both systemic and operational factors that hinder well spud readiness. Future initiatives should focus on further embedding real-time data analytics, enhancing cross-functional training, and continuously refining readiness criteria to adapt to evolving operational and regulatory conditions. These measures will support long-term resilience in upstream and contribute to the sustained achievement of national energy objectives.

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