INTERDISCIPLINARY APPROACHES TO SUSTAINABILITY, INNOVATIONS, CULTURAL HERITAGE, TECHNOLOGY, AND URBAN DEVELOPMENT IN INDONESIA

Editor

Dr. Teena Singh

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Interdisciplinary Approaches to Sustainability, Innovations, Cultural Heritage, Technology, and Urban Development in Indonesia

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PREFACE

This book brings together a diverse collection of interdisciplinary studies that explore the intersection of sustainability, technology, cultural preservation, and urban development. The chapters within offer a unique perspective on these themes, particularly in the context of Indonesia, a country rich in both cultural heritage and rapidly evolving technological advancements.

As the world faces an increasing need for sustainable practices, this book seeks to address key challenges in various sectors, from architecture and tourism to environmental management and industrial production. The chapters delve into cutting-edge topics, such as the application of Artificial Intelligence (AI) in preserving cultural heritage, the role of architecture in mitigating environmental impacts, and innovative approaches to urban development. They also highlight the practicalities of implementing sustainability in industries like footwear manufacturing and oil production, offering valuable case studies from Indonesia.

One of the central themes of this book is the integration of traditional practices with modern technologies. From the preservation of the Durgā statue at the Prambanan Temple using AI tools to the role of sustainable tourism in Indonesia's tropics, the book emphasizes how technology can enhance, rather than replace, cultural practices and natural environments. In doing so, it encourages a holistic approach to development that respects both historical legacies and contemporary needs.

The chapters also explore the role of system technologies, such as Enterprise Resource Planning (ERP) systems, in improving user satisfaction and operational efficiency across various sectors. Moreover, the book highlights how innovations in design and production, from footwear manufacturing to urban planning, can lead to more sustainable and socially responsible outcomes.

The contributors to this book come from diverse backgrounds, each offering a distinct viewpoint on the issues at hand. Their research reflects a growing commitment to creating solutions that are not only technologically advanced but also culturally sensitive and environmentally sound.

As we navigate the complexities of the 21st century, the knowledge and insights shared in this book serve as a valuable resource for academics, practitioners, and policymakers alike. By presenting a multifaceted view of Indonesia’s ongoing efforts to balance progress with sustainability, we hope to inspire further research and innovation that will contribute to a more sustainable, equitable, and prosperous future for all.

Dr. Teena Singh
Bursa, Türkiye – December 2024

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CHAPTER 5

The PSC Cost Recovery Analysis Comparison between Adding Infill Wells and Workovers Scenarios of a Remote Oil Producing Field in Indonesia

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ABSTRACT

The Production Sharing Contract (PSC) is a pivotal mechanism governing profit sharing in oil and gas extraction, outlining the distribution of profits between the government and contractor companies. This sharing is contingent on deducting cost recovery, a crucial element in collaboration agreements within the upstream oil and gas sector. Efficient cost recovery management is essential for both the state and contractors. Assessing the efficacy of this contractual framework, a comprehensive analysis explores three field development scenarios within the XYZ field. Scenario I involves 5 infill wells and 3 workovers, Scenario II expands on Scenario I with an additional 3 infill wells, and Scenario III further advances with 2 extra infill wells and 2 workovers. Upon evaluating the implications, it's clear that Scenario III proves to be the most lucrative, boasting the highest Net Present Value (NPV) for the contractor at 5,442 million USD compared to other scenarios. The cumulative forecast predicts oil production of 2,185 thousand barrels from 2021 to 2035, generating a gross revenue of 131.1044 million USD. Notably, the Internal Rate of Return (IRR) is commendable at 26.21%, exceeding the Minimum Acceptable Rate of Return (MARR) set at 15%, with a Payback Period of 4.30 years. Moreover, the sensitivity analysis, of the responsiveness of economic parameters and their impact on NPV and IRR values within the project. Keywords such as IRR, NPV, PSC Cost Recovery, and Sensitivity Analysis encapsulate the essence of this study, offering a holistic understanding of the intricate dynamics inherent in oil and gas mining ventures.

Keywords: IRR, NPV, PSC Cost Recovery, Sensitivity Analysis.

1. INTRODUCTION

While conducting activities related to the exploration and exploitation of oil and gas in the oil and gas sector, the Indonesian government, represented by the Special Task Force for Upstream Oil and Gas Business Activities, enforces a collaboration contract system. In this system, contractors, acting as investors, engage in cooperative agreements with the government.

Government and foreign oil companies enter into contractual agreements for the operation and management of oil and gas activities. Within these collaborative contracts, a specific type known as a Production Sharing Contract (PSC) has arisen. This contract entails the sharing of production, determined by the agreedupon percentage between both parties through the collaborative contract.

The involved parties include the government, serving as the area owner, and the contractor, a company engaged in upstream oil and gas activities, encompassing exploration to production, and functioning as an equipment supplier (Kastella & Prabowo, 2020). Within the Production Sharing Contract (PSC), a clause addresses the expenses of rescuing oil and gas operations, referred to as cost recovery. The implementation of this policy may incentivize the producer company to consider acquiring an oil and gas production area, facilitating the transfer of ownership rights. If successful in oil and gas production, all incurred costs can be reimbursed through the cost recovery mechanism.

2. FUNDAMENTAL THEORY

2.1. Production Sharing Contract in Indonesia

The oil and gas industry encompasses various stages, including exploration, development, production, transportation, and marketing. These activities are broadly categorized into upstream and downstream operations. Indonesia has adopted a Production Sharing Contract (PSC) system, outlined in Law Number 22 of 2001, to manage upstream (Pohan, C *et al.*, 2023)

The PSC entails a cooperative agreement between the government, serving as the regional supplier, and the contractor, responsible for exploration, development, and equipment supply. Uncertainty regarding the size of potential oil and gas reserves poses a challenge in this industry. In Indonesia, the PSC split is initially 65-35% between the government and contractors. Subsequently, profit sharing transforms to 85% - 15% for oil and 70% - 30% for gas. By 1979, the split depends on production, with a 50-50% arrangement for low production and 85% - 15% for high production (Irvan, Y P *et al.*, 2023).

2.2. PSC Cost Recovery

Indonesia has instituted a production sharing contract (PSC) framework to oversee investments and income in the oil and gas domain. In the upstream oil and gas sector, "cost recovery" refers to revenue collected from oil companies to address capital and operational expenses for a specific year, incorporating any outstanding costs not covered in the preceding year (Karisma R *et al.*, 2021; Karwan D S *et al.*, 2021; Arifin K *et al.*, 2021).

The implementation of cost recovery is intended to reimburse the costs incurred by investors when carrying out exploration and development activities for oil and natural gas produced and approved by the authorized institution/authority to repay these operational costs. The government will pay cost recovery to oil companies. Cost recovery can actually be said to be an investment in the form of developing natural resources, especially oil and gas natural resources. Payment of oil and gas contractor funds (Cost recovery) begins at the production stage and the budget spent during exploration and exploitation activities (construction of production facilities), will be repaid in full. From the point of view of production efficiency, the part of oil production after reduction by Cost Oil is called Profit Oil. The following Figure 1 is the PSC Cost Recovery scheme (Arifin K *et al.*, 2021; Fedella Esrar R *et al.*, 2021; Sabaris S *et al.*, 2020).

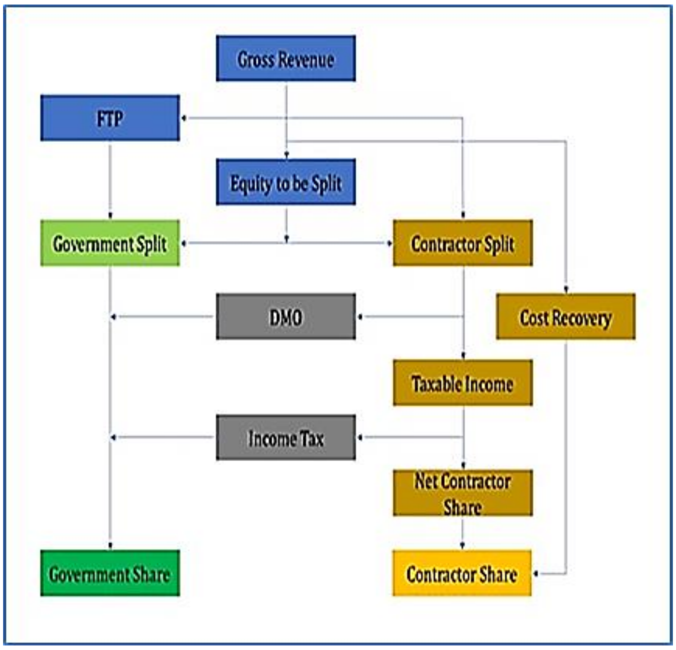

Figure 1. PSC Cost Recovery Scheme (Lubiantara, 2012)

3. METHODOLOGY

The following outlines the steps in computing the PSC Cost Recovery contract system:

1. Gross Revenue Value Identification: This involves determining the Gross Revenue, synonymous with Gross Income, derived from oil or gas production in a field (Ubaidillah, M, 2020).
2. First Trench Petroleum Assessment: Evaluate the Value of First Trench Petroleum, which constitutes a portion of the gross revenue accessible to collaborating companies and the government before undergoing cost recovery deductions (Pratama Y A, *et al.,* 2020).
3. Tax Bracket Establishment: Set the Tax bracket, specifying the Tax Value on Field XYZ. Tax serves as additional government income from oil and gas projects, and the applicable percentage is determined by the government (Trijana Kartoatmodjo R *et al.*, 2019).
4. Depreciation Computation: Calculate Depreciation using the declining balance method at the XYZ Field. This method factors in the diminishing value of assets over time and usage, with a greater decline at the beginning of the year (Gadjah *et al.*,2019).
5. Cost Recovery Determination: Identify Cost Recovery parameters, including intangible assets, tangible asset depreciation, operational costs (OPEX), ASR (Abandonment Site Restoration) costs, and unrecovered costs (Vonna, Z *et al.*, 2019).
6. Domestic Market Obligation (DMO) Evaluation: Assess the Domestic Market Value of Bonds, translating to the DMO as outlined in Government Regulation No. 53 of 2013. The contractor is obliged to sell 25% of its production to the government at Field XYZ, with a corresponding DMO Fee of 25% (Ruslijanto *et al.*, 2018).
7. Contractor Shares Calculation: Calculate Contractor Shares, incorporating the contracor's Equity to be Split (ETS) and First Trench Petroleum (FTP) as part of their entitlement from the gross income after pretax cost deductions, multiplied by ETS (Anjani, B *et al.*, 2018).
8. Contractor Taxable Income Consideration: Consider the value of Contractor Taxable Income, reflecting the contractor's income after taxation (Harry B.A. *et al.*, 2018).
9. Contractor Tax Value Determination: Determine the Contractor Tax value, which is imposed on contractors by the government at Field XYZ, set at 40.5% as per the initial agreement (Yin *et al.*, 2018).

10. Total Contractor Take Computation: Calculate the Total Contractor Take, representing the net profit after tax deductions, denoting the contractor's entitlement as an investor (A Saidu Sani, 2014).
11. Government Take Calculation: Determine the Government Take, computed by adding the government's First Trench Petroleum (FTP), government's Equity To be Split (ETS), and the Tax charged to the contractor (Ferdian F *et al.*, 2014).
12. Contractor Cash Flow Evaluation: Assess the Contractor Cash Flow, representing the turnover of funds in the company to analyze economic indicators such as Net Present Value (NPV), Internal Rate of Return (IRR), and Pay Out Time (POT) for XYZ Field's economic analysis (Nurakhmet G, 2012).
13. Net Present Value (NPV) Calculation: Compute Net Present Value (NPV), denoting the excess present value of cash inflow over the initial investment, serving as an economic indicator for project analysis (Satiyawira, B *et al.*, 2018).
14. Internal Rate of Return (IRR) Value Determination: Determine the Internal Rate of Return Value (IRR), representing the interest rate resulting in an NPV equal to 0. A negative IRR implies project infeasibility (Pramadika, H *et al.*, 2019).
15. Pay Out Time (POT) Assessment: Evaluate the Pay Out Time (POT), an economic indicator indicating the year in which the contractor's payback period occurs, aligning the capital issued with the value of money (Lubiantara, B, 2012).
16. Sensitivity Analysis: Lastly, employ Sensitivity Analysis as a method to scrutinize potential changes in economic indicators, providing insights into the project's robustness to varying conditions (Yusgiantoro P., 1993).

4. RESULTS AND DISCUSSION

The development of the XYZ Field progresses through three scenarios:

1. Involving 5 infill wells and 3 workovers.
2. Building upon Scenario I by adding 3 infill wells.
3. Advancing from Scenario II by incorporating an additional 2 infill wells and 2 workovers.

The importance of the following discussions to this study is paramount. These discussions are crucial in providing a comprehensive understanding of the research problem and its context. The discussions will enable the researcher to identify the key issues, concepts, and theories that are relevant to the study. Furthermore, the discussions will provide a platform for the study to critically evaluate the existing literature and identify gaps in the knowledge base. Therefore, it is imperative to engage in the following discussions with an open mind and a critical eye.

4.1. Production Data

The present study focuses on an oil producing field. The research employs secondary data to perform economic calculations based on the PSC Cost Recovery method. The study aims to provide a comprehensive understanding of the production forecast data for scenarios I, II, and III from 2021 to 2035. The PSC Cost Recovery mechanism determines the operating expenses, cost recovery costs, and the oil price. The study will critically evaluate the existing literature and identify gaps in the knowledge base.

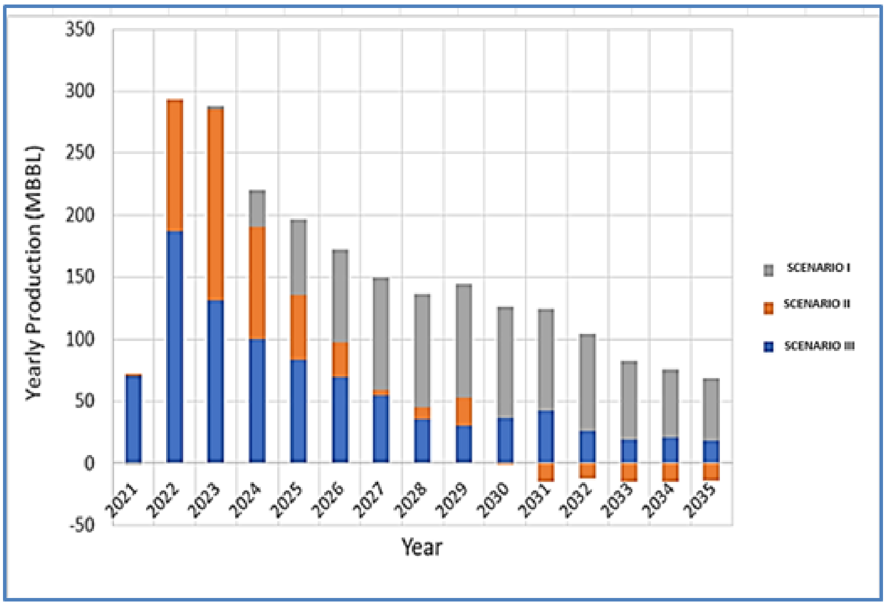

Figure 2. Forecasted oil production

The cumulative details of the production forecast for the field studied, which is known from the start of the contract to the end of production in the 15th year (Figure 2 and Table 1).

Table 1. The cumulative production forecasting

Scenario	I	II	III
OOIP (mmstb)	60,5	60,5	60,5
RF	13,2%	16,87%	18,26%
EUR (mmstb)	7,992	10,206	11,047
Cum.Prod (mmstb)	5.932	6.323	7.192
Incremental	0,923	1,322	2,195

4.2. The Economic Analysis

The subsequent section comprises the findings and the ensuing discussion of the economic analysis conducted on the field under examination for each scenario.

Table 2. The PSC cost recovery scenario 1 calculation results

Indicator	Unit	Result
• Gross Revenue	MUSD	55.409
• FTP	MUSD	2.763
• Intangible Asset	MUSD	10.443
• Tangible Asset	MUSD	9.801
• Operational Cost	MUSD	8.053
• ASR	MUSD	2,282
• *Cost Recovery*	MUSD	30.588
• *Equity to be Split*	MUSD	22.051
• DMO	MUSD	6.714
• Tax	MUSD	6.758
• IRR	%	20,97
• *Pay Out Time* (POT)	year	2,86
• Contr NPV @ 15%	MUSD	1.483
• Contractor Take	MUSD	40.516
• Government Take	MUSD	14.893

Table 2 depicts the outcomes of economic computations for Scenario I. The results indicate a contractor take value of 40,516 MUSD and a government take of 14,893 MUSD. The IRR is determined to be 20.97%, accompanied by a payout time of 2.86 years. Given the Minimum Acceptable Rate of Return (MARR) at 15%, Scenario I, with its 20.97% IRR, is considered economically viable.

Table 3. The PSC cost recovery scenario 2 calculation results

Indikator	Unit	Hasil
Gross Revenue	MUSD	79.370
FTP	MUSD	3.969
Intangible Asset	MUSD	20.564
Tangible Asset	MUSD	11,201
Operational Cost	MUSD	11.735
ASR	MUSD	2.899
Cost Recovery	MUSD	46.956
Equity to be Split	MUSD	28.446
DMO	MUSD	9.602
Tax	MUSD	8.825
IRR	%	28,83
Pay Out Time (POT)	Year	3,76
Contr NPV @ 15%	MUSD	3.459
Contractor Take	MUSD	59.922
Government Take	MUSD	19.449

The outcomes of economic computations for Scenario II are presented in Table 3. The economic analysis reveals a contractor take value of 59,992 MUSD and a government take of 19,449 MUSD. The IRR is calculated to be 28.83%, with a corresponding payout time of 3.69 years. Given the Minimum Acceptable Rate of Return (MARR) at 15%, Scenario II, with its 28.83% IRR, is deemed an economically feasible scenario.

Table 4. The PSC cost recovery scenario 3 calculation results

Indicator	Unit	Result
• Gross Revenue	MUSD	131.104
• FTP	MUSD	6.585
• Intangible Asset	MUSD	28.875
• Tangible Asset	MUSD	11.996
• Operational Cost	MUSD	19.141
• ASR	MUSD	3.311
• *Cost Recovery*	MUSD	63.292
• *Equity to be Split*	MUSD	61.826
• DMO	MUSD	15.453
• Tax	MUSD	18.626
• IRR	%	26,91
• *Pay Out Time* (POT)	Year	4,30
• Contr NPV@ 15%	MUSD	5.442
• Contractor Take	MUSD	90.657
• Government Take	MUSD	41.046

Table 4 displays the outcomes of economic computations for Scenario III. The economic analysis indicates a contractor take value of 90,657 MUSD and a government take of 41,046 MUSD. The IRR is determined to be 26.91%, accompanied by a payout time of 4.28 years. In accordance with the proposed Minimum Acceptable Rate of Return (MARR) at 15%, Scenario III, featuring a 26.91% IRR, is characterized as an economically favorable scenario.

4.3. Sensitivity Analysis

The examined economic indicators encompass oil production, oil prices, operational expenditure, and capital expenditure (Figure 3). Sensitivity analysis was conducted utilizing the economic outcomes of Scenario III. The economic parameters scrutinized in this analysis include oil prices, operational costs, capital expenditure, and field production. The rationale behind conducting sensitivity analysis is to anticipate variations in parameters that serve as economic indicators, encompassing NPV, IRR, and POT, thus ensuring the stability of the analysis in the face of potential parameter changes.

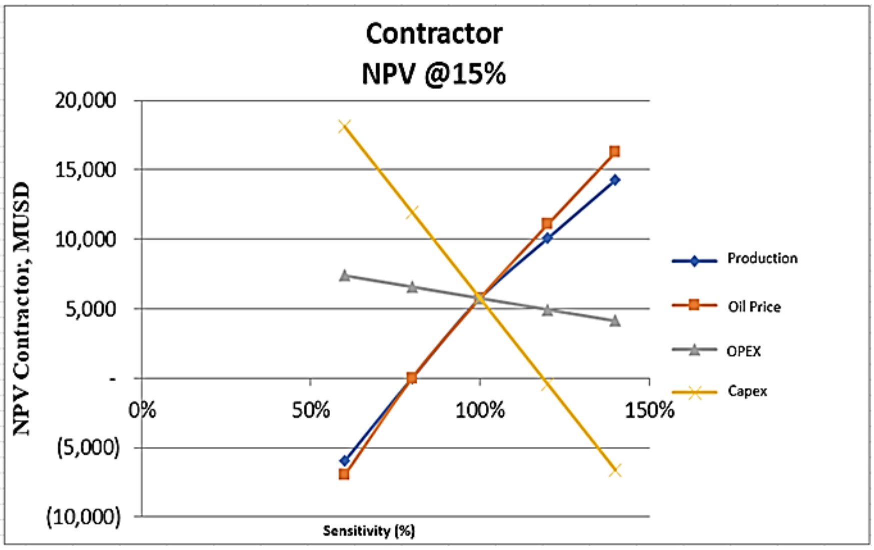

Figure 3. A figure sensitivity to production, OPEX, CAPEX and oil prices

The examination of Net Present Value (NPV) sensitivity concerning oil prices, Operational Expenditure (OPEX), Capital Expenditure (CAPEX), and production reveals that elevated oil prices and increased production correlate with higher NPV outcomes. This association arises from the fact that heightened oil prices and production levels result in a larger gross revenue value, thereby yielding substantial project profits. In terms of the OPEX indicator, a higher OPEX value corresponds to a diminished NPV. This relationship stems from the increased operational costs leading to reduced profits. Conversely, with the CAPEX indicator, a smaller CAPEX value corresponds to a larger NPV. This outcome is attributed to the lower costs incurred for CAPEX. Conversely, an escalation in CAPEX costs results in a diminished NPV.

5. CONCLUSION

In Scenario I, the contractor's NPV stands at 1,483 MUSD, with an IRR of 20.83% and a Pay Out Time (POT) of 3.76 years. For Scenario II, the contractor's NPV reaches 3,838 MUSD, featuring a 28.83% IRR and a POT of 3.76 years. Meanwhile, in Scenario III, the contractor's NPV amounts to 5,442 MUSD, accompanied by a 26.21% IRR and a POT of 4.30 years. Scenario III demonstrates the highest contractor NPV compared to both Scenario I and Scenario II. The POT in Scenario I is quicker than that in Scenario II and Scenario III. Analyzing IRR values reveals that Scenario I has the smallest IRR percentage.

The economic analysis results indicate that oil prices, production quantities, Capital Expenditure (CAPEX), and Operational Expenditure (OPEX) are pivotal factors influencing NPV, IRR, and POT values. NPV and IRR sensitivity analysis underscores the significance of oil prices and production as the most sensitive parameters. Elevated oil prices and increased production correspond to greater NPV and higher IRR. Sensitivity analysis regarding OPEX demonstrates that higher OPEX values lead to diminished NPV and IRR. In contrast, smaller CAPEX values result in greater NPV, albeit with a smaller IRR. Considering the obtained and analyzed indicators, Scenario III emerges as the most lucrative and viable option for the development of the XYZ Field due to its superior profitability.

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İş bu sertifika açık unvan ve adresi yazılı olan işyeri, 5846 sayılı Fikir ve Sanat Eserleri kanunu uyarınca yukarıda belirlenen alan/alanlara ilişkin faaliyet gösterir.

e-imzalıdır

SERTİFİKA NO	GEÇERLİLİK TARİHİ	Dr. Kamil ÖZER Vali a. İl Müdürü
51898	30.07.2021 - 30.07.2025	