



Feasibility Study of Oil Well Perforation Jobs Using Hamdi's GVM Method

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ABSTRACT

The decline in production rate at oil well AR#27 is unavoidable. This is partly due to channeling in the production zone of the well. In order to overcome this, it is necessary to optimize the AR#27 well with perforation job to improve the production. This study aims to analyze whether perforation job on the AR#27 well is feasible based on conventional economic calculations using Net Present Value (NPV) and whether it has the same decision value if calculated using an economic perspective of sharia using the Gold Value Method (GVM) without an interest basis. Economic analysis is obtained based on cashflow calculations using a gross split contract scheme. Cashflow is compiled based on the comparison of oil production before and after perforation, perforation costs, operational costs and oil prices. From the calculation results, the NPV value is 217,643 US\$ ($NPV > 0$) and the GVM value is 4,123.52 grams ($GVM > 0$). So, it can be concluded that the perforation job on the AR#27 well is feasible to do both according to conventional economics and sharia economics.

Keywords: Perforation, Oil Well, Economics, Net Present Value, Gold Value Method

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INTRODUCTION

Among many other resources, oil is a very important natural resource for producing energy, and because it provides many benefits, it cannot be separated from daily activities (Ihsan et al., 2024). Due to the population growth and the expansion of industry, the global demand for oil is expected to grow by 38% (Garmroudi et al., 2022). The increasing consumption of oil can lead to reduced oil production and reserves, so it is necessary to optimize oil production. However, there are many challenges in maintaining oil production (Hartono et al., 2017). The production rate of mature wells will eventually decline. There are several problems that can arise when a well is producing that can lead to decreased production. In order to overcome this, a workover operation can be performed to increase the productivity of the declining well. Workover, also known as well reworking, is a repair program that aims to increase productivity to recover the targeted production rate (Umar et al., 2017). Workover activity is a well maintenance job that involves changes in reservoir parameters such as perforation job, cementing, reworking, moving layers, well stimulation, fishing jobs, etc (Maulana et al., 2023).

A decrease in oil production rate accompanied by an increase in water cut was an issue that arises in well AR#27, which is the subject of the study. The reason why oil cannot move through the production zone is due to water cut in the layer, also known as channeling. Channeling is a phenomenon that indicates the dominance of water flow into the wellbore through high-permeability pathways or fractures, bypassing most of the oil-bearing formation so that oil is trapped in the productive zone and cannot optimally flow to the surface (Sinaga, 2019). The company put the well to the test to determine ways to increase production at the well. After the test results were released, it was discovered that there were still reserves that could be produced profitably. In order to address this, it is necessary to evaluate the well with perforation job. Perforation is conducted to open up perspective zones that were previously inaccessible, expecting to increase oil production and decrease water dominance.

This step is then evaluate through economic analysis to assess the investment feasibility of the perforation job. The economic analysis of the perforation job in well AR#27 is conducted to determine how much influence the increase in production in well AR#27 has and how much

profit is obtained after perforation. The economic analysis is obtained by comparing the production obtained after perforation with the previous production. To evaluate the economics and feasibility of workover implementation through the perforation method at well AR#27, an economic analysis calculation is carried out with reference to the gross split scheme. The gross split contract is a new production sharing contract system established by the government through the Minister of Energy and Mineral Resources (ESDM) in 2017. The main principle of the gross split method is the elimination of cost recovery, with the aim that contractors are more efficient in their work and get maximum results (Giranza and Bergmann, 2018).

Most of the time, economic calculations to determine business feasibility are calculated using Net Present Value (NPV), which is highly dependent on the interest rate. However, Gold Value Method (GVM) has recently emerged as an economic indicator in Hamdi's method as an alternative to determining business feasibility that does not use an interest basis and is in accordance with Islamic principles (Agustin et al., 2023). The approach in Hamdi's method uses an Islamic perspective, business feasibility is calculated using the basis of the profit sharing ratio of Islamic banks and the price of gold. This method is based on the use of the gold standard in the calculation of Hamdi's method (Ridho and Yusnita, 2021).

Research by (Susilo et al., 2020) has conducted a study related to the evaluation of the feasibility of production well workover through the perforation method in the new layer using conventional economic indicators, namely Net Present Value (NPV), Internal Rate of Return (IRR), and Pay Out Time (POT). The evaluation results showed that the workover project provided an IRR of 340%, NPV of 123,561 US\$, and POT of 1.8 months, indicating that the project was highly feasible. In this research, researchers want to see the feasibility of perforation workover using a gross split contract scheme by analyzing between conventional economic indicators, namely NPV, IRR and POT and using sharia economic indicators in Hamdi's method, namely GVM and GI. This research analyzes whether the perforation workover is feasible based on conventional economic calculations using NPV and whether the perforation workover is also feasible when calculated using an economic perspective of sharia using GVM.

METHOD

The location of this research is the well AR#27 in the Langgak Field. This oil field is located between Senama Nenek Village in Rokan Hulu Regency and Koto Village in Kampar Regency, Province of Riau.

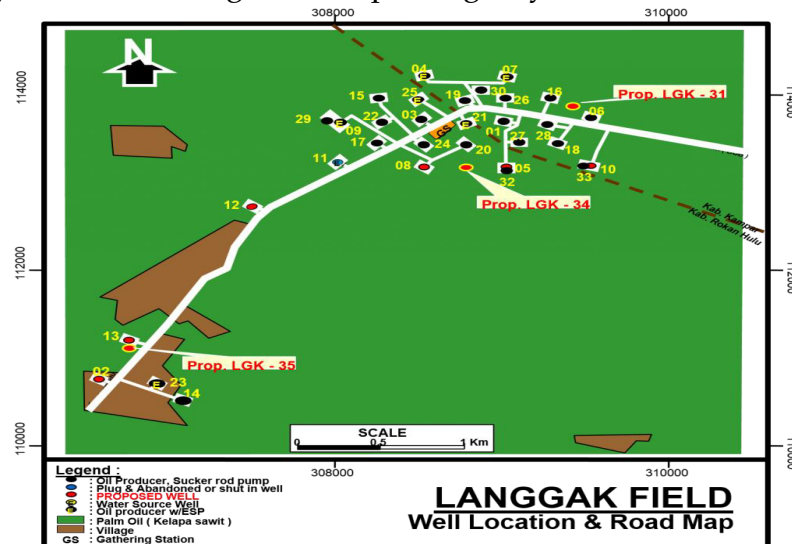


Figure 1. Location of Research

Procedures

The procedure of this research as shown in Figure 2 is as follows:

1. Literature study on perforation workover in Indonesia.
2. Collecting data that required in the calculation of the economics of perforation workover, including well history data, production data, cost budget data, oil price data and gold price data.
3. Calculate the economics with a production sharing contract system using a cashflow gross split scheme.
4. Based on the results of the economic cashflow obtained from the gross split scheme calculation, then calculate the conventional economic indicators, namely NPV, IRR and POT and sharia economic indicators in Hamdi's method, namely GVM and GI.
5. Analyze economic indicators to determine whether the evaluation of feasibility between sharia economic indicators Hamdi's method GVM and conventional method NPV provides the same decision results.

Economic Analysis

The economic analysis of this research is as follows:

1. Prepare cashflow by using gross split contract scheme

Gross Revenue (R) = Production × Oil Price

(1)

Operating Cost (OC) = Opex × Yearly Production

(2)

*Deductible Expense = Non Capital Cost + Depreciation +
Operating Cost*

(3)

Contractor Taxable Share = Deductible Expense × Tax

(4)

Government Tax Entitlement = Contractor Taxable Share × Tax

(5)

*Net Contractor Take = Contractor Taxable Share –
Government Tax Entitlement*

(6)

2. Conventional economic indicator analysis

a. Net Present Value (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 NPV values are for profitable investments and negative for unprofitable investments (Shereih, 2016).

$$NPV = x_0 + \frac{x_1}{(1+i)^1} + \frac{x_2}{(1+i)^2} + \dots + \frac{x_n}{(1+i)^n}$$

(7)

Where, x_n = cashflow in year n, x_0 = cashflow in year 0, and i = interest rate.

b. Internal Rate of Return (IRR)

IRR can be defined as the interest rate that causes NPV equal to zero (Shereih, 2016). A company will undertake an investment if the IRR is greater than the Minimum Attractive of Return (MARR) (Ariyon, 2013).

$$IRR = \frac{MARR_1 + (MARR_2 - MARR_1)(NPV_1)}{NPV_1 + NPV_2}$$

(8)

Where, $MARR_1$ = interest rate, $MARR_2$ = interest rate assumption to NPV minus, NPV_1 = NPV when positive, and NPV_2 = NPV when negative.

c. Pay Out Time (POT)

POT is the time required to return capital or investment (Oliviaputie and Sa'diyah, 2022). POT shows the year where the cumulative net

cash flow equals 0 (Pramadika and Satiyawira, 2018). POT is calculated in units of years (Casdira and Fikri, 2010).

$$POT = n_1 + \left(\frac{CF_1}{CF_1 + CF_2} \right) \times (n_2 - n_1)$$

(9)

Where, CF_1 = cumulative cashflow when negative, CF_2 = cumulative cashflow when positive, n_1 = year on CF_1 , and n_2 = year on CF_2 .

3. Sharia economic indicator Hamdi's method analysis

4.

a. Gold Value Method (GVM)

GVM is a new method for calculating financial aspects in determining investment feasibility based on an Islamic perspective (Agustin et al., 2022).

$$PV = \frac{INC_{t1}}{GP_{t1}} + \frac{INC_{t2}}{GP_{t2}} + \frac{INC_{t3}}{GP_{t3}} + \dots + \frac{INC_{tn}}{GP_{tn}}$$

(10)

$$GVM = \sum PV \text{ Cashflow} - INV$$

(11)

Where, INC = income, INV = initial investment, n = project life, t = time period, GP = gold price, PV = present value, and GVM = gold value method.

b. Gold Index (GI)

GI is the ratio of the present value of gold to the present value of gold from the initial investment expenditure (Rahman and Oktaviani, 2022).

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

(12)

RESULTS

Perforation Workover Analysis

Workover have been conducted on the well AR#27 with the perforation method in an attempt to optimize the oil production potential that has decreased. The problem that occurred in well AR#27 was a decrease in production due to channeling and necessary to readjust the depth. Before the workover, the active perforation interval in well AR#27 included several zones at depths of 1080-1090 ft, 1162-1168 ft, 1174-1184 ft, 1184-1192 ft, and 1217-1227 ft. After the workover, the new well intervals were adjusted to be more selective at depths of 1162-1168 ft,

1173-1177 ft and 1180-1184 ft with the plug back total depth (PBTB) settled at 1391 ft. For more details, consider the Figure 3 below:

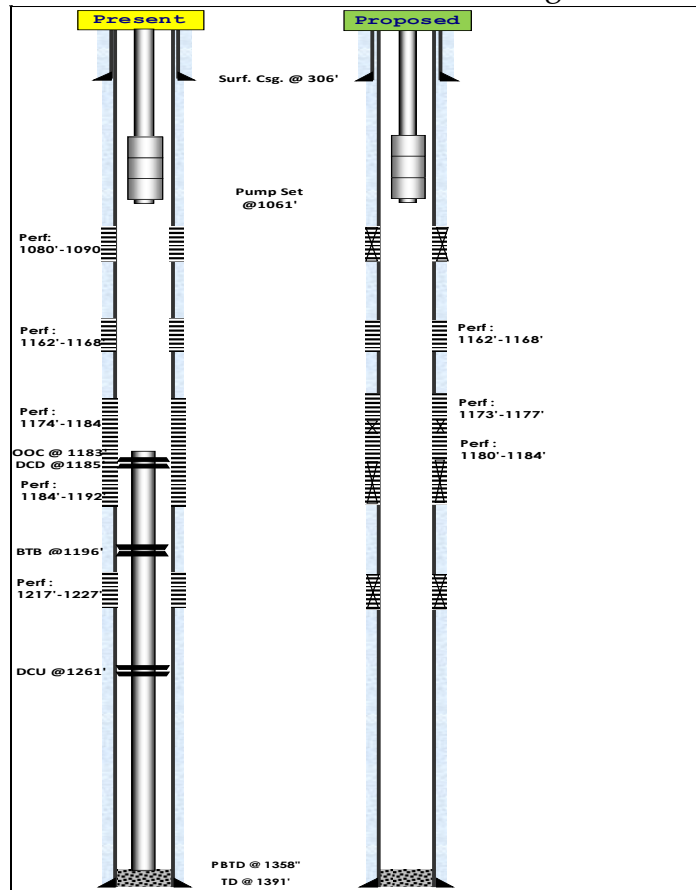


Figure 2. Well AR#27 before and after perforation (Source: SPR Langgak)

Table 1. Well AR#27 oil production data

Well Production Profile				
Year	Date	BFPD	WC	BOPD
2019	Jan-19	1301.36	97.53	32.14348
	Feb-19	1347.837	97.53	33.29158
	Mar-19	1679.174	98.47065	23.11383
	Apr-19	1952.04	99.15	16.59234
	May-19	1974.124	99.16806	16.42301
	Jun-19	1976.49	99.17	16.40487
	Jul-19	1976.49	99.17	16.40487
	Aug-19	1920.619	99.04097	18.40205
	Sep-19	1907.21	99.01	18.88138
	Oct-19	1926.487	99.24226	14.57318

	Nov-19	1937.09	99.37	12.20
	Dec-19	1937.09	99.37	12.20367
2020	Jan-20	1937.09	99.37	12.20367
	Feb-20	1943.648	99.42069	11.24931
	Mar-20	1964.26	99.58	8.249892
	Apr-20	1163.884	96.724	22.88968
	May-20	630.3	94.82	32.64954
	Jun-20	630.3	94.82	32.64954
	Jul-20	630.3	94.82	32.64954
	Aug-20	630.3	94.82	32.64954
	Sep-20	630.3	94.82	32.64954
	Oct-20	630.3	94.82	32.64954
	Nov-20	630.3	94.82	32.64954
	Dec-20	630.3	94.82	32.64954
2021	Jan-21	630.3	94.82	31.59637
	Feb-21	620.4041	94.71714	32.7377
	Mar-21	584.1184	94.34	33.0611
	Apr-21	584.1184	94.34	33.0611
	May-21	574.1493	94.32065	32.59794
	Jun-21	523.8042	95.056	25.77656
	Jul-21	458.465	95.02	22.83156
	Aug-21	498.1666	94.79187	26.08737
	Sep-21	561.0253	94.43099	31.24354
	Oct-21	561.0215	95.05345	27.75092
	Nov-21	580.0633	95.125	28.27904
	Dec-21	580.72	95.12	28.33914
2022	Jan-22	580.72	95.12	28.33914
	Feb-22	580.72	95.12	28.33923
	Mar-22	580.72	95.12	28.33914
	Apr-22	579.4659	95.08807	28.46034
	May-22	580.9756	94.35589	32.87117
	Jun-22	596.948	93.55047	38.50423
	Jul-22	605.6169	93.99596	36.369
	Aug-22	590.8142	94.81742	30.58484
	Sep-22	564.3372	94.25193	32.41751
	Oct-22	543.3673	93.85976	33.3631
	Nov-22	579.5917	94.72447	30.54057
	Dec-22	559.095	94.3734	31.45803
2023	Jan-23	554.4276	94.5978	29.95582

Feb-23	552.5179	94.68954	29.34145
Mar-23	552.9025	94.6355	29.66109
Apr-23	569.3861	94.55118	31.03883
May-23	569.0091	95.03136	28.37478
Jun-23	561.664	95.88733	22.98811
Jul-23	594.7481	96.66834	19.80199
Aug-23	581.5123	95.87495	23.9856
Sep-23	584.8332	96.08815	22.87866
Oct-23	562.6898	95.79866	23.57219
Nov-23	539.07	95.49	24.31206
Dec-23	539.07	95.49	24.31192

Economic Analysis of Gross Split Scheme

In evaluating the feasibility of a project, it is not only based on technical aspects, but also on economic aspects. To reduce the high risk of failure, a cooperation contract between the government and the contractor is required. The type of contract used in this project is the Gross Split contract scheme without cost recovery. In order for the contractor to be more efficient in its work and get maximum results.

The results of the calculation of Islamic economic indicators in Hamdi's method, such as GVM and GI, and conventional economic indicators, such as NPV, IRR, and POT, were analyzed using the cashflow of the gross split contract scheme to find out whether GVM and NPV have the same decision in determining the feasibility of implementing perforation job.

Table 2. Fiscal Term

Economic Data	Value
Discount Rate	15%
Total Split (Contractor)	69.85%
Total Split (Government)	30.15%
Tax	44%
MARR	15%
CAPEX	58,554.51 US\$
OPEX	10 US\$/bbl

Table 3. Base Split

Description	Split
Contractor	43 %
Government	57%

Table 4. Variable and Progressive Split of Perforation Job

No	Component	Parameter	Contractor Split Correction (%)	Field Data
Variable Split				
1	Field Status	POD I	5	
		POD II	3	
		No POD	0	0%
		Onshore	0	
		Offshore (0 < h < 20)	8	
2	Field Location	Offshore (20 < h < 50)	10	0%
		Offshore (50 < h < 150)	12	
		Offshore (150 < h < 1000)	14	
		Offshore (h > 1000)	16	
3	Reservoir Depth (m)	< 2500	0	0%
		>2500	1	
4	Supporting Infrastructure Availability	Well developed	0	
		New frontier offshore	2	0%
5	Reservoir Type	New frontier onshore	4	
		Conventional	0	
6	CO ₂ Content (%)	Non Conventional	16	0%
		< 5%	0	0%
	5% = x = < 10%	0.5		

		10% = $x < 20\%$	1.5	
		20% = $x < 40\%$	2	
		= 60%	4	
		< 100	0	
		100 = $x < 1000$	1	
7	H ₂ S Content (%)	1000 = $x < 2000$	2	2%
		2000 = $x < 3000$	3	
		3000 = $x < 4000$	4	
		>5000	5	
8	Oil Specific Gravity (API)	API < 25	1	0%
		API > 25	0	
		30% = $x < 50\%$	2	
9	Domestic Component Level	50% = $x < 70\%$	3	2%
		70% = $x < 100\%$	4	
10	Production Phase	Primary	0	
		Secondary	6	6%
		Tertiary	10	
Total				10%
Progressive Split				
1	Oil Price (\$/Bbl)		(85-ICP)*0.25	6.85%
		< 7	(7-Gas Price)*2.5	
2	Gas Price (\$/MMBTU)	7 < $x < 10$	-	
		>10	(10-Gas Price)*2.5	
		< 30	10	10%
		30 < $x < 60$	9	
3	Cumulative Production	60 < $x < 90$	8	
		90 < $x < 125$	6	
		125 < $x < 175$	4	
		>175	-	
Total				16.85%

Table 5. Total Contractor Split (Base Split + Variable Split + Progressive Split)

Total Split (%)	
Contractor	69.85 %
Government	30.15%
Total	100%

1. Investment Cost

Table 6. Well AR#27 Investment Cost

Non Capital Cost		
Item	Unit	
	Rp	US\$
Rig Operation Cost		
MIRU	24,218,750	1501.14
Operation	208,281,250	12,944.24
Repair	-	-
SBWC	292,562,500	18,182.14
Unpaid	-	-
Perforation Cost	185,000,000	11,497.37
Squeeze Cost		
Job Fee + Material	232,117,600	14,425.62
Total	942,461,350	58,554.51

2. Oil Pricing

An oil price of 57.616 US\$/bbl was used. The price is an estimated price taken flat with an 80% approach from the average historical ICP (Indonesian Crude Price) data for the last 5 years. It starts from January 2020 to January 2024. Oil price assumptions in the POD are determined by the Program and Budget Control Division.

3. Operating Cost

Operating cost at well AR#27 is the cost incurred routinely in daily activities to maintain the viability of a project. The operating cost (Opex) used is 10 US\$/bbl. The accumulated Opex incurred in the next 4 years amounted to 137,102 US\$.

4. Gold Price

A gold price of 65.72 US\$/gram was used. The price is an estimated price taken flat with an approach to the Indonesian gold price on the precious metal website for the last 5 years, starting from January 2020 to January 2024.

Conventional Economic Indicator

1. Net Present Value (NPV)

$$NPV = (-58,554.51) + \frac{77.123}{(1+0.15)^1} + \frac{108.945}{(1+0.15)^2} + \frac{131.079}{(1+0.15)^2} + \frac{70.939}{(1+0.15)^2}$$

$$NPV \text{ well AR\#27} = 217,613 \text{ US\$}$$

2. Internal Rate of Return (IRR)

$$IRR = 145\% + \frac{1.956}{(1.956+1.973)} (155\% - 145\%)$$

$$IRR = 150\%$$

3. Pay Out Time (POT)

$$POT = 0 + \frac{58.554,508}{58.554,508+18.569} \times (1 - 0)$$

$$POT = 0.3 \text{ years}$$

Sharia Economic Indicator Hamdi's Method

1. Gold Value Method (GVM)

$$GVM = 5.014,55 - 891,035$$

$$GVM = 4.123,52 \text{ gram}$$

2. Gold Index (GI)

$$GI = \frac{5,014.55}{891,035} = 5.6238$$

CONCLUSION

Based on the analysis, the NPV value of 217,634 US\$ is obtained, which qualifies the project feasibility because the NPV is positive. In addition, a GVM value of 4,123.52 grams is also obtained, which also qualifies the feasibility criteria based on the Hamdi's method, which the project is declared feasible if the GVM value is greater than 0. Thus, both calculations using conventional economic indicators (NPV) and sharia economic indicators (GVM) result in the same decision, namely that the perforation workover is declared feasible. Therefore, based on the entire economic evaluation process of the perforation workover at well AR#27,

it can be concluded that the project is feasible to be implemented and further developed.

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