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Economic Analysis of Marginal Oil Field Development By Testing The Feasibility of GVM in Sharia Method Against NPV

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ABSTRACT - A marginal oil field (MOF) is a field with relatively small hydrocarbon reserves located at significant depths. This presents major technical and economic challenges for its development. In the Central Sumatra Basin, a MOF with fair development potential has been discovered. The development of this MOF has to be analyzed to determine its feasibility. Previous research has predominantly evaluated oil field feasibility using conventional metrics, such as net present value (NPV) and profitability index (PI). However, assessing feasibility with a Syariah economic approach is an underdeveloped area of study. This study aims to compare conventional and Syariah methods for assessing MOF feasibility. The study involved field observation, primary and secondary data collection, calculation of reserves and oil production, cost estimation, oil price forecasting, and cash flow preparation based on a production sharing contract gross split contract scheme. The economic evaluation was conducted using conventional economic indicators (NPV, internal rate of return (IRR), payout time (POT), and PI) and Syariah indicators, namely, the gold value method (GVM) and gold index (GI). It is found that the development of the MOF is economically feasible. The NPV reached USD 172.27 million, with an IRR of 16.50%, a POT of 3.86 years, and a PI of 1.04. Moreover, the GVM was 10,687.03 grams of gold, and the GI stood at 1.20. This study demonstrates that the results of the Syariah method are consistent with those of the conventional methods, affirming its viability as an alternative evaluation approach for MOF development.

Keywords: marginal oil field, economic feasibility, sharia method, gold value method, gold index.

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INTRODUCTION

Indonesia's economy relies significantly on its oil and gas industry (Nonci et al. 2020). Indonesia has significant oil and gas potential. Its oil and gas working areas cover an expanse of about 750,000 km^2, containing 3.8 billion barrels of proven oil reserves and 77 trillion standard cubic feet tsc of natural gas (Butar et al. 2023). As the nation's energy demand continues to rise, the development of marginal oil fields (MOFs) is crucial. These fields are often overlooked due to the perception that their economic potential is insufficient compared with that of larger, more prolific fields.

A MOF is defined as an accumulation of hydrocarbons that have been discovered but is deemed uneconomical to develop or produce further. This is typically due to low reserves, significant reservoir depth, and high production costs. However, these fields can be developed if there are technological advancements, cost efficiencies, or fiscal incentives (Abdulkadir 2024). An effective field development strategy should be established to ensure optimal hydrocarbon production, taking into account technical as well as economic considerations (Al-Attas & Yasutra, 2021). MOFs can be revitalized and become economically feasible through various methods, including infill drilling. This strategy involves drilling additional wells between existing ones to enhance recovery efficiency and increase producible reserves, often without requiring major infrastructure investments (Pan et al. 2022).

One of the MOFs is in the Middle Sumatra Basin a mature basin with a long production history. The economic feasibility of developing this field requires a holistic analysis. This is crucial because the inherent marginal characteristics of the field reflect high risks and significant uncertainties. In general, conducting an economic evaluation of petroleum projects is crucial when an oil and gas company considers investing. Such an evaluation highlights the importance of further analysis to assess the project's profitability (Mardiana et al. 2024). Historically, economic assessments in the oil and gas industry have primarily relied on conventional financial indicators, such as net present value (NPV), internal rate of return (IRR), payout time (POT), and profitability index (PI). Although they are widely practiced and useful, these approaches are largely profit-oriented, which often do not explicitly consider ethical aspects, environmental impacts, or the fair distribution of benefits. Consistent with Indonesia's increasingly inclusive and sustainable energy policy direction, there's a growing need for alternative evaluation approaches that better align with local values and religious principles.

To address these evolving needs, this study proposes leveraging Syariah economic principles to analyze the feasibility of MOF development. The gold value method (GVM) translates a project's value into a gold equivalent because of its universal benchmark and high resistance to inflation, while the gold index (GI) represents the ratio of a project's output value to its gold equivalent investment (Agustin et al. 2022). These Syariah indicators aim to present a real economic value and social justice, moving beyond mere speculative projections or debt-based valuations. The use of GVM and GI is particularly relevant in regions with an Islamic socio-economic foundation, as it promotes ethical investment, avoids excessive uncertainty (gharar), and ensures value preservation. Furthermore, this method provides a more robust evaluation basis for intergenerational resource management and wealth distribution. This is crucial when assessing marginal assets that have a long-term impact on the community.

The novelty of this study lies in its integration of Syariah-based economic analysis for evaluating MOF development an approach that is largely unexplored in the current oil and gas literature—with conventional methods. While previous research has evaluated project feasibility using production sharing contract models and conventional financial indicators, there's a notable gap in directly comparing the decision outcomes of conventional and Syariah indicators in real-world case studies of MOF development. By applying both conventional and Islamic economic approaches to the same marginal field project, this study offers a direct comparison of evaluation results. It also aims to determine whether Islamic economic methods can serve as a valid alternative or a valuable complement in the decision-making process in the oil and gas sector. This contribution is expected to enrich the methodological toolkit available to policymakers, investors, and regulators, particularly in Muslim-majority countries, for evaluating small-scale and challenging oil and gas projects.

METHODOLOGY

This study was conducted at the marginal field in the Central Sumatra Basin. The oil in this basin was discovered at a depth of 1500 ft (457.2 meters) or more than 75 meters, so it is categorized as a marginal field because the oil is in the extreme deep (Usman et al. 2019).

The field is projected to produce for 20 years, with a constant decline in production of 18% each year. Three wells will be drilled in this field, each of which can produce 60 BOPD, implying that in the first year, 180 BOPD would be produced. The production data are obtained from the analogy of field or well production data of the marginal field, as the structure, stratigraphy, and the reservoir characteristics of the field are similar to those of surrounding fields and wells.

This study is conducted in several stages as follows (Figure 1).

Preparation

- Literature review on MOF
- Collection of data to calculate the economics of MOF development, including: 1). Reservoir data: Reservoir radius (m), thickness (ft), porosity (%), water saturation (%), and formation volume factor (bbl/STB); 2). Field production: Initial well production (BOPD), number of wells, and decline factor; 3). Investment data: Capital investment (tangible cost) and non-capital investment (intangible cost, operating cost data); 4). Fiscal data; 5). Oil price data; 6). Gold price data.

Data processing

- Calculating oil reserves

The original oil in place (OOIP) is calculated as follows:

OOIP calculation:

$$OOIP = \frac{7758\ A \cdot h \cdot \emptyset \cdot (1 - swi)}{Boi} \tag{1}$$

where the variables are defined as follows:

OOIP = original oil in place (STB)
7758 = conversion factor from acr/ft to bbl
A = area (acre)
H = layer thickness (ft)
Ø = average porosity (%)
Swi = average water saturation (%)
Boi = initial oil formation volume factor (bbl/STB).

The ultimate recovery calculation is as follows:

$$UR = N \times RF \tag{2}$$

where the variables are defined as follows:

N = OOIP (reserves)
RF = recovery factor (%)

The recovery factor calculation is as follows:

$$RF = \left(\frac{UR}{N} \times 100\%\right) \tag{3}$$

Production forecast

To calculate oil production, an exponential equation is used in the decline curve analysis method. This analysis is used to estimate future oil production (Saphiro, 2017). After determining the total initial oil production in field X and the decline factor, the oil production in the following years can be calculated by using the following formula (Irwin 2015):

where the variables are defined as follows:

$$q_t = q_i \times e^{-Dt} \tag{4}$$

q_t = production at time t
q_i = initial production
e = exponential
D = decline factor
t = time

Investment planning

Investment planning for wells involves both capital and non-capital costs.

Oil price calculation

The oil price used is an estimated price that is taken flat with an 80% approach from the average historical Indonesia Crude Price (ICP) data for the last 5 years, from January 2020 to January 2024. This is based on the oil price assumption in the POD determined by the Program and Budget Control Division.

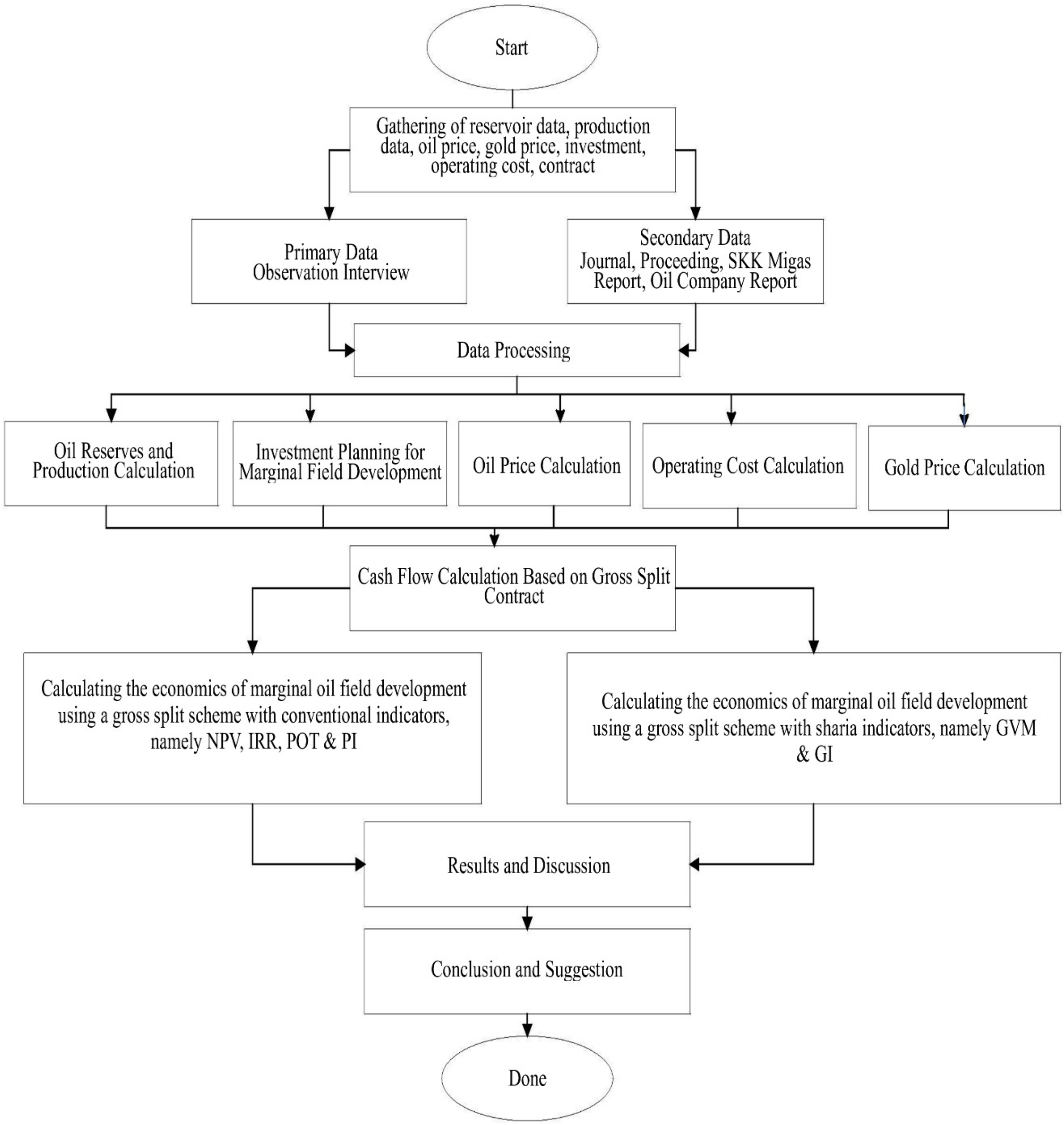

Figure 1. Flowchart of the research activities

Gold price calculation

The estimated gold price used is an estimated price that is taken flat with an approach to the Indonesian gold price on the precious metal website for the last 5 years, from January 2020 to January 2024.

Cash flow calculation

The cash flow calculation is based on the gross split contract. Figure 2 depicts the gross split cash flow scheme.

The conventional economic indicators

That is, NPV, IRR, POT, PI, and sharia economic indicators, that is, GVM and GI, are calculated based on the economic results obtained from the calculation of the gross split contract scheme.

Conventional economic indicators

NPV

NPV is an economic indicator used to evaluate whether an investment is profitable or not by calculating the present value of future cash flows (Ariyon, 2013). Positive NPVs indicate profitable investments, while negative values indicate unprofitable investments (Shereih 2016). The following formula is used to calculate the NPV (Ariyon et al. 2022):

$$NPV = NCF_0 + \frac{NCF_1}{(1+i)} + \cdots + \frac{NCF_n}{(1+i)^n} \quad (5)$$

where the variables are defined as follows:

NCF_0 = net cash flow (NCF) year 0

NCF_n = NCF in year n

i = discount rate

Internal rate of return (IRR)

IRR is the interest rate that makes the NPV zero (Shereih 2016). A company will undertake an investment if the IRR is greater than the minimum attractive rate of return (MARR) (Ariyon 2013). The IRR formula is as follows (Ariyon et al. 2022):

$$IRR = i + \frac{NPV_1}{(NPV_1 + NPV_2)}(i_2 - i_1) \quad (6)$$

where the variables are defined as follows:

NPV_1 = NPV (+)

NPV_2 = NPV (-)

i_1 = discount rate (NPV (+))

i_2 = discount rate (NPV (-))

POT

POT is the time required to return capital or investment (Oliviaputie & Sa'diyah, 2022). POT indicates the year in which the cumulative NCF (CNCF) equals zero (Pramadika & Satiyawira, 2018). POT is calculated in units of years (Casdira & Fikri, 2010). The formula for determining the POT value is as follows (Ariyon et al. 2022):

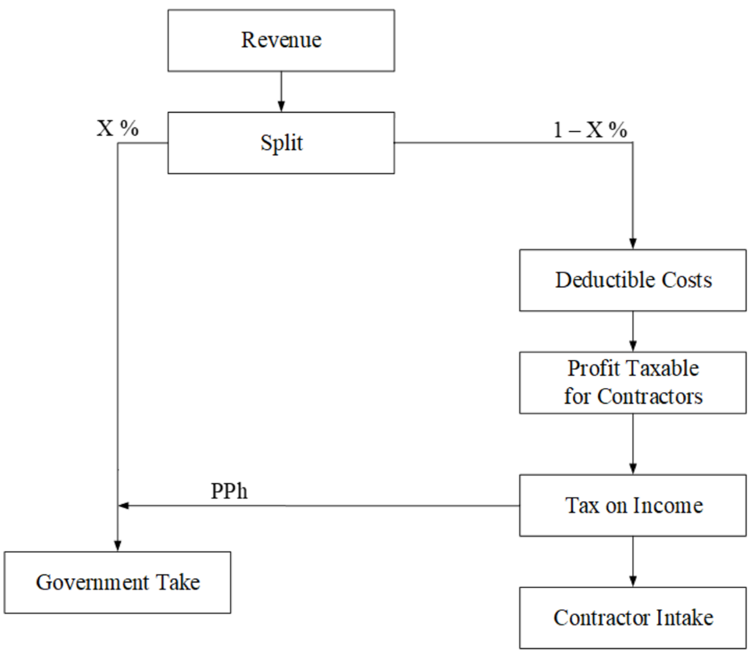

Figure 2. Gross split cashflow scheme

$$POT = n_1 + (n_2 - n_1)\left(\frac{CNCF_1}{CNCF_1 - CNCF_2}\right) \quad (7)$$

where the variables are defined as follows:

$CNCF_1$ = CNCF (-)

$CNCF_2$ = CNCF (+)

n_1 = year when CNCF is negative

n_2 = year when CNCF is positive

If the POT is smaller than the investment life, then the project is profitable (Sudarti et al. 2021).

PI

PI is the ratio of the total present value of cash flow to the project investment (Ridwan et al., 2022). If the PI is greater than 1, then the project is categorized as feasible (Afaz & Gusman 2021). . The PI is calculated as follows (Agustin & Azwirman 2019):

$$PI = \frac{PV\ Cashflow}{Investment} \quad (8)$$

Sharia economic indicators

GVM

GVM is a new method for calculating the financial aspects of investment feasibility from an Islamic perspective (Agustin et al. 2022). The GVM is aimed to serve as an alternative to the NPV method, which has an element of interest. The GVM is used to calculate the time value of money of an investment based on the future price of gold. The GVM uses a simple and rational formula that is adjusted to the price of gold. The GVM formula is as follows (Agustin et al. 2023):

$$GVM = \sum PV\ Cashflow - INV \quad (9)$$

$$PV = \frac{INC_{t1}}{GP_{t1}} + \frac{INC_{t2}}{GP_{t2}} + \frac{INC_{t3}}{GP_{t3}} + \ldots + \frac{INC_{tn}}{GP_{tn}} \quad (10)$$

where the variables are defined as follows:

GVM = gold value method

INV = initial investment

INC = income

GP = gold price

If the GVM is positive, then the project is feasible (Agustin et al. 2023).

GI

GI is the ratio of the present value of gold to the present value of gold of the initial investment expenditure (Rahman & Oktaviani 2022). GI's results are consistent with those of GVM (Agustin & Azwirman 2019). The GI formula is as follows:

$$GI = \frac{total\ gold\ revenue\ (gram)}{total\ initial\ investment\ (gram)} \quad (11)$$

If the GI is 1 or more, the project can be implemented (Agustin et al. 2023).

Result Interpretation

This study analyzes the feasibility of marginal petroleum field development based on the results of GVM (the Sharia method) against those of the NPV method (conventional method). It also compares economic indicators to determine whether a feasibility assessment based on the Hamdi method and the conventional method produces the same decision results.

RESULT AND DISCUSSION

Oil reserves

Based on field data, it is assumed that the reservoir is ellipse-shaped, and the oil reserves are calculated using the volumetric method. In determining oil reserves, we first calculate the reservoir area, which is 61.10 acres. The oil reserves are then obtained as 1,137,689 STB.

Forecasting oil production

Forecasting oil production is used to determine the total oil production (Herawati et al. 2017). The production profile of the MOF is forecasted to be 20 years. Based on the amount of oil reserves obtained, production forecasting can be performed by utilizing the initial production data, number of wells, and decline factors. Figure 3 depicts the daily production pattern of MOF X.

Figure 3 depicts the forecasted production (BOPD) for all wells (3 wells) of field X over 20 years by utilizing natural reservoir drivers. It was forecasted that in the first year, field X would have a daily production of 180 BOPD, so the total production in the first year would be 65,700 BOPD

(1 year = 365 days). In the last year of exploitation, the field would have a daily production of 6 BOPD, accumulating to 2,149 BOPY.

Oil price

MOF X has a type of light oil; thus, the cash flow calculation uses Sumatra Light Crude (SLC) oil price. SLC oil price is one type of ICP. This price is obtained through the Official Website of the Ministry of Energy and Mineral Resources of the Republic of Indonesia Directorate General of Oil and Gas. The SLC oil price is $82.13/bbl.

Investment value planning

The investment budget for three wells and the fiscal data are presented in Table 1.

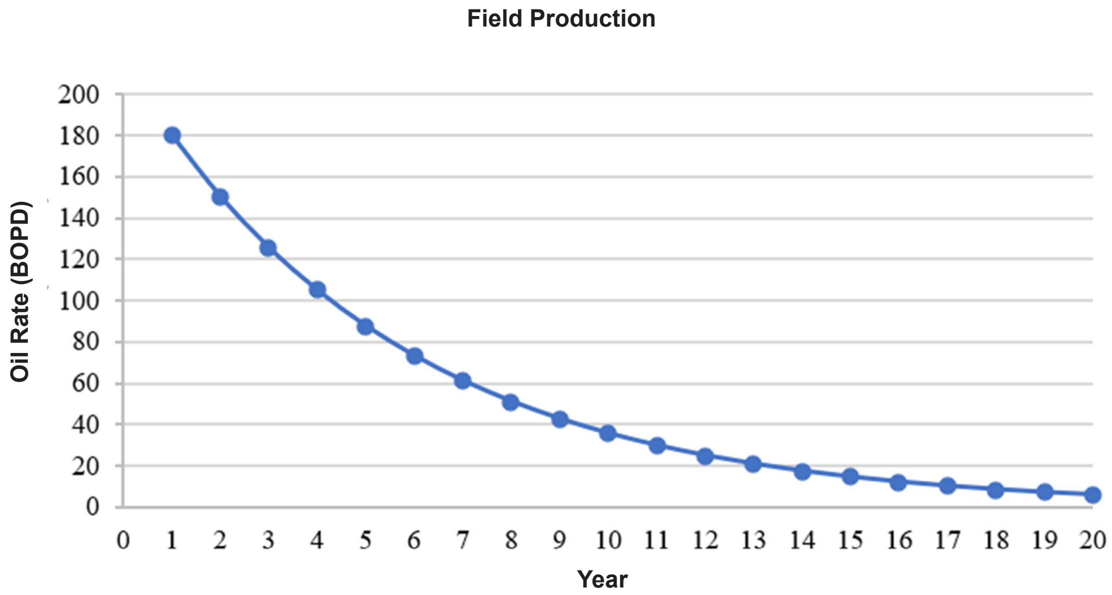

Figure 3. Production of MOF X

Table 1. Field investment budget data X

Investment Budget	Price ($M)
I. Capital Cost	
1. Capital Drilling	
Casing	450.83
Tubing	88.18
Well Equipment	97.23
2. Production Facility	
Piping	161.61
Equipment and Accessories	202.17
Sub Total Capital Cost	1,000,000

Table 1. Field investment budget data X (continued)

Investment Budget	Price ($M)
II. Non-Capital Cost	
1. Non-Capital Drilling	
Rig Contract	615.56
Mud and Cementing	380.54
Bits, Reamers, Accessories	310.70
Directional Drilling	329.57
Perforation and Completion	123.76
Logging and Coring	124.72
General (overhead, etc)	326.33
2. Road and Location	
Well Site	550.52
Access Road Prep	238.31
Sub Total Non-Capital Cost	3,000,000
Total Investment	4,000,000

Cash flow preparation based on gross split contract

In 2017, Indonesia's Minister of Energy and Mineral Resources launched a new upstream oil and gas contract system called "Gross Split." The main objective of this contract was the elimination of cost recovery (Daniel 2017). There were several other reasons for launching the system. For instance, the government intended to encourage the effectiveness and efficiency of the oil and gas industry in Indonesia. The government also wanted contractors to be more efficient in managing costs and risks in production. Moreover, the government wanted to simplify production sharing contracts without debate and manipulation of cost recovery (Sugiyartomo 2019). The facilities used by the contractor remained the property of the state (Intaniasari 2020). Furthermore, an additional split will be given to the contractor if there is a decrease in the price of either oil or gas (Jumiati & Sismartono 2018). In addition to the elimination of cost recovery, there is also an element of first tranche petroleum (FTP) that is eliminated in gross split contracts. The reason for the elimination of FTP is that at the beginning of the contract, the government and the contractor agree on the shares that would be received. Thus, the elimination of FTP in this contract is an advantage for investors (Fajri 2020). Gross split is divided by three in its calculation. The state will receive 57% and 43% goes to the contractor if the product produced is categorized as oil, and the state will get 52% and the contractor 48% if it is gas, which is a base split in this case (Rulandari et al. 2018). Block status, location, production stage, infrastructure, domestic component level, hydrogen sulfide and carbon dioxide content, oil specific gravity, and reservoir depth and type are included in the variable split component. The total amount of production, natural gas prices, and oil prices are components of progressive (Fajri, 2020).

Cash flow is a financial flow of both revenue (cash in) and expenditure (cash out) in a specified period (Dwirini et al. 2020). The data in Figure 3, Table 1, Table 2, and Table 3 are used to calculate the cash flow of this petroleum field.

Table 2. Field investment budget data X

Fiscal Term	Rate
Depreciation Factor	25%
Operating Expenditure	$8
Escalation Rate	2%
Discount Rate & MARR	15%
MARR	15%
Tax	44%

Table 3. Gross split contract data

Component	Parameter	GS No. 52
Variable Split		**Split Correction**
Field Status	No POD	0%
Field Location	Onshore	0%
Reservoir Depth	<2500 m	0%
Supporting Infrastructure Availability	Well Development	0%
Reservoir Type	Conventional	0%
CO_2 Content (%)	-	0%
H_2S Content (%)	-	0%
Oil Specific Gravity	>25	0%
Domestic Component Level	70-100	4%
Production Stages	Primary	0%
Progressive Split		**Split Correction**
Oil Price	82.13	0.72%
Cumulative Production	<30	10%
Split Contractor	BS+VS+PS	57.72%

Further cash flow calculations for the 2nd year to the 20th year are presented in Table 4.

Based on the CNCF value, the first, second, and third years are still negative, and only in the fourth year is a positive value obtained.

Calculation of conventional economic indicators

NPV

To find the NPV of 15%, the NCF in Table 5 was used with a discount rate of 15%.

Use a discount factor of 15% in the first year.

$$DF_1 = \frac{1}{(1+i)^n}$$

$$DF_1 = \frac{1}{(1+0.15)^1} = 0.86957 \quad (12)$$

Find the present value for each of the NCF values

$$PV_1 = DF_1 \times NCF_1$$

$$PV_1 = 0.86957 \times 1309.73 \quad (13)$$

$$PV_1 = \$1138.90\ M$$

The discount factor and NPVs for years 0 to 20 are presented in Table 5.

Project NPV

$$NPV = PV_0 + PV_1 + \cdots + PV_{20}$$

$$NPV = -4{,}000{,}000 + 1{,}138.90 + \cdots + 2.63 \quad (14)$$

$$NPV = \$172.27\ M$$

The NPV is $172.27m, implying that the project is feasible because the NPV is positive. According to (Pramadika & Satiyawira, 2018) , a project is considered profitable if the NPV > 0 (positive).

IRR

The IRR calculation is based on Table 6.

As the IRR is between 15% and 20% discount rate, it is interpolated as follows:

$$IRR = i_1 + \frac{NPV_1}{(NPV_1 + NPV_2)}(i_2 - i_1)$$

$$IRR = 15\% + \frac{172.27}{(172.27 + 401.29)}(20\% - 15\%) \quad (15)$$

$$IRR = 16.50\%$$

The IRR value indicates that the NPV is 0. Based on the interpolation of the NPV to the discount factor, an IRR of 16.50% is obtained, as depicted in Figure 4.

Table 4. Cashflow calculation of gross split contract

Year	Contractor Cash Flow			
	Cash In (MUSD)	**Cash Out (MUSD)**	**NCF (MUSD)**	**CNCF (MUSD)**
0	0	4,000.00	-4,000.00	-4,000.00
1	3,114.40	1,804.67	1,309.73	-2,690.27
2	2,601.37	1,500.37	1,101.00	-1,589.27
3	2,172.84	1,248.45	924.40	-664.88
4	1,814.91	1,039.65	775.27	110.39
5	1,515.94	999.28	516.66	627.05
6	1,266.22	689.26	576.96	1,204.01
7	1,057.64	577.93	479.71	1,683.72
8	883.41	484.60	398.81	2,082.53
9	737.89	406.83	331.51	2,414.04
10	616.34	340.80	275.54	2,689.58
11	514.81	285.82	228.98	2,918.56
12	430.00	239.73	190.27	3,108.83
13	359.17	201.08	158.08	3,266.92
14	300.00	168.68	131.32	3,398.24
15	250.58	141.50	109.08	3,507.32
16	209.30	118.72	90.59	3,597.91
17	174.83	99.61	75.22	3,673.13
18	146.03	83.58	62.45	3,735.58
19	121.97	70.13	51.84	3,787.42
20	101.88	58.85	43.03	3,830.45
	18,389.54	14,559.09	3,830.45	

Table 5. NPV Calculation

Year	NCF (MUSD)	Discount Rate	
		15%	
		Factor	**Value**
0	-4,000.00	1	-4,000.00
1	1,309.73	0.86957	1,138.90
2	1,101.00	0.75614	832.51
3	924.40	0.65752	607.81
4	775.27	0.57175	443.26
5	516.66	0.49718	256.87
6	576.96	0.43233	249.44
7	479.71	0.37594	180.34
8	398.81	0.32690	130.37
9	331.51	0.28426	94.24
10	275.54	0.24718	68.11
11	228.98	0.21494	49.22
12	190.27	0.18691	35.56
13	158.08	0.16253	25.69
14	131.32	0.14133	18.56
15	109.08	0.12289	13.41
16	90.59	0.10686	9.68
17	75.22	0.09293	6.99

Table 5. NPV Calculation (continued)

Year	NCF (MUSD)	Discount Rate 15%	
		Factor	Value
18	62.45	0.08081	5.05
19	51.84	0.07027	3.64
20	43.03	0.06110	2.63
NPV			172.27

Table 6. IRR Calculation

Year	NCF (MUSD)	Discount Rate	
		15%	20%
0	-4,000.00	-4,000.00	-4,000.00
1	1309.73	1,138.90	1091.44
2	1,101.00	832.51	764.58
3	924.40	607.81	534.95
4	775.27	443.26	373.87
5	516.66	256.87	207.63
6	576.96	249.44	193.22
7	479.71	180.34	133.88
8	398.81	130.37	92.75
9	331.51	94.24	64.25
10	275.54	68.11	44.50
11	228.98	49.22	30.82
12	190.27	35.56	21.34
13	158.08	25.69	14.78
14	131.32	18.56	10.23
15	109.08	13.41	7.08
16	90.59	9.68	4.90
17	75.22	6.99	3.39
18	62.45	5.05	2.35
19	51.84	3.64	1.62
20	43.03	2.63	1.12
	NPV	172.27	-401.29

The project of MOF development is feasible because the IRR is 16.50%, which is greater than the MARR of 15%. It is also consistent with the recommendation by (Pramadika & Satiyawira, 2018) that a project can be considered feasible if the IRR value is greater than the MARR value.

POT

Based on the CNCF value in Table 5, the POT is calculated as follows:

$$POT = 3rd\ year + \left(\frac{CNCF_3}{(CNCF_3 - CNCF_4)}\right) \times (4th - 3rd)\ year$$
$$POT = 3 + \left(\frac{-664.88}{(-664.88 - 110.39)}\right)(4 - 3) \quad (16)$$
$$POT = 3.86\ years$$

The POT is based on the results of interpolating the CNCF value by year, where a POT of 3.86 years is obtained, as depicted in Figure 5.

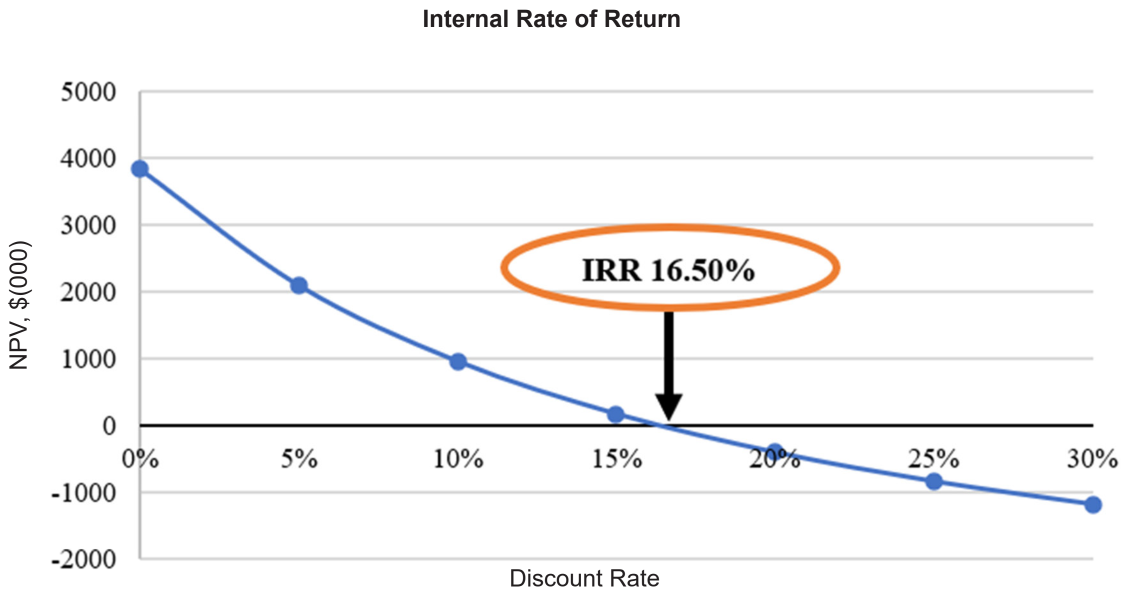

Figure 4. Graph of IRR

Based on the POT obtained, which is 3.86 years, the project is feasible as the POT is greater than the project period. It is also consistent with the study by (Pramadika & Satiyawira, 2018) which states that a project will be profitable if the POT is smaller than the project period. Similarly, the study by (Danastri et al., 2024) stated that a project can be considered feasible if the POT value is less than the project life.

PI

PI is the ratio of the total present value of cash flow to the project investment (Ridwan et al., 2022). The following is the PI calculation for the development of MOF X:

$$PI = \frac{PV\ Cash\ Flow}{Investment} \quad (17)$$

$$PI = \frac{4172.27}{4000} = 1.04$$

Based on the PI value, this project is considered feasible, agreeing with the recommendation by (Agustin et al., 2022) who stated that an investment is feasible if the PI is more than 1.

Sharia economic indicator calculation

GVM

To calculate the GVM, the gold price obtained through the gold price website is used, which is \$74.68/gram and assumed to increase by 15% each year. The contractor's revenue will be divided by the gold price (per gram). After the total contractor gold income is obtained, the amount of the initial investment (grams of gold) is deducted to get the GVM (Agustin, 2017). Table 8 presents the GVM of the MOF X field.

Based on Table 7, the GVM is 10,687.03 grams of gold. This implies that if the project is carried out, the contractor will get a profit of 10.7 kg of gold. Then, the investment should be accepted in accordance with the study by (Agustin, 2016) which stated that if the GVM is positive, then the project is feasible and acceptable. Similarly, (Agustin et al., 2023) stated that a project can be accepted if the GVM is greater than 0.

GI

GI is the ratio of the present value of gold to the present value of gold of the initial investment. The GI is calculated as follows:

The GI value is 1.20, which is more than 1.

$$GI = \frac{Total\ Gold\ Revenue\ (gram)}{Total\ Initial\ Investment\ (gram)}$$

$$GI = \frac{64{,}248.89\ gram}{53{,}561.86\ gram} \quad (18)$$

$$GI = 1.20$$

Therefore, the MOF X project is feasible to carry out in accordance with the recommendation by (Agustin et al. 2021), which stated that a project is feasible if the GI value is more than 1.

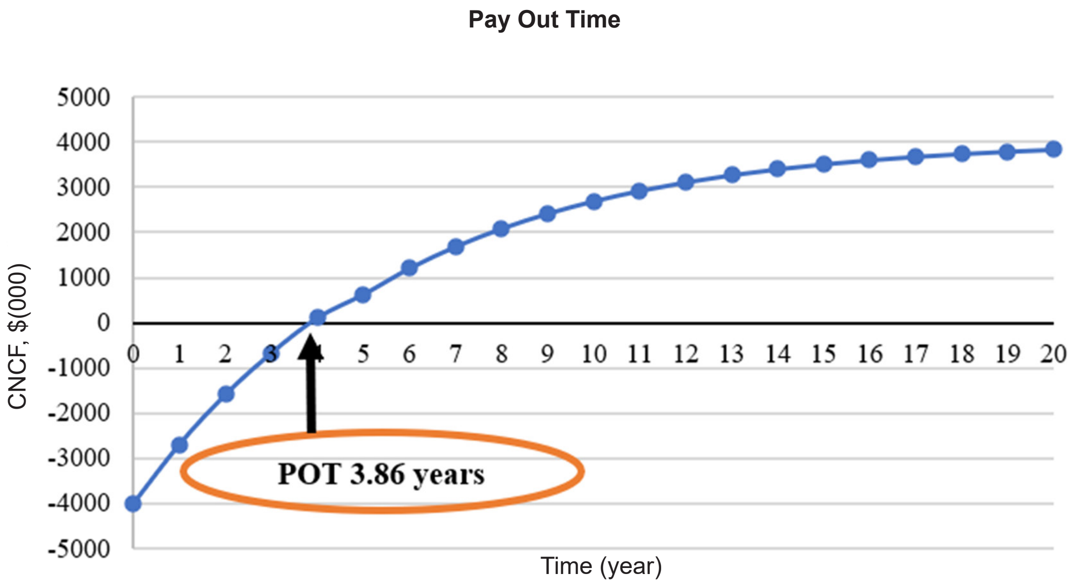

Figure 5. Graph of POT

Table 7. GVM calculation

Year	Revenue	Gold Price (per gram)	Revenue After Converted Into Gold Gram
1	1,309,729.26	74.68	17,537.89
2	1,100,998.66	85.88	12,819.90
3	924,395.59	98.76	9,359.61
4	775,266.06	113.58	6,825.79
5	516,661.54	130.62	3,955.58
6	576,960.78	150.21	3,841.07
7	479,710.98	172.74	2,777.08
8	398,807.84	198.65	2,007.59
9	331,510.20	228.45	1,451.14
10	275,535.64	262.72	1,048.80
11	228,983.81	302.12	757.92
12	190,272.59	347.44	547.64
13	158,084.91	399.56	395.65
14	131,324.46	459.49	285.80
15	109,078.70	528.41	206.43
16	90,558.18	607.68	149.07
17	75,220.86	698.83	107.64
18	62,450.84	803.65	77.71
19	51,840.50	924.20	56.09
20	43,025.79	1,062.83	40.48
Contractor’s Total Gold Revenue (gram)			64,248.89
Total Initial Investment (gram)			53,561.86
GVM (gram)			10,687.03

CONCLUSION

The analysis results indicate that the development of the MOF in the Central Sumatra Basin is economically feasible, both from a conventional and a Syariah perspective. The NPV stands at USD 172.27 million; the IRR is a robust 16.50%; the POT is a relatively quick 3.86 years; and the PI is 1.04. These figures collectively underscore the project’s financial attractiveness. Similarly, the Syariah-compliant assessment also signals project feasibility. The GVM yielded 10,687.03 grams of gold, while the GI was 1.20. Both the GVM and GI results indicate the project's economic soundness within an Islamic framework. Therefore, the Syariah economic approach presents itself as a viable alternative for evaluating the economic feasibility of oil and gas projects, particularly in marginal fields, which are often characterized by high complexity and limited reserves.

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GLOSSARY OF TERMS

Symbol	Description	Unit
OOIP	Original Oil In Place	STB
Boi	Initial Oil Formation Volume Factor	bbl/STB
UR	Ultimate Recovery	
RF	Recovery Factor	%
NPV	Net Present Value	$
IRR	Internal Rate of Return	%
POT	Pay Out Time	year
PI	Profitability Index	
NCF	Net Cash Flow	$
GVM	Gold Value Method	gram
INV	Initial Investment	gram
INC	Income	
GP	Gold Price	/gram
GI	Gold Index	

REFERENCES

Abdulkadir, M.K., 2024, Advance Digital Technology Solutions for Enhancing the Productivity of Marginal Oil and gas Fields in Nigeria. Petroleum Technology Development Journal, 14(2). https://doi.org/10.21275/sr23624065052.

Afaz, T., & Gusman, M., 2021, Analisis Kelayakan Investasi Menggunakan Metode Discounted Cash Flow pada Tambang Aspal PT. Wijaya Karya Bitumen di Desa Nambo Kecamatan Lasalimu, Kabupaten Buton, Sulawesi Tenggara. Jurnal Bina Tambang, 6(6), 84–95.

Agustin, H., 2016, Comparative Feasibility Study Analysis of Islamic and Conventional (Case Study Quail Farm in Pekanbaru). Jurnal Ekonomi KIAT, 27(2), 23–37.

Agustin, H., 2017, Analisis Keuangan Kelayakan Bisnis Syariah Hamdi's Model (Studi Kasus Usaha Swalayan Syariah di Pekanbaru). Jurnal Manajemen Bisnis Indonesia, 4(3), 295–305.

Agustin, H., Afwa, A., & Jamil, P.C., 2022, Analisis Studi Kelayakan Bisnis Menggunakan Konsep Hamdi's Method. Prosiding Forum Manajemen Indonesia Ke-14, 1–12.

Agustin, H., Almuttaqin, M.A., Yusnita, R.R., & Safitri, N., 2023, Analyzing Business Feasibility: A Comprehensive Study Using Hamdi's Method. Journal of System and Management Sciences, 13(4), 521–534. https://doi.org/10.33168/JSMS.2023.0431.

Agustin, H., Azmi, N., Armis, & Asril., 2021, Analisis Pengembangan Usaha Nenas Sakinah Berdasarkan Aspek Keuangan Konvensional dan Syariah (Hamdi's Method). Jurnal Tabarru' : Islamic Banking and Finance, 4(1), 219–230.

Agustin, H., & Azwirman, A., 2019, The Analysis Feasibility Study on the Financial Aspects of Islamic Perspective. 6th Annual International Conference on Management Research (AICMaR 2019), 70–73.

Al-Attas, M. S. S., & Yasutra, A., 2021, Feasibility Study and Technical Optimization by Implementing Steam Flooding for the Field Development Plan of A Heavy-Oil Field in Yemen. Scientific Contributions Oil and Gas, 44(3), 183–198. https://doi.org/10.29017/SCOG.44.3.711

Ariyon, M., 2013, Analisis Ekonomi Pemilihan Electric Submersible Pump Pada Beberapa Vendor Economic. Journal of Earth Energy Engineering, 2(2), 9–19.

Ariyon, M., Santika, B., & Fitrianti, 2022, Economic Feasibility Analysis of Fishing Job Operation in Well YS13. Journal of Geoscience, Engineering, Environment, and Technology, 7(4), 189–195. https://doi.org/10.25299/jgeet.2022.7.4.10190

Butar, M.H.P.B., Juventa, & Marlinda, L., 2023, Identifikasi Prospek Reservoir Hidrokarbon Menggunakan Inversi Impedansi Akustik Pada Blok Kampar. Lembaran Publikasi Minyak Dan Gas Bumi, 57(1), 43–59. https://doi.org/10.29017/lpmgb.57.1.1324.

Casdira, & Fikri, M.F., 2010, Perbandingan Analisis Keekonomian PSC dan Gross Split Menggunakan Metode Deterministik. The 39th IAGI Annual Convention and Exhibition, 1–7.

Danastri, T.I., Manouchehr, A., & Hajeera, S., 2024, Economic Work Evaluation Of New Zone Behind Pipe Based On Psc Cost Recovery And Gross Split Contract In YL Field. Journal of Geoscience, Engineering, Environment, and Technology, 9(2), 163–168. https://doi.org/10.25299/jgeet.2024.9.2.15480.

Daniel, H., 2017, Indonesian Milestone in Production-Sharing Contract in Perspective of Government Take, Contractor Take, Cost Recovery and Production Target. SPE-187008-MS, 1–18.

Dwirini, Dewi, K., Relasari, Rostartina, E., & Abdulrohman, 2020, Strategi-Strategi dalam Mengontrol Cash Flow di Era Pandemi Bagi Pelaku UMKM dan Masyarakat Desa Kerinjing. Jurnal Ilmiah Manajemen, 9(3), 24–35.

Fajri, M., 2020, Analisis Hukum Skema Kontrak Gross Split Terhadap Peningkatan Investasi Hulu Minyak dan Gas Bumi. Jurnal Hukum & Pembangunan, 50(1), 54–70. https://doi.org/10.21143/jhp.vol50.no1.2482

Herawati, I., Rita, N., Novrianti, N., & Taufand, R. M., 2017, Analyzing The Statistics Function For Determination Of Oil Flow Rate Equation in New Productive Zone. Journal of Geoscience, Engineering, Environment, and Technology, 2(1), 69–75. https://doi.org/10.24273/jgeet.2017.2.1.34.

Intaniasari, K., 2020, Gross Split Contract Framework Regulation on the Caring for People. Jurnal Bestuur, 8(2), 96–107. https://doi.org/10.20961/bestuur.43141.

Irwin, R.W., 2015, Penentuan Isi Awal Minyak dan Peramalan Produksinya dengan Metode Decline Curve Analysis di Lapangan "R." Seminar Nasional Cendekiawan, 411–421.

Jumiati, W., & Sismartono, D., 2018, Tantangan Keekonomian Kontrak Bagi Hasil Gross Split dan Cost Recovery (Studi Kasus Lapangan Gas Offshore di Sumatera Bagian Utara). Lembaran Publikasi Minyak Dan Gas Bumi, 52(2), 105–112. http://www.journal.lemigas.esdm.go.id.

Mardiana, D.A., Rakhmanto, P.A., Riswati, S.S., Sofilda, E., Aribawa, S., & Martines, G., 2024, Petroleum Fiscal Regimes Attractiveness in Indonesia, Malaysia and Thailand: Application on Offshore Project Development. Scientific Contributions Oil and Gas, 47(3), 265–276. https://doi.org/10.29017/SCOG.47.3.1633.

Nonci, R., Fauzi, A., Thamrin, F.D., & Pertanian Bogor, I., 2020, Analisa Deskripsi Minyak dan Gas (Studi Kasus Lapangan "X"). Equilibrium: Jurnal Penelitian Pendidikan Dan Ekonomi, 17(2), 44–50. https://doi.org/10.25134/equi.v17i02.

Oliviaputie, T., & Sa'diyah, K., 2022, Analisa Ekonomi Prarancangan Pabrik Kimia Pembuatan Pupuk Organik Cair dari Sekam Padi Kapasitas 8.000 Ton/Tahun. Jurnal Teknologi Separasi, 8(3), 646–653. http://distilat.polinema.ac.id.

Pan, J., Meng, Y., Sun, N., Liu, C., Yang, S., Xu, J., Wu, W., Li, R., & Chen, Z., 2022, Review of Marginal Oil Resources in Highly Depleted Reservoirs. Processes, 10(2), 1–11. https://doi.org/10.3390/pr10020245.

Pramadika, H., & Satiyawira, D.B., 2018, Pengaruh Harga Gas dan Komponen Variabel Terhadap Keuntungan Kontraktor pada Gross Split. Jurnal Petro, VII(3), 113–117. http://trijurnal.lemlit.trisakti.ac.id/index.php/petro.

Rahman, F.A., & Oktaviani, R.N., 2022, Analisis Studi Kelayakan Bisnis Syariah pada Industri Kecil dan Menengah dalam Mendapatkan Pembiayaan dari Perbankan Syariah. Jurnal Tabarru' : Islamic Banking and Finance, 5(1), 108–121.

Ridwan, A. F., Romli, Z., & Soeroto, W.M., 2022, Analisa Kelayakan Investasi Proyek Penggantian Secondary Crusher pada PT Berau Coal Site Binungan. Sebatik, 26(1), 1–8. https://doi.

org/10.46984/sebatik.v26i1.1832.

Rulandari, N., Rusli, B., Mirna, R., Nurmantu, S., & Setiawan, M.I., 2018, Valuation of Production Sharing Contract Cost Recovery Vs Gross Split in Earth Oil and Gas Cooperation Contracts in Indonesia and the Aspect of Public Service. Journal of Physics: Conference Series, 1114(1), 1–9. https://doi.org/10.1088/1742-6596/1114/1/012132.

Saphiro, Z., 2017, Peramalan Kinerja Produksi Minyak pada Lapangan "Z" dengan Menggunakan Decline Curve Analysis. Jurnal Petro 2017, VI(4), 143–147.

Shereih, K., 2016, Economics Modeling for Petroleum Exploration and Production Projects Considering Risk and Imprecise Data. https://doi.org/10.14279/depositonce-4983.

Sudarti, Elly, F.H., & Rengkung, L.R., 2021, Analisis Kelayakan dan Sensitivitas Usaha Pembibitan Krisan Teknik Stek Pucuk (Studi Kasus Penangkar Bibit Krisan di Kakaskasen Dua). Jurnal Agrisosioekonomi, 17(2), 655–666.

Sugiyartomo, F.H., 2019, The Legality of Oil & Gas Production Sharing Contract Gross Split Scheme. Indonesian Journal of Energy, 2(1), 29–37. http://iesr.or.id/wp-content/uploads/Heru-Wibowo_DJA-Kemenkeu.pdf.

Usman, Hazman, Pribadi, E., Lucia, A., & Widarsono, B., 2019, Kajian Regulasi Pengusahaan Oil Sands Kedalaman Dangkal dengan Metode Oil Mining. Lembaran Publikasi Minyak Dan Gas Bumi, 53(1), 1–14. https://doi.org/10.29017/lpmgb.53.1.265.