ENHANCEMENT OF PRODUCTION SHARING CONTRACTS AND ENTITLEMENT STRATEGIES IN MALAYSIAN UPSTREAM OIL AND GAS COMPANIES THROUGH INTEGRATED SUPPLY CHAIN MANAGEMENT

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ASIA e UNIVERSITY
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ABSTRACT

The oil and gas industry is a cornerstone of Malaysia's economy, contributing approximately 20% to the national GDP. With the dwindling reserves and rising costs, the Madani Vision and the 12th Malaysia Plan aims to ensure continuous competitiveness and sustainability of the sector. The Production Sharing Contract (PSC) is the key governing agreement between PETRONAS, as the custodian petroleum resources in Malaysia, and oil companies. PSCs draw conceptual roots from sharecropping theory, principal-agent theory, and economic rent theory. Under the PSC, oil companies receive reimbursement for their incurred expenditures (cost oil) and a portion of the remaining profits (profit oil); collectively, these allocations are referred to as the 'entitlement'. Effective management of PSC entitlement is critical for oil companies to maximise value, attract investment and ensure the sector's long-term sustainability and competitiveness. However, in addition to the persistent challenges such as market volatility and rising production costs, the supply chain disruptions and fragmented processes adds to the challenges that hinder oil companies from fully realizing their entitlement value potential. This breakthrough exploratory study examines how integrating Supply Chain Management (SCM) strategies with PSC entitlement management can enhance operational efficiency, profitability, and strategic outcomes, focusing on upstream oil and gas companies in Malaysia, particularly those operating under PETRONAS PSC. Employing a qualitative exploratory approach within an interpretivist research paradigm, the study uses in-depth interviews with eight senior industry professionals based in Kuala Lumpur, Malaysia. This methodology aligns with the research objectives, allowing a deep exploration of subjective experiences, perceptions, and context-specific insights related to PSC entitlement management and SCM integration. Through rigorous thematic analysis, the study identifies significant opportunities arising from aligning SCM processes more closely with entitlement frameworks, notably improved coordination, reduction of operational silos, and enhanced accuracy in entitlement calculations. This study introduces the ISAC-E model, a practical, strategic framework designed to bridge existing operational and planning gaps and facilitate stakeholder collaboration, within PSC practices. The findings demonstrate that effective SCM integration not only optimizes cost efficiency and operational agility but also substantially improves regulatory compliance, and profitability essential for long-term resilience and sustained growth in the evolving global energy landscape. Ultimately, this research offers oil and gas industry stakeholders an actionable, integrated approach for navigating complex regulatory environments, and market uncertainties, ensuring Malaysia's upstream sector remains robust, competitive, and future-ready.

Keywords: Upstream oil and gas, production sharing contract, fiscal system, supply chain management, entitlement, business integration

APPROVAL

This is to certify that this thesis conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, for the fulfilment of the requirements for the Doctor of Business Administration

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8 September 2025

DECLARATION

I hereby declare that the thesis submitted in fulfilment of the requirements for the Doctor of Business Administration is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

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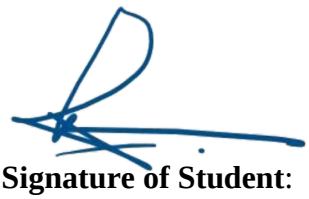

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LIST OF ABBREVIATION

EIA	U.S. Energy Information Administration
HGA	Host Government Agreement
JOA	Joint Operating Agreement
PDA	Petroleum Development Act 1974
PETRONAS	Petroleum National Berhad
PSC	Production Sharing Contract
SCM	Supply Chain Management

CHAPTER 1

INTRODUCTION

1.0 Overview

The upstream oil and gas industry plays a critical role in Malaysia's economy, contributing a significant 20% to the nation's GDP (PwC, 2023). According to the U.S. Energy Information Administration (EIA, 2023), Malaysia is the second-highest producer of petroleum and other liquids in Southeast Asia and the fifth-highest exporter of liquefied natural gas (LNG) globally in 2023. As Southeast Asia leading producers of oil and gas, Malaysia relies heavily on its oil and gas industry to fuel economic activity, secure energy needs, and maintain a prominent position in global energy markets (EIA, 2023). The industry, however, faces increasing complexity in managing Production Sharing Contracts (PSCs), which govern the extraction of resources between governments and oil companies. These contracts involve complex fiscal terms, cost recovery mechanisms, and profit-sharing clauses, all of which directly influences the how much of the oil and gas produced by the oil company would be able to be taken by the oil company, known as entitlement which determines the profitability (Pereira et al., 2023).

The upstream oil and gas industry is also inherently capital-intensive, with increasing operational costs per barrel, presenting significant challenges, especially when oil prices fluctuate (International Energy Forum & S&P Global, 2024)[1]. Accenture report in 2020[2] highlighted that inefficient investments in the oil and gas industry have led to a staggering US$320 billion in trapped value. Therefore, effective cost management is critical, and this is where Supply Chain Management (SCM) plays a central role to ensure efficient coordination of capital and operational expenditures by strategically managing sourcing, procurement, logistics, and storage (Boston

Consulting Group, 2022). This will ensure timely, cost-effective, and high-quality deliveries of the equipment and services (Jiang et al., 2021). In the Malaysian context, local content requirements by PETRONAS introduce additional complexity to the SCM process, affecting the quality, cost, and timeliness of resources deliveries (Kasahara et al., 2025; Menhat et al., 2019). These challenges, in turn, impact oil companies' ability to optimize their entitlements, which are vital for maximizing profitability.

Oil companies investing in exploration and development activities face significant risks, with returns largely dependent on the terms of the Production Sharing Contract (PSC) with the government or host authorities such as Petronas. Under the PSC model, the oil company bears the majority of the risk, ranging from exploration to abandonment, while the government shares in the profits once hydrocarbons are produced (Pereira et al., 2023). The contractor's share of these profits, referred to as the entitlement, is determined by the fiscal terms outlined in the PSC. The contractor's entitlement share is influenced by various factors such as oil prices, production volumes, and expenditures. Optimizing all these factors, particularly expenditures, is a complex yet crucial task for oil companies to maximize their entitlement and, ultimately, profitability (BCG, 2024).

PSC management also requires managing the stakeholder interests—governments, oil companies, and subcontractors—all of whom have differing priorities (Candeias, 2024). This misalignment often leads to process inefficiency, bureaucratic hurdles, delayed decision-making, and inefficiencies (Masud et al., 2019). In Malaysia, where PSCs are central to the governance of oil and gas resources, these challenges can impact profitability, operational efficiency, and the ability to attract further investment (Pereira et al., 2023).

In this context, the integration of Supply Chain Management (SCM) with PSC entitlement management becomes crucial. As noted by Frohlich and Westbrook (2001) and later carried on by Partyka and Paiva (2024), integration across the supply chain fosters value creation by streamlining operations and aligning data flows. By aligning specific SCM process with PSC management process, companies can reduce inefficiencies, optimize resource allocation, and enhance decision-making processes (Mehmet et al., 2019). Thus, the effective management of SCM is fundamental for upstream oil and gas companies to navigate these complexities and achieve sustainable profitability (Mckinsey & Company, 2023).

Therefore, there is a need for integrated solutions for entitlement optimization and it is heightened by the evolving energy landscape, where oil and gas companies now face growing regulatory pressure, rising operational costs, and the imperative to adopt sustainable practices – the challenges framed by energy trilemma (Oke et al., 2024). With increasing technological advancements, including AI, data analytics and automation, companies have the opportunity to modernize PSC entitlement processes, minimize value leakage, and improve profitability (Eggers, 2024). This study explores these challenges and proposes an integrated approach to PSC entitlement management and SCM in Malaysia's upstream oil and gas sector, aiming to enhance entitlement and operational efficiency.

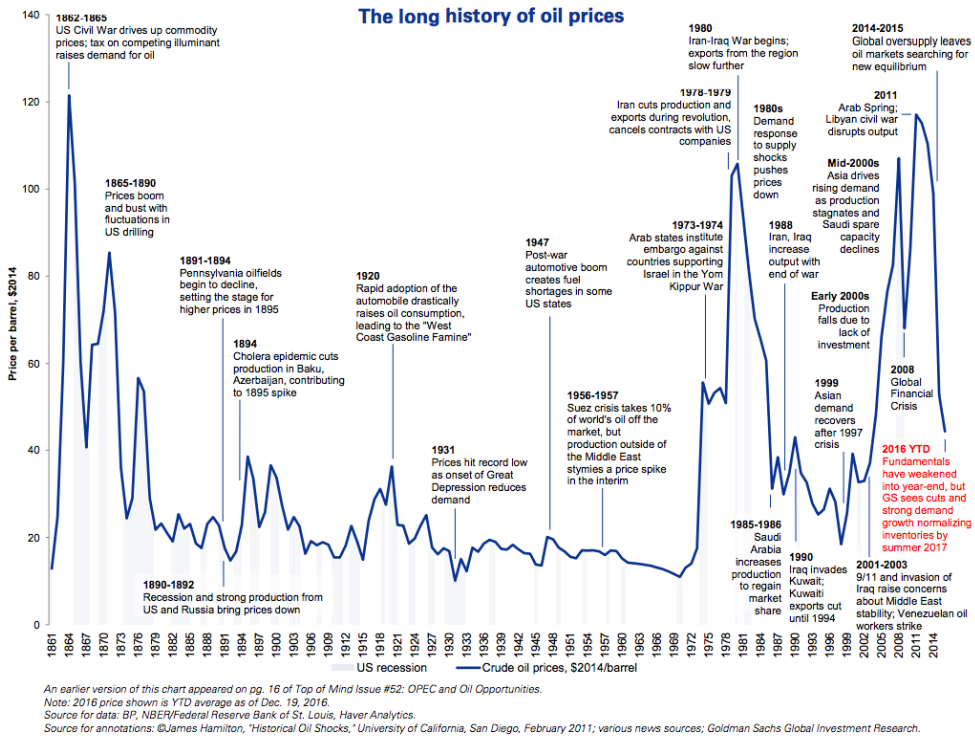
1.1 Background of the Study

1.1.1 Overview of the Upstream Oil and Gas Industry

The global oil and gas industry remains one of the most influential sectors, powering economies and playing a pivotal role in international relations. As of 2020, oil and gas accounted for approximately 53% of global energy need (IEA, 2020). This fuels industries, transportation, and residential energy consumption globally, making the

sector vital for economic activity across both developed and developing nations. United States, Saudi Arabia, Russia, and the Organization of the Petroleum Exporting Countries (OPEC), control 80% portions of the world's oil supply, dictating prices and production levels through various agreements and policies (EIA, 2023). Notably, five countries – United States, Russia, Saudi Arabia, Canada and Iraq – account for 51% of global crude oil production, as per the US Energy Information Administration (WEF, 2024). These nations, together with leading multinational oil companies, significantly shape the global economy and geopolitics. However, the industry faces substantial challenges, including volatile geopolitical tensions within these oil producing counties and growing environmental scrutiny, both of which impact oil prices and market stability (WEF, 2024).

Figure 1.1: History of Oil Price & Key Events



An earlier version of this chart appeared on pg. 16 of Top of Mind Issue #52: OPEC and Oil Opportunities.
Note: 2016 price shown is YTD average as of Dec. 19, 2016.
Source for data: BP, NBER/Federal Reserve Bank of St. Louis, Haver Analytics.
Source for annotations: ©James Hamilton, "Historical Oil Shocks," University of California, San Diego, February 2011; various news sources; Goldman Sachs Global Investment Research.

Source: World Economic Forum (2016), 155 years of oil prices - in one chart

As shown in **Figure 1.1** fluctuations in oil prices are driven by a combination of factors, including global conflicts, supply chain disruptions, and shifting demand patterns particularly within these major oil producing countries (EIA, 2023). As oil prices become more volatile, it becomes increasingly difficult to ensure affordable energy access for all, particularly in developing regions where energy infrastructure is more vulnerable to price shocks. Consequently, one of the primary goals for major oil producers is to promote price stability, not only to safeguard their own economic interests but also to ensure the global availability and affordability of energy (Pereira et al., 2020).

With the significance of oil and gas to the global energy mix, the security of supply becomes critical to every nation. As oil and gas remain key sources of energy, particularly for transportation, industry, and electricity generation, disruptions in their supply can have severe economic and social consequences. Global events, such as geopolitical tensions, natural disasters, and technical failures, can affect oil and gas supply chains, leading to price volatility and shortages. Ensuring energy security involves securing reliable access to affordable energy, mitigating supply risks, and enhancing the resilience of energy infrastructure. According to the International Energy Agency (IEA, 2023), energy security is fundamental to ensuring that nations can maintain a stable supply of energy while meeting growing demand, particularly in the face of shifting global energy dynamics and the ongoing transition to renewable sources.

Moreover, the global push toward cleaner energy sources, coupled with the urgent need to address climate change, is prompting the oil and gas sector to rethink its role in the future energy mix. Investments in renewable energy, carbon capture technologies, and sustainability initiatives are now central to many oil companies'

strategies as they navigate the energy transition (McKinsey & Company, 2024). At the same time, evolving regulatory frameworks and government policies worldwide are exerting increasing pressure on these companies to reduce their carbon footprints and adhere to more stringent environmental standards (PwC, 2023; NETR 2023). As the industry faces growing social and political opposition, with heightened demands for stricter regulations and stronger commitments to emission reductions, the challenge of balancing profitability with environmental sustainability becomes even more complex.

These pressures create a dynamic and challenging landscape, where companies must manage the delicate balance between ensuring energy security, achieving environmental sustainability, and maintaining energy equity through global compliance and access to affordable energy. This is the energy trilemma facing the industry today (Carr et al., 2024). In this evolving context, national oil companies and private sector players are reassessing their strategies to enhance operational efficiency, optimize resource management, and secure their future competitiveness (Pereira et al., 2020). The integration of new technologies, digitalization, and sustainable business strategies are becoming increasingly vital to ensure long-term viability (Anaba et al., 2024). The shift towards a more collaborative and risk-sharing approach through frameworks such as Production Sharing Contracts (PSCs) has gained traction to streamline operations, reduce costs, and maximize resource utilization.

Against this global backdrop, Malaysia, as a significant oil and gas producer in Southeast Asia, finds itself navigating these challenges and opportunities. Malaysia's oil and gas industry remains central to its economic stability and energy security, but like the global industry, it faces pressures related to resource depletion, environmental sustainability, and the need for technological innovation (PwC, 2023; NETR 2023)[4].

1.1.2 Upstream Oil and Gas Industry in Malaysia

The oil and gas industry is the cornerstone of Malaysia's economy, contributing around 20% to the nation's GDP, part of a broader energy sector contribution of 28% (PwC, 2023). Malaysia also plays a pivotal role in the Southeast Asian oil and gas industry, positioning itself as one of the region's leading energy producers and exporters. According to the U.S. Energy Information Administration (EIA, 2023), Malaysia is the second-highest producer of petroleum and other liquids in Southeast Asia and the fifth-highest exporter of liquefied natural gas (LNG) globally in 2023. According to the 2024 Statistical Review of World Energy by Energy Institute, Malaysia's oil production reached 565,000 barrels per day (bbl/d) in 2023, making it the fifth-largest producer in the Asia Pacific region. The natural gas production was approximately 81.07 billion cubic meters (Bcm), maintaining its position as the third-largest natural gas producer in the Asia Pacific region. Additionally, with LNG exports totaling 36.3 billion cubic meters (Bcm), Malaysia ranked as the second-largest LNG exporter in the region

According to the U.S. Energy Information Administration (EIA, 2024) in the Country Analysis Brief: Malaysia (November 12, 2024 update), Malaysia's probable and proven petroleum reserves were estimated at 6.9 billion barrels of oil equivalent (boe), with approximately 61% of these reserves located in Sarawak, 18.8% in Sabah, and the remaining 20.2% in Peninsular Malaysia. These reserves can last up to 15 years (NST, 2023)[5]

Petroliam Nasional Berhad (PETRONAS) was incorporated in 1974 under the Petroleum Development Act (PDA) 1974, which established its dual role as both operator and regulator within Malaysia's oil and gas sector (Bhattacharya & Hutchinson, 2022). PETRONAS sets and enforces standards for upstream activities,