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Forecasting Indonesia's Oil and Gas Export Volumes for 2026 as Supporting Information for Managerial Decision-Making

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Abstract: *The volatility in Indonesia's oil and gas export volumes creates uncertainty for companies when planning production capacity and logistics; consequently, a reliable forecasting tool is required to support managerial decision-making. This study aims to forecast Indonesia's oil and gas export volumes for 2026 using an ARIMA model, and to formulate the implications of the forecast results as supporting information for managerial decision-making. The data used consists of monthly secondary data on Indonesia's oil and gas export volumes for the period January 2020–December 2025 (72 observations) from the Central Statistics Agency (BPS). The analysis employs the ARIMA model using the Box–Jenkins procedure, with the best model selected based on parameter significance, residual diagnostic tests, the AICc criterion, parsimony, and forecasting accuracy (MAPE). The results indicate that the ARIMA(0,1,1) model was selected as the best model, with a MAPE of 9.09 per cent and the lowest AICc value (1,007.31); although the ARIMA(2,1,0) model yielded a marginally lower MAPE (9.06 per cent), the ARIMA(0,1,1) model was preferred on the grounds of parsimony and more stable residuals. The 12-month forecast suggests that Indonesia's oil and gas export volumes in 2026 are likely to remain stable in the range of 2,103–2,111 thousand tonnes per month, with a very flat trend. Validation using actual data from January to May 2026 confirmed the model's reliability for the first three months (error 2–9 per cent), but revealed significant deviations in April and May (error 24–47 per cent) that coincide with external shocks not captured by the univariate model. This finding carries a practical implication: ARIMA forecasts are most valuable when embedded within a decision support system and complemented by scenario planning, buffer-stock policies, and early-warning indicators linked to geopolitical and price dynamics. The managerial implications of this study are that the forecasting results can be used as supporting information in operational planning, rather than as the sole basis for decision-making. It is hoped that this study will serve as a reference for oil and gas companies and policymakers in formulating more adaptive and data-driven operational strategies.*

Keywords: *ARIMA; Forecasting; Managerial Considerations; Oil and Gas Export.*

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Introduction

The performance of national oil and gas exports over the past decade has shown a fluctuating pattern, heavily influenced by global oil price dynamics, geopolitical conditions, and domestic factors relating to production and energy policy.[1] Indonesia's oil and gas trade balance continues to experience a structural deficit; in 2024 alone, the oil and gas deficit reached US$20.4 billion, whilst the national surplus was entirely underpinned by the non-oil and gas sector.[2] This situation underscores that Indonesia's oil and gas sector is under serious structural pressure, with import volumes consistently exceeding export volumes, thereby necessitating more accurate, data-driven planning instruments.

Figure 1 Trends in Indonesia's Oil and Gas Exports, 2010–2024

Year	Crude Oil		Oil Yield		Gas	
	Eksport	Import	Eksport	Import	Eksport	Import
2010	18,132.4	14,249.6	7,322.8	25,123.9	30,469.9	1,126.0
2011	17,819.5	13,253.6	6,931.5	28,840.3	34,302.9	1,633.9
2012	14,973.1	12,550.1	5,629.5	28,534.5	27,843.3	3,170.4
2013	13,016.9	16,015.6	5,914.5	29,612.2	25,110.4	3,425.9
2014	12,400.0	16,185.9	5,556.9	29,093.6	23,786.2	3,589.9
2015	15,554.1	18,727.6	4,625.8	25,404.7	24,784.8	4,176.8
2016	16,955.5	19,932.3	2,868.1	23,958.3	23,505.2	4,435.2
2017	13,570.7	17,949.2	4,059.4	26,932.7	24,874.9	5,488.2
2018	10,214.5	16,932.1	3,122.1	26,737.1	23,719.0	5,546.9
2019	3,576.7	11,756.4	3,810.8	23,449.3	19,140.7	5,720.7
2020	4,395.6	10,510.2	4,819.7	20,790.0	18,282.6	6,354.0
2021	6,016.7	13,777.0	3,712.7	21,927.5	17,160.8	6,421.8
2022	2,180.7	15,263.4	6,361.0	25,700.3	15,700.8	6,777.1
2023	2,844.8	17,835.5	8,737.0	27,373.8	15,498.8	6,934.7
2024	3,620.10	16,856.20	8,091.90	36,888.70	15,490.70	

Source: Badan Pusat Statistik, 2025

However, the value-based approach that dominates policy discourse obscures a more operational dimension: the physical volume of exports. For companies engaged in production capacity planning, logistics, and supply chain management, the relevant variable is not export value in dollars—which is heavily distorted by price fluctuations—but the volume of oil and gas exports in thousands of tonnes.[3] This distinction matters because managerial decisions on capacity, inventory, and resource allocation are based on physical

[1] Badan Pusat Statistik, 'Nilai Ekspor dan Impor Migas (Juta US$) 1996-2024', *BPS*, 29 July 2025 https://www.bps.go.id/id/statistics-table/1/MTAwNCMx/nilai-ekspor-dan-impor-migas--juta-us---1996-2024.html [accessed 21 April 2026].

[2] Badan Pusat Statistik, 'Nilai Ekspor, Impor, dan Neraca Perdagangan RI Januari-Oktober 2024', *Databoks*, 19 November 2024 https://databoks.katadata.co.id/perdagangan/statistik/67493165b3796/neraca-perdagangan-migas-indonesia-terus-defisit [accessed 21 April 2026].

[3] Jay Heizer, Barry Render, and Chuck Munson, *Operations Management: Sustainability and Supply Chain Management*, 12th edn (Pearson Education, 2017), p. 45.

throughput, not on revenue figures that fluctuate with global prices.[4]

The year 2026 carries particular significance for this planning horizon. The Government has set a national oil lifting target of 610 thousand barrels per day in the 2026 State Budget, compared with the 605.3 thousand barrels per day realised in 2025.[5] At the same time, a member of the House of Representatives' Commission XII has stated that the completion of the long-delayed revision of the Oil and Gas Law is targeted for March 2026, a regulatory change that is expected to reshape the investment and contractual landscape for upstream operators.[6] For oil and gas companies, these concurrent policy shifts make 2026 a year in which operational plans must be formulated under heightened regulatory and production uncertainty—precisely the condition in which reliable volume forecasts become most valuable.

Previous research has frequently utilised ARIMA to forecast Indonesia's oil and gas exports; however, it has primarily focused on model accuracy or method comparisons, without integrating the forecast results into strategic planning and practical managerial implications.[7] This gap forms the basis for research that not only produces accurate forecasts but also translates them into operational recommendations for oil and gas companies, particularly for budgeting, cost control, capacity planning, and

[4] Badan Pusat Statistik, 'Nilai Ekspor dan Impor Migas (Juta US$) 1996-2024', *BPS*, 29 July 2025

[5] Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 'Target Lifting Naik, Pemerintah Perkuat Kolaborasi dengan Badan Usaha Hulu Migas', *ESDM*, 3 December 2025 https://www.esdm.go.id/id/media-center/arsip-berita/target-lifting-naik-pemerintah-perkuat-kolaborasi-dengan-badan-usaha-hulu-migas [accessed 27 October 2026]; untuk realisasi 2025, lihat Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 'Pertama Kalinya dalam 10 Tahun, Lifting Minyak Bumi Lewati Target APBN', *ESDM*, 8 January 2026 https://www.esdm.go.id/en/media-center/news-archives/pertama-kalinya-dalam-10-tahun-lifting-minyak-bumi-lewati-target-apbn [accessed 27 October 2026].

[6] JDIH Setjen DPR RI, 'Legislator Dorong Percepatan Revisi UU Migas Demi Wujudkan Swasembada Energi', *JDIH DPR RI*, 18 November 2025 https://jdih.dpr.go.id/berita/detail/id/61044/t [accessed 27 October 2026].

[7] Euis Nurhasanah, Yani Sukmawaty, and Maisarah, 'Peramalan Ekspor Migas di Indonesia Menggunakan Pendekatan Seasonal Autoregressive Integrated Moving Average with Exogenous (SARIMAX)', *Indonesian Journal of Applied Statistics*, 7.1 (2024), pp. 87–97.; Anisa B. Sinaga, Rina P. Sari, and Nurviana, 'Forecasting the Amount of Oil and Non-Oil and Gas Exports in Indonesia Using the Box-Jenkins Method', *Mathline: Jurnal Matematika dan Pendidikan Matematika*, 8.4 (2023), pp. 1573–1588.

decision-making information within a management accounting framework.

This study aims to fill this gap by forecasting Indonesia's oil and gas export volumes for 2026 using an ARIMA model and by formulating the implications of the forecast results as supporting information for managerial decision-making. The novelty of this study lies in the explicit integration of ARIMA forecasting results into a strategic management framework, supported by a focus on physical export volumes (thousands of tonnes) and the use of the most recent data period (2020–2025).

Literature Review

Forecasting as Managerial Decision Information

The core function of forecasting in operations management is to reduce uncertainty in decision-making.[8] Heizer, Render, and Munson (2017) define forecasting as a scientific estimate of future events based on historical data and position it as a fundamental input for capacity planning, production scheduling, and inventory control; Rusdiana (2014) adds that a good forecast must meet three criteria—accuracy, cost, and ease of application.[9] Within a management accounting framework, forecasting functions as a feedforward control mechanism that enables management to anticipate future conditions before decisions are made, in contrast to feedback control, which merely evaluates past outcomes.[10] This distinction is central to the present study: the forecast of oil and gas export volumes is not an end in itself, but an information input for budgeting, cost control, capacity planning, and operational decision-making.[11]

Decision Support Systems and the Integration of Forecasts

A Decision Support System (DSS) provides the organisational architecture through which forecast results are transformed into managerial information. Turban, Aronson, and Liang (2005) define a DSS as an interactive, flexible information system developed to support the resolution of unstructured management problems, and identify its three components—the database, the model base, and the user interface—following Sprague and

[8] Heizer, Render, and Munson, p. 45.

[9] Robert N. Anthony and Vijay Govindarajan, *Management Control Systems*, 5th edn (McGraw-Hill Education, 2013), p. 8.

[10] Robert N. Anthony and Vijay Govindarajan, *Management Control Systems*, 5th edn (McGraw-Hill Education, 2013), p. 8.

[11] Heizer, Render, and Munson, p. 52.

Carlson (1982).[12] In this study, the ARIMA model functions as one element of the model base, processing historical export volume data to produce projections presented to managers as supporting information. Crucially, a DSS does not replace managerial judgement; it provides analytical models and prediction intervals that assist managers in evaluating alternatives and understanding uncertainty.[13]

Research Gap

Previous studies have applied ARIMA to forecast Indonesia's oil and gas exports, but have primarily focused on model accuracy or method comparison, without integrating the forecast results into strategic planning or practical managerial implications. Nurhasanah, Sukmawaty, and Maisarah (2024) employed SARIMAX and identified seasonal patterns, while Sinaga, Sari, and Nurviana (2023) compared Box-Jenkins specifications; neither study translated the forecasts into operational recommendations. Ahmar et al. (2023) produced an ARIMA(0,1,1) model with an upward trend but did not address the managerial use of the forecast.[14] This gap forms the basis for the present study, which not only produces an accurate forecast of physical export volumes but also formulates its implications for budgeting, cost control, capacity planning, and decision-making information within a management accounting framework.

Research Methodology

This study employs a quantitative approach, specifically a descriptive study designed to carry out univariate time series forecasting.[15] The quantitative approach was chosen as it enables the researcher to examine the phenomenon of demand for Indonesian oil and gas exports objectively through the analysis of measurable numerical data.[16] The research design consists of univariate time series forecasting, in

[12] Efraim Turban, Jay E. Aronson, and Ting-Peng Liang, *Decision Support Systems and Intelligent Systems*, 7th edn (Prentice Hall, 2005), p. 12.

[13] Ibid, p. 4.

[14] Euis Nurhasanah, Yani Sukmawaty, and Maisarah, 'Peramalan Ekspor Migas di Indonesia Menggunakan Pendekatan Seasonal Autoregressive Integrated Moving Average with Exogenous (SARIMAX)', pp. 87–97 (p. 88); Anisa B. Sinaga, Rina P. Sari, and Nurviana, 'Forecasting the Amount of Oil and Non-Oil and Gas Exports in Indonesia Using the Box-Jenkins Method', 8.4 (2023), pp. 1573–1588 (p. 1575); A. S. Ahmar and others, 'Forecasting the Export Value of Oil and Gas in Indonesia using Autoregressive Integrated Moving Average (ARIMA)', *Quantitative Economics and Management Studies*, 4.5 (2023), pp. 1036–1044 (p. 1037).

[15] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (Alfabeta, 2016).

[16] Sugiyono, *Statistika untuk Penelitian* (Alfabeta, 2015), p. 10

which the researcher focuses the study on depicting historical trends in the volume of Indonesia's oil and gas exports and forecasting future periods using the ARIMA model.[17]

The data used in this study consist of monthly secondary data on Indonesia's oil and gas export volume, obtained from official BPS publications. The dataset comprises 72 observations from January 2020 to December 2025, a period selected to capture stable fluctuations, the structural shock of the COVID-19 pandemic, and the geopolitical turbulence of 2025.[18]

To ensure the integrity of the forecasting exercise, the dataset was divided into three segments. First, the development sample (January 2020–February 2024) was used for model identification, parameter estimation, and diagnostic testing. Second, the backtesting sample (March 2024–December 2025, 22 months) was used to evaluate out-of-sample accuracy through MAPE, providing a sufficiently long evaluation window while retaining enough observations for stable estimation. Third, the validation sample (January–May 2026) comprised actual BPS data accessed in June 2026, used to assess the model against realizations after the forecast was generated.[19] This three-way split ensures that the forecast used for validation was produced without any knowledge of the 2026 actual data.

The forecast for 2026 was generated in December 2025, immediately after the final observation became available and before any 2026 data were published, using Minitab version 21.[20] Data were collected through the documentation technique to ensure integrity prior to processing.[21]

The analysis utilised a univariate ARIMA model via the Box–Jenkins procedure: (1) model identification through historical plots, the Augmented Dickey–Fuller (ADF) test, and the Box–Cox plot; (2) order identification through ACF and PACF plots, followed by parameter estimation using conditional least squares; (3) diagnostic testing through the Ljung–Box test for white noise and a normality test; and (4) forecasting.[22]

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[17] Ahmad Khoiri, *Analisis Deret Waktu Univariat: Teori dan Pengolahan Data* (UNIPMA Press, 2023), p. 20

[18] Badan Pusat Statistik, 'Volume Ekspor Migas-NonMigas (Ribu Ton)'.

[19] Ibid

[20] Khoiri, *Analisis Deret Waktu Univariat*, p. 45.

[21] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*, p. 25.

[22] Peter J. Brockwell and Richard A. Davis, *Introduction to Time Series and Forecasting*, 3rd edn (Springer, 2016), p. 180; Khoiri, *Analisis Deret Waktu Univariat*, p. 30.

Model selection followed a hierarchical sequence: (1) statistical significance of all parameters ($p < 0.05$); (2) fulfilment of residual diagnostic tests; (3) the lowest AICc value; (4) parsimony, preferring fewer parameters when accuracy differences are negligible; and (5) MAPE during backtesting as a confirmatory measure.[23] This sequence prioritises model validity and parsimony over marginal differences in point-forecast accuracy. MAPE is classified as highly accurate (≤10 per cent), good (10–20 per cent), acceptable (20–50 per cent), or inaccurate (>50 per cent).[24]

Once the best model had passed all diagnostic tests, forecasts were made for January–December 2026 with 95 per cent prediction intervals.[25] Validation compared these forecasts with actual BPS data for January–May 2026, accessed in June 2026, calculating the percentage error for each month as the absolute difference between forecast and actual values divided by the actual value.[26] This ensures a genuine out-of-sample evaluation under real-world conditions.

Figure 2 Conceptual Framework



Source: Author Estimation (2026)

The conceptual framework (Figure 2) illustrates the research process: historical BPS data on Indonesia's oil and gas export volumes (2020–2025) are analysed using an ARIMA model via the Box–Jenkins procedure to produce 12-month forecasts (January–December 2026) with 95 per cent prediction intervals, which are then interpreted as supporting information for managerial decision-making.[27]

Result and Discussion

Descriptive statistics (Table 1) show a mean export volume of 2,199.10 thousand tonnes (median 2,183.95), ranging from 1,637.30 (January 2022) to 3,293.30 thousand tonnes (December 2020), with a standard deviation of 272.51 and a coefficient of variation of 12.39 per cent. This indicates a fairly

[23] Khoiri, *Analisis Deret Waktu Univariat*, p. 50; William W. S. Wei, *Time Series Analysis: Univariate and Multivariate Methods*, 2nd edn (Pearson, 2023), p. 120.

[24] Ibid, p. 55

[25] Wei, *Time Series Analysis*, p. 130; Efraim Turban, Jay E. Aronson, and Ting-Peng Liang, *Decision Support Systems and Intelligent Systems*, 7th edn (Prentice Hall, 2005), p. 125.

[26] Badan Pusat Statistik, 'Volume Ekspor Migas-NonMigas (Ribu Ton)'.

[27] Jay Heizer, Barry Render, and Chuck Munson, *Operations Management: Sustainability and Supply Chain Management*, 12th edn (Pearson Education, 2017), p. 45; Efraim Turban, Jay E. Aronson, and Ting-Peng Liang, p. 4.

high level of volatility during the observation period. All data were complete (N* = 0), requiring no imputation.[28]

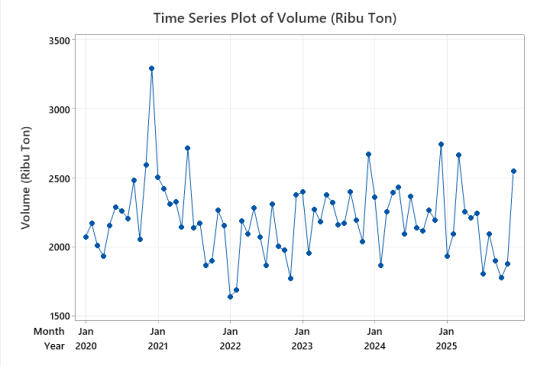
Table 1 Descriptive Statistical Analysis of Indonesia's Oil and Gas Exports

Statistics	Volume (thousand tonnes)
Number of Observations (n)	72
Mean	2199,10
Median	2183,95
Maximum Value	3293,30 (December 2020)
Minimum Value	1637,30 (January 2022)
Standard Deviation	272,51
Coefficient of Variation (CV)	12,39%

Source: Author Estimation (2026)

Figure 3 shows that Indonesia's oil and gas export volume fluctuates significantly, with an extreme spike in December 2020 (3,293.30 thousand tonnes) followed by a sharp decline to a low of 1,637.30 thousand tonnes in January 2022. Across 2020–2025, the data exhibit no clear long-term growth or decline trend, but rather horizontal stagnation with high volatility, reflecting the influence of external events such as the COVID-19 pandemic in 2020 and geopolitical shocks in 2025.

Figure 3 Visualisation of a Time Series Plot



Source: Author Estimation (2026)

Stationarity was tested using the Augmented Dickey–Fuller (ADF) test for the mean and a Box–Cox plot for the variance. The ADF test at the zero-order level (d = 0) yielded a test statistic of –6.37195 (critical value at 5 per cent: –2.90320; p = 0.000), indicating stationarity. Nevertheless, to eliminate the time trend detected in the initial ACF plot and to ensure long-term stability, first-order differencing (d = 1) was applied, yielding a test statistic of –6.70060 (critical value: –2.90576; p = 0.000), confirming stationarity (Table 2). The Box–Cox plot showed a rounded λ value of –1.00 for the original data, which does not equal 1; the data were therefore transformed using the inversion method until λ = 1.00 was obtained, satisfying the assumption of variance stationarity.

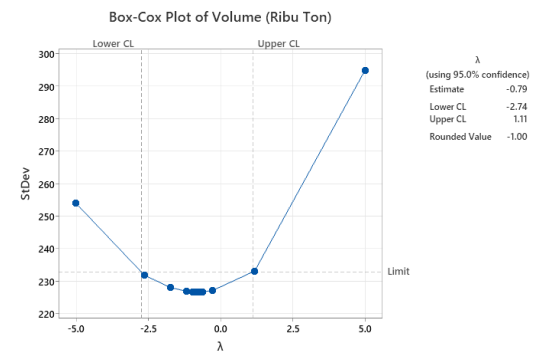
[28] Badan Pusat Statistik, 'Volume Ekspor Migas-NonMigas (Ribu Ton)', *BPS* https://www.bps.go.id/id/statistics-table/2/MjE3MiMy/volume-ekspor-migas-nonmigas--ribu-ton-.html [accessed 10 June 2026].

Table 2 Results of the ADF Stationarity Test

Skenario	Test Statistic	Critical Value (5%)	p-value	Description
Level (d = 0)	-6,37195	-2,90320	0,000	Stasioner
Level (d = 1)	-6,70060	-2,90576	0,000	Stasioner

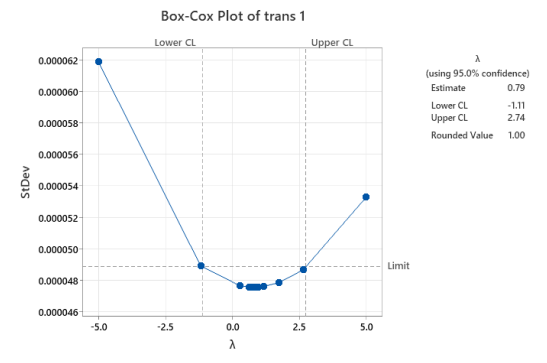
Source: Author Estimation (2026)

Figure 4 Plot Box– Cox: Oil and Gas Exports Before the Transformation



Source: Author Estimation (2026)

Figure 5 Plot Box– Cox: Oil and Gas Exports Following the Transformation

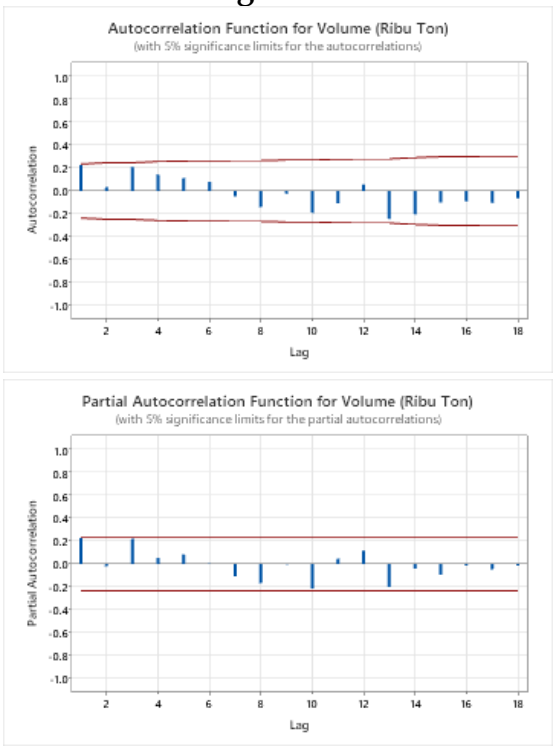


Source: Author Estimation (2026)

Initial model identification examined the ACF and PACF plots of the raw data (Figure 6). The ACF plot shows a very slow decay pattern, characteristic of non-stationary data with a time trend. At the seasonal lag (lag 12), both plots show values within the significance threshold, indicating no statistically significant correlation between years; consequently, modelling was focused on a non-seasonal ARIMA(p,d,q) model.

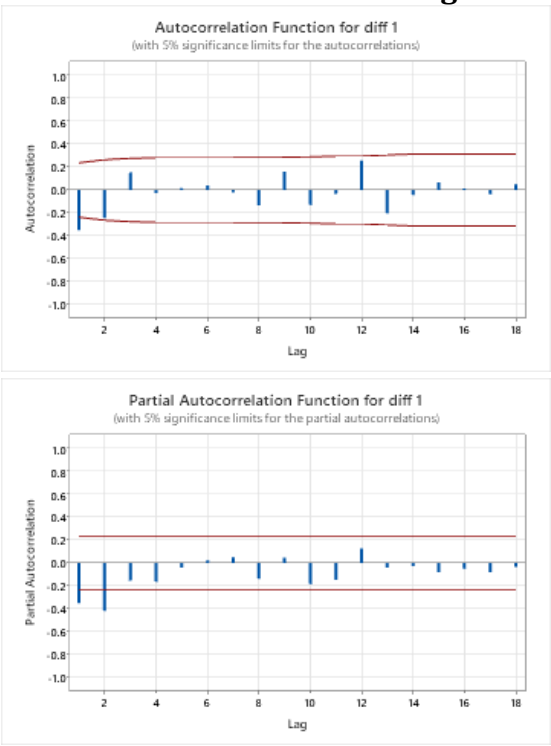
Following first-order differencing (Figure 7), the ACF plot shows a sharp drop-off rather than gradual decay, providing strong evidence that the data have reached stationarity in the mean. The PACF plot reveals two significant peaks at lags 1 and 2, indicating the presence of AR(1) and AR(2) components, whilst the ACF plot shows a single significant peak at lag 1, indicating an MA(1) component.

Figure 6 Plot the ACF and PACF of the original data



Source: Author Estimation (2026)

Figure 7 Plot the ACF and PACF of the Data After Differencing



Source: Author Estimation (2026)

Based on the ACF and PACF identification, five candidate models were estimated to test parameter significance (Table 3). Four models—ARIMA(1,1,0), ARIMA(2,1,0), ARIMA(0,1,1), and ARIMA(2,1,1)—had p-values < 0.05 for all parameters. The ARIMA(1,1,1) model was deemed unsuitable because its AR(1) parameter had a p-value of 0.097 (> 0.05) and was therefore not statistically significant.

Table 3 Comparison of ARIMA Model Candidates

Candidate Model	Parameters	P-value	Significance
(1, 1, 0)	AR 1	0,002	S
(2, 1, 0)	AR 1	0,000	S
	AR 2	0,000	S
(0, 1, 1)	MA 1	0,000	S
(2, 1, 1)	AR 1	0,000	S
	AR 2	0,001	S
	MA 1	0,000	S
(1, 1, 1)	AR 1	0,097	NS
	MA 1	0,000	S

Source: Author Estimation (2026)

Key: S = Significant (P-value < 0.05), TS = Not Significant (P-value > 0.05)

Diagnostic tests were carried out to ensure that the residuals satisfied the assumptions of white noise (Ljung–Box test) and normality (probability plot of residuals). Of the four models with significant parameters, only ARIMA(2,1,0) and ARIMA(0,1,1) met all diagnostic assumptions (Table 4). ARIMA(1,1,0) and ARIMA(2,1,1) were deemed unsuitable because their residuals were not random, indicating systematic information not captured by the models.

Table 4 Diagnostic Test Results

Model	Diagnostic Tests		Conclusion
	Random	Normally Distributed	
(1,1,0)	<0,05 (not random)	0,109	Unsuitable
(2,1,0)	>0,05 (random)	0,375	Suitable
(0,1,1)	>0,05 (random)	0,342	Suitable
(2,1,1)	<0,05 (not random)	0,175	Unsuitable

Source: Author Estimation (2026)

The best model was selected by comparing the forecasting accuracy of the two models that passed the diagnostic tests, using MAPE over the

backtesting period (March 2024–December 2025). ARIMA(2,1,0) produced a MAPE of 9.06 per cent, whilst ARIMA(0,1,1) produced 9.09 per cent—a negligible difference of 0.03 percentage points. However, ARIMA(0,1,1) exhibited more stable residuals with no significant outliers, whereas ARIMA(2,1,0) had several residual points outside the ±2 standard deviation range. Taking into account the principle of parsimony, the simpler ARIMA(0,1,1) model—with only one MA parameter—was selected as the best model. This selection is further supported by its lowest AICc value (1,007.31), compared with 1,011.00 for ARIMA(2,1,0) (Tables 5 and 6).

Table 5 Comparison of ARIMA Model Accuracy

Candidate Model	Average MAPE (%)	Description
ARIMA (2, 1, 0)	9.06%	Highly Accurate
ARIMA (0, 1, 1)	9.09%	Highly Accurate

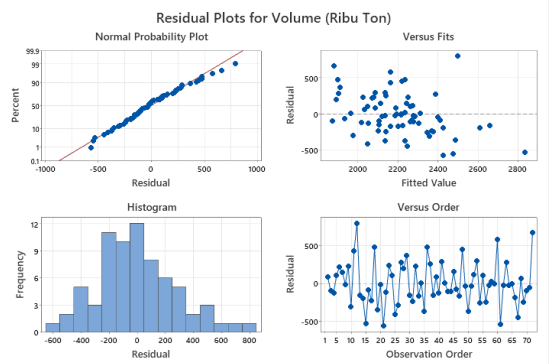
Source: Author Estimation (2026)

Table 6 Comparison of Models Based on the AICc Criterion

Model	AICc	Log Likelihood	Para meter	Diagnostic
ARIMA(2,1,0)	1011.00	-501.196	2	Passed
ARIMA(0,1,1)	**1007.31**	**-500.477**	**1**	**Passed**

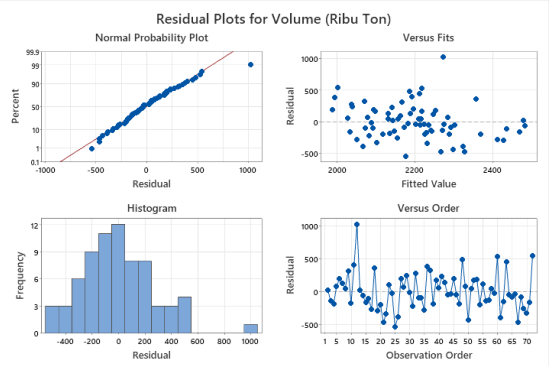
Source: Author Estimation (2026)

Figure 8 Residual Plot Model ARIMA (2,1,0)



Source: Author Estimation (2026)

Figure 9 Residual Plots Model ARIMA (0,1,1)



Source: Author Estimation (2026)

The selected ARIMA(0,1,1) model comprises a first-order differencing term (d = 1), reflecting non-stationarity in the mean due to extreme fluctuations such as the December 2020 surge and the January 2022 decline, and a first-order moving average component (q = 1), indicating that monthly export volume is influenced by shocks from the previous month. This model was used to forecast Indonesia's oil and gas export volumes for January–December 2026. The results indicate a relatively stable range between 2,103.52 thousand tonnes

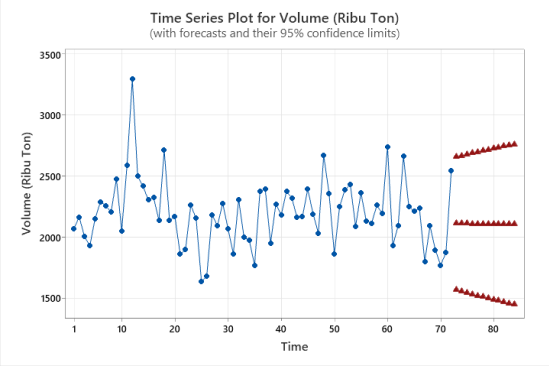
(December) and 2,111.34 thousand tonnes (January), averaging approximately 2,107 thousand tonnes per month (Table 7).

Table 7 Forecast for Indonesia's Oil and Gas Exports in 2026

Period	Month	Forecasting Results	Lower Limit (95%)	Upper Limit (95%)
73	January 2026	2111.34	1565.84	2656.83
74	February 2026	2110.63	1553.99	2667.26
75	March 2026	2109.92	1542.36	2677.47
76	April 2026	2109.21	1530.93	2687.48
77	May 2026	2108.50	1519.70	2697.29
78	June 2026	2107.79	1508.65	2706.92
79	July 2026	2107.08	1497.78	2716.37
80	August 2026	2106.36	1487.08	2725.65
81	September 2026	2105.65	1476.53	2734.78
82	Oktober 2026	2104.94	1466.14	2743.75
83	November 2026	2104.23	1455.89	2752.58
84	Desember 2026	2103.52	1445.78	2761.27

Source: Author Estimation (2026)

Figure 10 Graph: Forecast for Indonesia's Oil and Gas Exports in 2026



Source: Author Estimation (2026)

The forecast results show that the 95 per cent confidence interval widens as the forecast horizon increases—from 1,565.84–2,656.83 thousand tonnes in January 2026 to 1,445.78–2,761.27 thousand tonnes in December 2026—reflecting growing uncertainty over a longer timeframe, although the point forecast remains the single most likely estimate. The difference between the highest and lowest monthly point forecasts is only about 7.8 thousand tonnes, indicating no specific critical points requiring special logistical preparation.

Model validation compared these forecasts with actual BPS data for January–May 2026 (Table 8). For January–March, the forecast error ranged from 2 to 9 per cent—better than the model's backtesting MAPE of 9.09 per cent. However, actual data for April (1,602.2 thousand tonnes; error 24.04 per cent) and May (1,116.4 thousand tonnes; error 47.06 per cent) showed very significant deviations. This drastic decline was not captured by the model because ARIMA is univariate and relies solely on historical patterns without incorporating exogenous variables such as trade policy changes, global price fluctuations, or geopolitical dynamics.[3]

Table 8 A Comparison of Forecast Results with Actual Data on Indonesia's Oil and Gas Exports for 2026

Month	Forecast Results	Data Real	Difference	Error (%)
January 2026	2.111,34	1.916,9	-194,44	9,21%
February 2026	2.110,63	2.193,0	+82,37	3,76%
March 2026	2.109,92	2.153,5	+43,58	2,02%
April 2026	2.109,21	1.602,2	-507,01	24,04%
May 2026	2.108,50	1.116,4	-992,10	47,06%

Source: Author Estimation (2026)

These results confirm that, whilst ARIMA(0,1,1) demonstrates good accuracy for short-term forecasting under normal conditions, it cannot anticipate significant external shocks not reflected in historical data.[29] Forecast results should therefore be used as supplementary information, combined with the latest data and external indicators—such as global oil prices, DMO policy, and geopolitical conditions—for more comprehensive managerial decision-making.[30]

Discussion

The ARIMA(0,1,1) model was selected as the best model, with a MAPE of 9.09 per cent and the lowest AICc value (1,007.31). The 12-month forecast indicates a very flat trend, with export volumes expected to range between 2,103 and 2,111 thousand tonnes per month, without significant spikes or declines. Under normal conditions, Indonesia's oil and gas export volumes thus tend to be stable and show no significant growth, reflecting the structural characteristics of the national oil and gas sector, which is influenced more by limited production capacity and the Domestic Market Obligation (DMO) policy than by the dynamics of global market demand itself.[31] Interpreted through the Product Life Cycle lens, this flat trend suggests a maturity stage, characterised by slowing growth and market saturation. For oil and gas companies, this implies that volume expansion strategies are unlikely to yield significant returns in the short term; management attention should instead shift toward cost efficiency, supply chain optimisation, and regulatory incentives such as Permen ESDM No. 13/2024 on Gross Split PSCs.[32]

[29] William W. S. Wei, p. 130.

[30] Turban, Aronson, and Liang, p. 4.

[31] R. Paramita, 'Permasalahan dan Tantangan Peningkatan Investasi Industri Hulu Migas', *Jurnal Budget: Isu dan Masalah Keuangan Negara*, 7.2 (2022); Jay Heizer, Barry Render, and Chuck Munson, *Operations Management: Sustainability and Supply Chain Management*, 12th edn (Pearson Education, 2017), p. 45.

[32] Heizer, Render, and Munson, p. 45; Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, *Peraturan Menteri ESDM Nomor 13 Tahun 2024 tentang Kontrak Bagi Hasil Gross Split* (Kementerian ESDM, 2024).

The first-order differencing component (d = 1) indicates that the 2020–2025 data are non-stationary in mean, due to extreme fluctuations such as the December 2020 spike and the January 2022 decline, whilst the moving average component (q = 1) indicates that monthly export volume is influenced by shocks from the previous month.[33] This reflects that fluctuations in demand are more heavily influenced by external shocks in the preceding period than by the variable's own historical values—consistent with the characteristics of Indonesia's oil and gas exports, which are relatively stable due to long-term contracts with key trading partners yet remain sensitive to unexpected shocks.[34]

Validation using actual data from January to May 2026 provides an important lesson regarding the limitations of univariate ARIMA models. The model's performance in the first three months (error 2–9 per cent) demonstrates that ARIMA(0,1,1) is reliable for short-term forecasting under normal conditions. However, the large deviations in April–May 2026 (error 24–47 per cent) coincide with the escalation of geopolitical conflict in the Middle East and the effective closure of the Strait of Hormuz since March 2026, which disrupted approximately 20 per cent of global oil and LNG trade.[35] It should be emphasised that this study does not empirically test the causal link between the geopolitical event and the observed decline; rather, the temporal coincidence is presented as a plausible explanation that highlights the limitations of univariate models in anticipating structural shocks not reflected in historical data.[36]

These findings align with the Decision Support System framework of Turban, Aronson, and Liang (2005), in which forecast results serve as one component of the model base that informs—rather than replaces—managerial judgement.[37] They also support the feedforward control logic of Anthony and Govindarajan (2013), whereby forecasting enables anticipatory action before deviations occur,[38] and Wheelen and Hunger's (2012) emphasis on environmental scanning as the first stage of strategy

[33] William W. S. Wei, p. 125.

[34] Heizer, Render, and Munson, p. 52.

[35] Qatar News Agency, 'Qatar Warns of Global Impact of Strait of Hormuz Closure at UN Briefing', *QNA*, 7 May 2026 https://qna.org.qa/en/news/news-details?id=qatar-warns-of-global-impact-of-strait-of-hormuz-closure-at-un-briefing&date=7/05/2026 [accessed 27 October 2026].

[36] Wei, *Time Series Analysis*, p. 130.

[37] Efraim Turban, Jay E. Aronson, and Ting-Peng Liang, p. 4.

[38] Anthony and Govindarajan, p. 8.

formulation.[39] Accordingly, companies are advised to develop three planning scenarios (low, base, high) based on the 95 per cent prediction intervals, implement rolling forecasts updated monthly, and combine forecast results with external indicators such as global oil prices, exchange rates, DMO policies, and geopolitical dynamics.[40]

A comparison with previous studies reveals differences in forecast direction, primarily due to differences in data coverage and observation period. Ahmar et al. (2023) produced an ARIMA(0,1,1) model with an upward trend using 2010–2022 data; Nurhasanah, Sukmawaty, and Maisarah (2024), using SARIMAX, found an upward trend until July 2024 before slowing down, indicating a seasonal pattern not observed in this study; and Sinaga, Sari, and Nurviana (2023), using ARIMA(5,1,3), identified yet another pattern.[41] These divergent directions underscore that model selection and forecasting results depend heavily on data characteristics, the type of variable (value versus volume), and the observation period. This study contributes by integrating ARIMA technical forecasting into the strategic management framework of oil and gas companies, using physical volume to provide a more operational perspective for logistics and supply chain capacity planning than export values, which are heavily influenced by price fluctuations. ARIMA is reliable for operational planning under normal conditions but insufficient for anticipating significant external shocks such as geopolitical crises—as confirmed by the April–May 2026 validation. Oil and gas companies therefore need to develop early-warning systems that integrate external indicators such as global oil prices and geopolitical dynamics.

Forecasting results should be viewed as one piece of supporting information that helps management reduce uncertainty; final decisions must still account for the broader business context

[39] Thomas L. Wheelen and J. David Hunger, *Strategic Management and Business Policy* (Addison-Wesley, 2012), p. 15.

[40] Anthony and Govindarajan, p. 8; Heizer, Render, and Munson, p. 52.

[41] A. S. Ahmar and others, 'Forecasting the Export Value of Oil and Gas in Indonesia using Autoregressive Integrated Moving Average (ARIMA)', pp. 1036–1044; Euis Nurhasanah, Yani Sukmawaty, and Maisarah, 'Peramalan Ekspor Migas di Indonesia Menggunakan Pendekatan Seasonal Autoregressive Integrated Moving Average with Exogenous (SARIMAX)', *Indonesian Journal of Applied Statistics*, 7.1 (2024), pp. 87–97; Anisa B. Sinaga, Rina P. Sari, and Nurviana, 'Forecasting the Amount of Oil and Non-Oil and Gas Exports in Indonesia Using the Box-Jenkins Method', 8.4 (2023), pp. 1573–1588.

and up-to-date information.[42] Consequently, this study not only enriches the literature on forecasting and operations management but also provides practical insights for policymakers and industry practitioners in formulating more adaptive and data-driven strategies.

Conclusion And Recommendation

This study successfully forecast Indonesia's oil and gas export volumes for 2026 using the ARIMA(0,1,1) model, selected based on a hierarchical sequence of criteria: parameter significance, residual diagnostics, the lowest AICc value (1,007.31), parsimony, and a backtesting MAPE of 9.09 per cent.[43] The 12-month forecast indicates a range of 2,103–2,111 thousand tonnes per month, with a very flat trend and an average of approximately 2,107 thousand tonnes—reflecting that, in the absence of significant external shocks, national export volumes tend to remain stable, consistent with the maturity stage of the Product Life Cycle framework.[44]

Validation using actual data from January to May 2026 confirms the model's reliability for short-term forecasting under normal conditions (error 2–9 per cent in January–March, outperforming the model's MAPE).[45] However, the significant deviations in April–May 2026 (errors of 24–47 per cent) coincided with external shocks—the escalation of geopolitical conflict in the Middle East and the effective closure of the Strait of Hormuz since March 2026, which disrupted approximately 20 per cent of global oil and LNG trade.[46] This study does not empirically test the causal link between the geopolitical event and the observed decline; rather, the temporal coincidence highlights the limitations of the univariate ARIMA model, which relies solely on historical patterns without incorporating exogenous variables.[47]

Limitations and future research

[42] Turban, Aronson, and Liang, p. 4; Fred R. David, *Strategic Management: Concepts and Cases*, 15th edn (Pearson, 2015).

[43] Ahmad Khoiri, p. 50; William W. S. Wei, p. 120.

[44] Jay Heizer, Barry Render, and Chuck Munson, p. 45.

[45] Badan Pusat Statistik, 'Volume Ekspor Migas-NonMigas (Ribu Ton)', *BPS* https://www.bps.go.id/id/statistics-table/2/MjE3MiMy/volume-ekspor-migas-nonmigas--ribu-ton-.html [accessed 10 June 2026].

[46] Qatar News Agency, 'Qatar Warns of Global Impact of Strait of Hormuz Closure at UN Briefing', *QNA*, 7 May 2026 https://qna.org.qa/en/news/news-details?id=qatar-warns-of-global-impact-of-strait-of-hormuz-closure-at-un-briefing&date=7/05/2026 [accessed 27 October 2026].

[47] Wei, *Time Series Analysis*, p. 130.

This study has several limitations: the univariate ARIMA model does not incorporate exogenous variables (global oil prices, exchange rates, geopolitical indicators), which limits its ability to anticipate structural shocks; the development sample covers only six years (2020–2025), a period marked by the COVID-19 pandemic and geopolitical turbulence; the out-of-sample validation covers only five months (January–May 2026); and the analysis is conducted at the aggregate level without disaggregating crude oil, petroleum products, and gas.[48] These limitations suggest directions for future research, including ARIMAX or Transfer Function models with exogenous variables, comparisons with machine-learning methods (LSTM, Random Forest) over longer data periods, product-specific and company-level analyses, and the development of early-warning systems that integrate quantitative models with external indicators.[49]

Practical implications

Oil and gas companies are advised to develop three planning scenarios (low, base, high) based on the 95 per cent prediction intervals, implement rolling forecasts updated monthly, and combine forecast results with external variables such as global oil prices, exchange rates, DMO policies, and geopolitical indicators.[50] Forecasting results should be viewed as one component within a Decision Support System, rather than as the sole basis for decision-making, and must be combined with up-to-date information and managerial judgement.[51] This study contributes to the integration of technical ARIMA forecasting into the strategic management framework of oil and gas companies.

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[48] Badan Pusat Statistik, 'Nilai Ekspor dan Impor Migas (Juta US$) 1996–2024'.

[49] Wei, *Time Series Analysis*, p. 130; Efraim Turban, Jay E. Aronson, and Ting-Peng Liang, p. 4.

[50] Robert N. Anthony and Vijay Govindarajan, p. 52.

[51] Turban, Aronson, and Liang, p. 4.

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