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Forecasting Tourism Levy Revenue Using the SARIMAX Method as a Basis for Regional Own-Source Revenue (PAD) Planning: A Case Study of Garut Regency

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ABSTRACT
Tourism retribution is a component of Regional Own-Source Revenue (PAD) that can support local fiscal independence, yet its realization in Garut Regency fluctuates considerably because of seasonal tourism patterns, the COVID-19 period, and the moving Eid al-Fitr holiday. This study aims to analyze the pattern of monthly tourism retribution, identify an appropriate SARIMAX forecasting model, and interpret the 2026 projection as an evidence-based input for public financial planning. The study applies a quantitative time-series approach using monthly tourism retribution realization data for 2021–2025. The model includes a mobility restriction dummy and an Eid al-Fitr dummy as exogenous variables. The results show that SARIMAX $(2,1,1)(1,1,0)_{12}$ was identified as the preferred specification based on AIC and residual diagnostics and remained competitive in rolling-origin out-of-sample validation, achieving the lowest average MAE of approximately IDR 71.90 million and the lowest average MAPE of 107.45% among the candidate models. The model produced an AIC of 1337.429 and a Ljung–Box p-value of 0.119851, indicating that the residuals satisfy the white-noise criterion. The Eid al-Fitr dummy is statistically significant and is associated with an increase in tourism retribution of approximately IDR 132.80 million, while the Mobility Restriction Dummy could not be reliably estimated. The 2026 point forecast reaches approximately IDR 1.426 billion, with April projected as the highest month at IDR 480.49 million and December as a secondary peak at IDR 199.48 million. These findings imply that local governments should set PAD targets using a realistic range, align cash-flow planning with seasonal revenue patterns, diversify tourism activities in low-revenue months, and strengthen data management for future forecasting.

ABSTRAK
Fasilitasi perdagangan melalui instrumen kepabeanan merupakan hal sentral dalam upaya Indonesia untuk memperkuat daya saing manufaktur, namun bukti tentang bagaimana fasilitas prosedural (Operator Ekonomi Resmi/AEO, Mitra Utama Kepabeanan/MITA, Ekosistem Logistik Nasional/NLE, dan Jendela Tunggal Nasional Indonesia/INSW) dan fasilitas fiskal (Zona Berikat, Kemudahan Impor Tujuan Ekspor/KITE, dan Zona Ekonomi Khusus) berkontribusi terhadap daya saing masih terfragmentasi di berbagai disiplin ilmu dan jarang disintesis dengan transparansi metodologis. Studi ini melakukan tinjauan literatur sistematis (SLR) yang dipandu oleh protokol PRISMA 2020 untuk memetakan, menilai secara kritis, dan mensintesis basis bukti. Pencarian dilakukan di Google Scholar, DOAJ, ResearchGate, IDEAS/RePEc, dan repositori institusional Indonesia menggunakan string pencarian spesifik basis data yang terdokumentasi, dengan pencarian terakhir dilakukan pada 15 Juli 2026. Kualitas metodologis dinilai menggunakan Mixed Methods Appraisal Tool (MMAT 2018). Dari 215 catatan yang diidentifikasi, 19

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studi empiris atau konseptual memenuhi kriteria kelayakan melalui pencarian basis data, ditambah dengan 10 referensi teoritis dan metodologis dasar tambahan yang diperoleh melalui pelacakan kutipan mundur, menghasilkan 29 sumber dalam sintesis akhir. Tinjauan ini menemukan bahwa fasilitas prosedural terutama beroperasi dengan mengurangi waktu, ketidakpastian, dan intensitas inspeksi, sementara fasilitas fiskal terutama beroperasi dengan mengurangi biaya produksi dan meningkatkan arus kas; keduanya memengaruhi daya saing secara tidak langsung melalui variabel perantara seperti efisiensi logistik dan kontinuitas pasokan, yang dimoderasi oleh ukuran perusahaan, sektor, kualitas kelembagaan, kesiapan digital, dan infrastruktur regional. Bukti tentang hasil yang diperoleh beragam dan tidak selalu positif, dan akses ke fasilitas prosedural seperti AEO dan MITA terkonsentrasi secara tidak proporsional di antara perusahaan besar yang sangat patuh, sehingga menimbulkan kekhawatiran tentang kesetaraan bagi UKM. Tinjauan ini mengusulkan kerangka kerja konseptual variabel menengah (Fasilitas Kepabeanan → Efisiensi Kepabeanan dan Logistik → Hasil Tingkat Perusahaan → Daya Saing Manufaktur, dimoderasi oleh kualitas kelembagaan, kesiapan digital, ukuran perusahaan, dan sektor) dan menawarkan dasar bukti yang transparan untuk penelitian empiris tingkat perusahaan dan sektor tertentu di masa mendatang.

A. INTRODUCTION

Regional Own-Source Revenue (Pendapatan Asli Daerah/PAD) is an important indicator for assessing the capacity of local governments to finance regional development and public services independently. Within the framework of fiscal decentralization, local governments are not only granted the authority to manage public expenditures but are also expected to optimize revenue sources under their jurisdiction. One of these revenue sources is tourism levy revenue, which is generated from the utilization of tourist attractions and tourism-related services managed by local governments. Therefore, tourism levy revenue should not merely be viewed as a source of government income but also as a public finance instrument that reflects the quality of fiscal planning, budgeting, and local economic development (Christia & Ispriyarso, 2019; Republik Indonesia, 2022).

Garut Regency possesses considerable tourism potential, including natural, cultural, religious, and coastal tourism attractions. This potential makes tourism levy revenue one of the important sources of local revenue that can contribute to PAD. However, tourism-related revenue is inherently unstable. Levy collections tend to increase during holiday seasons and decline during regular months. This pattern indicates that local revenue planning cannot rely solely on annual trends or simple averages, as revenue fluctuations occur on a monthly basis and are strongly influenced by the timing of public holidays and community activities.

The primary issue addressed in this study concerns regional fiscal planning. Fluctuations in tourism levy revenue may complicate local governments' efforts to establish realistic PAD targets, prepare regional cash flow plans, and determine tourism policy priorities. Overly optimistic revenue targets may not be achieved, thereby disrupting expenditure planning, whereas excessively conservative targets may prevent local governments from fully realizing their revenue potential. Consequently, data-driven revenue projections are required to support more realistic revenue planning, budgeting, and tourism destination management policies.

One important factor that must be considered is the Eid al-Fitr holiday. In this study, the Eid holiday period is not treated as occurring in a fixed calendar month because Eid al-Fitr follows the Islamic (Hijri) calendar, causing its occurrence to shift across years in

the Gregorian calendar. As a result, the impact of Eid al-Fitr on tourism levy revenue should be modeled as a specific explanatory variable rather than assuming that it always occurs in the same month. In addition, the COVID-19 pandemic period must also be taken into account because restrictions on community activities during the pandemic substantially affected tourist arrivals and tourism levy collections.

Previous studies have demonstrated that time series methods, particularly ARIMA, SARIMA, and their extensions, are effective for forecasting data exhibiting seasonal patterns, including tourism-related and regional revenue data (Alwi et al., 2021; Jesica et al., 2019; Maryadi et al., 2020). However, most previous studies have primarily focused on statistical model selection and forecasting accuracy, while comparatively limited attention has been given to translating forecasting results into public financial planning and regional policy recommendations. Therefore, this study does not regard the statistical model as the ultimate objective but rather as an analytical tool for generating empirical evidence that can support the policy-making process.

The contribution of this study lies primarily in the application of seasonal time-series forecasting to tourism levy revenue as an empirical input for Regional Own-Source Revenue (PAD) planning in Garut Regency. The study does not propose a new forecasting method; rather, it applies SARIMAX with relevant exogenous variables and out-of-sample validation to provide evidence for local revenue planning.

Based on the foregoing discussion, this study addresses the following research questions: (1) How can a seasonal time series model with exogenous variables be employed to forecast tourism levy revenue in Garut Regency? (2) How can the resulting forecasts be translated into practical public finance policy recommendations? Accordingly, this study aims to analyze the monthly realization pattern of tourism levy revenue in Garut Regency during the 2021–2025 period, identify the most appropriate SARIMAX model, generate tourism levy revenue projections for 2026, and formulate policy implications for regional own-source revenue (PAD) planning. Given that the analysis is based on five years of monthly time series data, the forecasting results should be interpreted as indicative projections intended to support fiscal planning rather than as definitive values to be adopted as fixed revenue targets.

Several pronounced revenue spikes are visible in the historical tourism levy series. These observations may reflect unusually high tourist visits during peak holiday periods, special tourism events, changes in levy collection or tariff arrangements, or other one-off administrative factors. However, the available dataset does not provide sufficient information to identify the specific cause of each spike. Therefore, the extreme observations were retained in the analysis rather than treated as errors or removed. Future research should incorporate intervention variables for identifiable exceptional events to determine whether explicitly modeling such periods improves forecasting performance.

B. RESEARCH METHOD

From a public administration perspective, tourism levy forecasting is viewed as decision-support information for evidence-based fiscal planning. The analysis also considers the interaction between tourism activity, holiday calendars, destination management, and regional fiscal planning.

This study employed a quantitative time-series approach using monthly tourism levy revenue data from January 2021 to December 2025 (60 observations). The data represent aggregate tourism levy revenue recorded in official local government records and do not provide separate information by tourism object or retribution category. The

dependent variable was realized tourism levy revenue in Indonesian rupiah. The exogenous variables were a Mobility Restriction Dummy and an Eid al-Fitr dummy. The Mobility Restriction Dummy represented July–September 2021, but the corresponding revenue observations were unavailable; therefore, its coefficient of 0 with an undefined standard error and *p*-value was treated as an identification limitation rather than evidence of no effect.

The Eid al-Fitr dummy was initially coded as the Eid month and the following month to capture extended holiday and post-Eid tourism activity. Alternative Eid windows were also tested using AIC and rolling-origin cross-validation. The two-month specification was retained because it produced the lowest average MAE, although the Eid-month-only specification had a lower in-sample AIC. Thus, the selected window represents a forecasting specification rather than a causal duration of the Eid effect.

The analysis was conducted using Python in Google Colaboratory. The procedure included data visualization, dummy-variable construction, ADF stationarity testing, ACF/PACF analysis, SARIMAX estimation, AIC-based model comparison, residual diagnostics using the Ljung–Box test, parameter evaluation, and 2026 forecasting.

Model evaluation combined in-sample fit, residual diagnostics, and out-of-sample forecasting performance. Rolling-origin cross-validation was applied using an expanding training window and a six-month forecasting horizon. Four folds were constructed sequentially from 2024 to 2025 to preserve the temporal structure of the data. Forecast accuracy was assessed using MAE, RMSE, and MAPE, with MAPE interpreted alongside MAE and RMSE because some monthly revenues were relatively small. The final model was therefore selected based on the combined evidence from AIC, Ljung–Box diagnostics, and rolling-origin forecasting performance rather than AIC alone.

Table 1. Definition of Research Variables and Dummy Variable Coding

Variable	Operational Definition	Coding
Tourism Levy Revenue	Monthly realized tourism levy revenue of Garut Regency, measured in Indonesian rupiah (IDR).	Dependent variable
Mobility Restriction Dummy	Represents the July–September 2021 period associated with substantial mobility and tourism activity restrictions.	1 = July–September 2021; 0 = otherwise
Eid al-Fitr Dummy	Represents the Eid al-Fitr holiday and the subsequent holiday period, which are expected to increase tourist arrivals and tourism levy revenue.	1 = Eid al-Fitr/extended holiday period; 0 = otherwise

Table 2. Active Periods of the Dummy Variables in the Historical Data

Period	Mobility Restriction Dummy	Eid al-Fitr Dummy	Description
May 2021	0	1	Eid al-Fitr holiday period
June 2021	0	1	Eid al-Fitr holiday period
July 2021	1	0	Mobility-restriction episode
August 2021	1	0	Mobility-restriction episode
September 2021	1	0	Mobility-restriction episode
May 2022	0	1	Eid al-Fitr holiday period
June 2022	0	1	Eid al-Fitr holiday period
April 2023	0	1	Eid al-Fitr holiday period
May 2023	0	1	Eid al-Fitr holiday period
April 2024	0	1	Eid al-Fitr holiday period
May 2024	0	1	Eid al-Fitr holiday period
March 2025	0	1	Eid al-Fitr holiday period
April 2025	0	1	Eid al-Fitr holiday period

C. RESULT ANDI DISCUSSION

Characteristics of the Tourism Levy Revenue Pattern in Garut Regency, 2021–2025

The visualization results indicate that the monthly tourism levy revenue in Garut Regency during the 2021–2025 period exhibited substantial fluctuations. At the beginning of the observation period, revenue remained relatively low and was further suppressed during the COVID-19 pandemic. As community activities gradually resumed, tourism levy revenue increased noticeably in several months, particularly during periods surrounding the Eid al-Fitr holiday and other major holiday seasons. This pattern suggests that tourism levy revenue was not evenly distributed throughout the year but was instead concentrated within specific periods characterized by heightened tourism demand.

Several extreme revenue spikes are visible in the historical series, but the available data do not provide sufficient information to determine whether they resulted from exceptional tourist visits, special events, tariff changes, or administrative factors. Therefore, these observations were retained in the analysis, while potential structural changes in tariff rates, destination coverage, collection mechanisms, or accounting classifications are acknowledged as limitations.

From a public administration perspective, this seasonal concentration of revenue has important implications for regional fiscal management. Revenue streams that are concentrated in particular months require local governments to adopt more adaptive approaches to revenue target setting, cash flow management, and expenditure planning. Allocating annual revenue targets evenly across all months may lead to inaccurate assessments of fiscal capacity during low-revenue periods. Conversely, incorporating seasonal revenue patterns into the planning process enables local governments to align revenue projections, cash flow management, and budget execution more effectively with periods of peak and off-peak tourism activity. Consequently, recognizing the seasonal characteristics of tourism levy revenue provides a stronger evidence base for improving fiscal planning and supporting more effective public financial management.

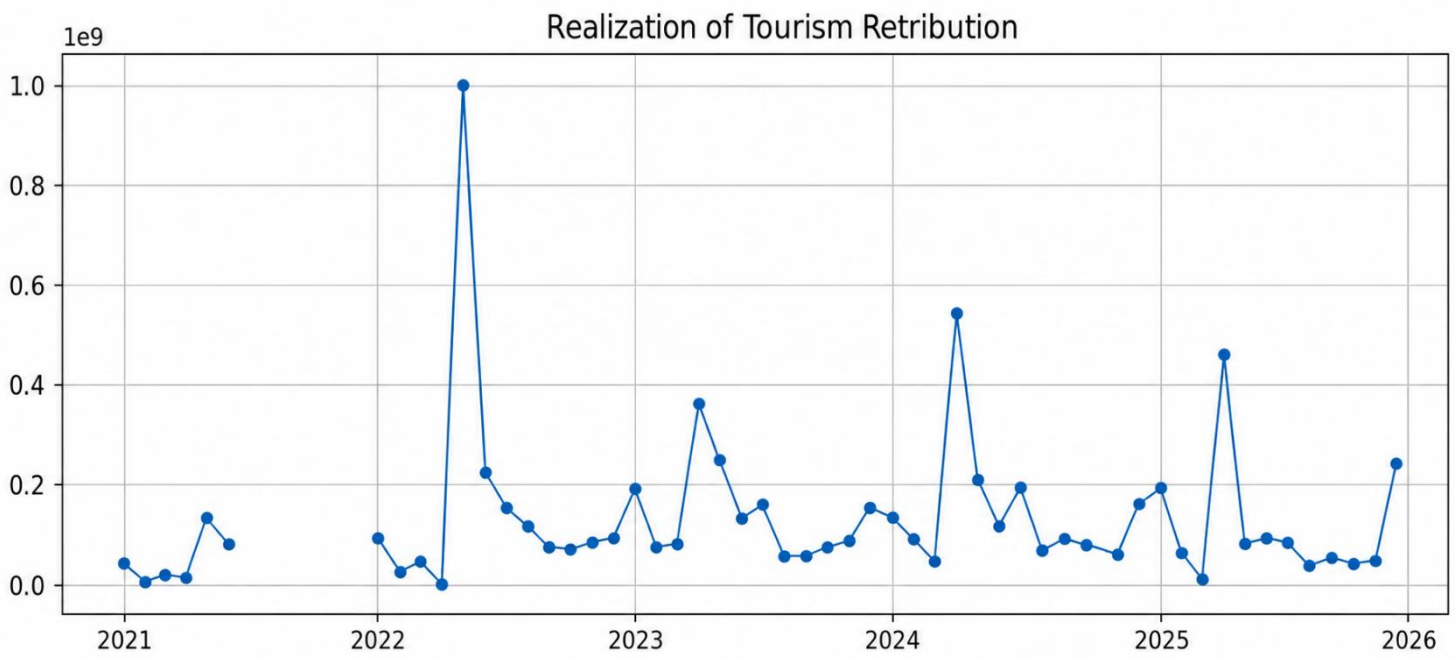

Figure 1. Monthly Tourism Levy Revenue Realization in Garut Regency 2021-2025

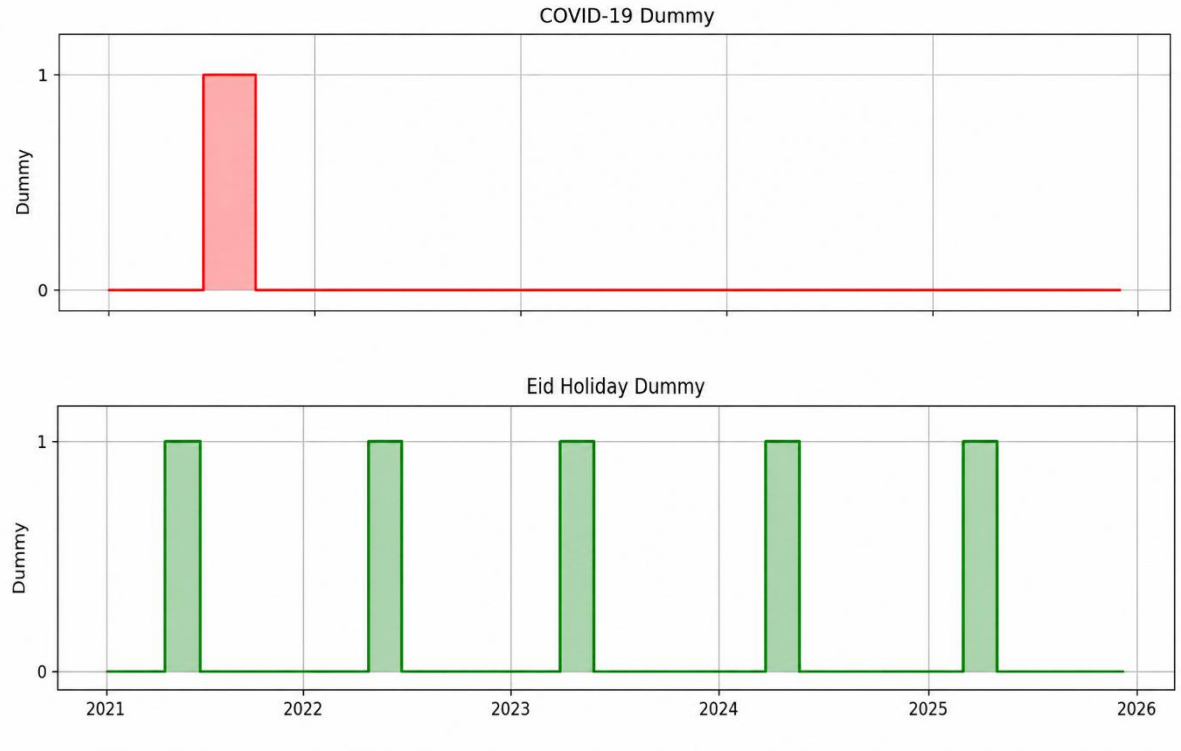

Figure 2. Visualization of tourism fee revenue and dummy variables

Figure 2 illustrates that the Eid al-Fitr dummy variable occurs in different months across the observation period. This finding reinforces the rationale for incorporating an exogenous dummy variable, as the timing of Eid al-Fitr cannot be treated as a fixed effect in the Gregorian calendar. The observed revenue peaks during holiday periods indicate that tourism levy revenue in Garut Regency is highly responsive to changes in community mobility and tourism demand. From a policy perspective, these findings suggest that tourism promotion strategies, destination management, and operational preparedness should be aligned with both the national holiday schedule and the Islamic religious calendar to maximize tourism-related revenue.

Contribution of Tourism Levy Revenue to Regional Own-Source Revenue (PAD)

Table 3. Tourism Levy Revenue and Its Contribution to Regional Own-Source Revenue (PAD), 2021–2025

Year	Tourism Levy Revenue (IDR million)	Realized PAD (IDR million)	Contribution to PAD (%)
2021	316.60	141,972.00	0.223
2022	2,014.39	173,335.00	1.162
2023	1,710.06	212,930.00	0.803
2024	1,818.17	384,949.00	0.472
2025	1,442.77	717,577.00	0.201

To assess the fiscal significance of tourism levy revenue, its contribution to Garut Regency's Regional Own-Source Revenue (PAD) was calculated using realized PAD data obtained from Satu Data Kabupaten Garut (Satu Data Kabupaten Garut, 2026). The contribution varied from 0.223% in 2021 to 1.162% in 2022, before declining to 0.803% in 2023, 0.472% in 2024, and 0.201% in 2025. These results indicate that tourism levy revenue represents a relatively small component of total PAD, although its seasonal fluctuations remain relevant for tourism-sector revenue planning. The 2021 figure

should be interpreted cautiously because tourism levy observations for July–December were unavailable.

Stationarity Tests and Identification of Seasonal Patterns as the Basis for the SARIMAX Model

The Augmented Dickey–Fuller (ADF) test conducted on the original data produced a p-value of 0.7719, which is greater than 0.05. Therefore, the series was non-stationary at its original level. After applying first-order differencing, the p-value decreased to 1.49×10^{-12} (approximately 0.0000), indicating that the differenced series had become stationary. These results indicate that first-order differencing was required to achieve stationarity as a methodological condition for SARIMAX modeling. The differencing procedure was applied to satisfy the statistical assumptions of the time-series model and does not imply that monthly changes are substantively more important for public policy than revenue levels.

Table 4. Results of the Augmented Dickey–Fuller (ADF) Stationarity Test

Data Series	ADF Statistic	*p*-value	Decision
Original series	-0.9475	0.7719	Non-stationary
After first-order differencing	-8.0774	1.49×10^{-12}	Stationary

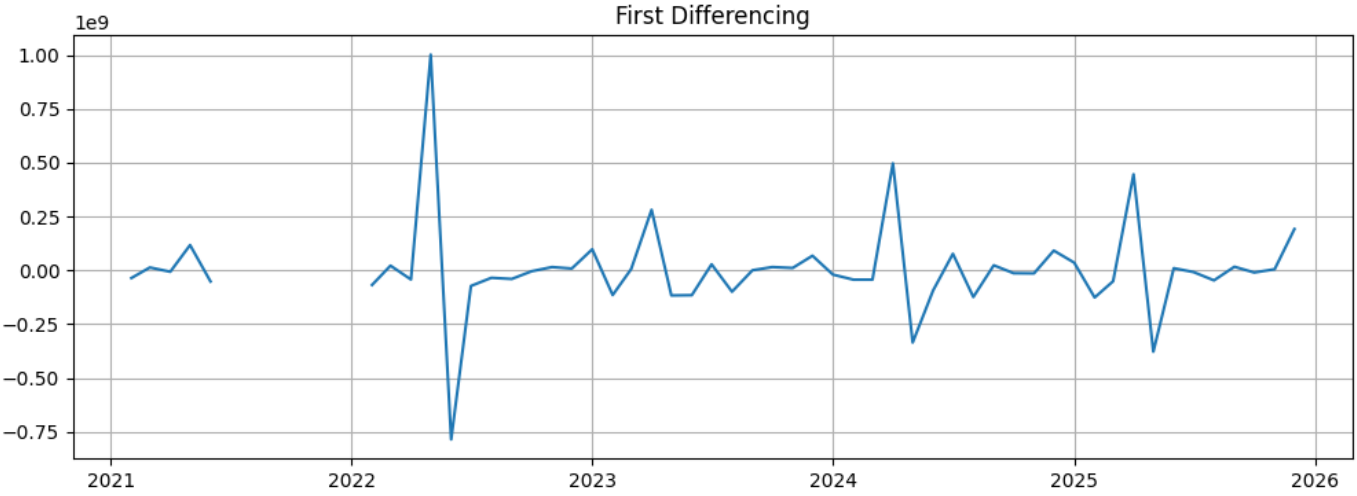

Figure 3. Plot of the Tourism Levy Revenue Series After First-Order Differencing

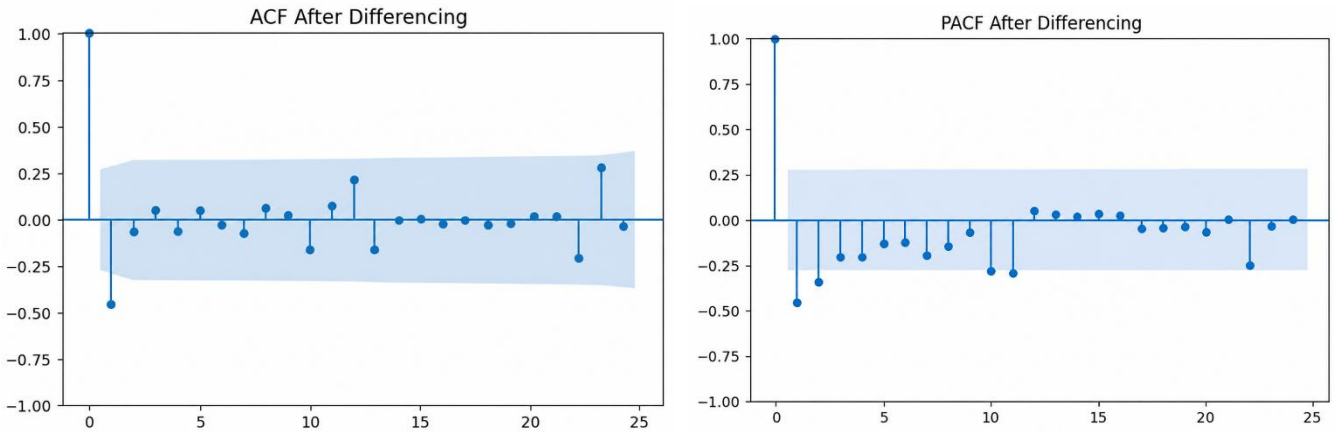

Figure 4. Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) Plots of the First-Order Differenced Series

The ACF and PACF plots reveal significant autocorrelation at the initial lags as well as seasonal lags. These patterns support the application of the SARIMAX model, as it is capable of simultaneously capturing autoregressive and moving average components, seasonal effects, and the influence of exogenous variables. However, the statistical interpretation is not the primary focus of this study. Rather, the forecasting model serves as an analytical tool to help local governments better understand the dynamics of tourism levy revenue and to support the formulation of more evidence-based public finance policies.

Selection of the Best SARIMAX Model Based on the Akaike Information Criterion (AIC) and the Ljung–Box Test

Table 5. Evaluation of Candidate SARIMAX Models

Model	AIC	BIC	Ljung–Box *p*-value	Decision
SARIMAX $(2,1,1)(1,1,0)_{12}$	1337,429	1347,904	0,119851	White noise
SARIMAX $(2,1,0)(1,1,0)_{12}$	1355,067	1364,046	0,439315	White noise
SARIMAX $(1,1,1)(1,1,0)_{12}$	1376,085	1385,243	0,665625	White noise
SARIMAX $(1,1,0)(1,1,0)_{12}$	1399,853	1407,485	0,326506	White noise
SARIMAX $(0,1,1)(1,1,0)_{12}$	1420,419	1428,196	0,979296	White noise
SARIMAX $(0,1,1)(0,1,1)_{12}$	3445,563	3453,045	0,162375	White noise
SARIMAX $(1,1,1)(0,1,1)_{12}$	3447,444	3456,423	0,120487	White noise
SARIMAX $(2,1,1)(0,1,1)_{12}$	3449,413	3459,888	0,171516	White noise
SARIMAX $(0,1,1)(1,1,1)_{12}$	3494,992	3503,971	0,089963	White noise
SARIMAX $(1,1,1)(1,1,1)_{12}$	3496,872	3507,348	0,069957	White noise
SARIMAX $(2,1,1)(1,1,1)_{12}$	3498,842	3510,814	0,094740	White noise
SARIMAX $(2,1,0)(1,1,1)_{12}$	3517,138	3527,613	0,010561	Not white noise
SARIMAX $(2,1,0)(0,1,1)_{12}$	3572,427	3581,585	0,006355	Not white noise
SARIMAX $(1,1,0)(0,1,1)_{12}$	3574,565	3582,197	0,000667	Not white noise
SARIMAX $(1,1,0)(1,1,1)_{12}$	3625,431	3634,590	0,001101	Not white noise

Based on Table 5, the SARIMAX $(2,1,1)(1,1,0)_{12}$ model was identified as the preferred in-sample specification because it yielded the lowest AIC value of 1337.429 while satisfying the Ljung–Box residual diagnostic. However, because in-sample fit and residual diagnostics alone do not establish superior forecasting accuracy, the model was subsequently evaluated using rolling-origin time-series cross-validation. The cross-validation results are presented in the following subsection. All candidate SARIMAX models were estimated using the same dataset, seasonal period, exogenous variables, and maximum-likelihood estimation framework. Therefore, the AIC values were obtained under comparable estimation settings and can be compared across the candidate specifications. The differences in AIC reflect differences in model fit and parameterization rather than differences in the underlying estimation sample or likelihood framework.

Out-of-Sample Forecast Validation Using Rolling-Origin Cross-Validation

The AIC and Ljung–Box results were supplemented with rolling-origin time-series cross-validation to evaluate whether the candidate models maintained their forecasting performance when predicting observations that were not used during model estimation. Four validation folds were evaluated using a six-month forecasting horizon. The cross-validation comparison focused on the five leading candidate specifications identified from the initial AIC and residual diagnostic screening.

The cross-validation results indicate that the SARIMAX $(2,1,1)(1,1,0)_{12}$ specification remained competitive in out-of-sample forecasting. It produced the lowest average MAE of approximately IDR 71.90 million and the lowest average MAPE of 107.45%. However,

its average RMSE of IDR 118.21 million was not the lowest among the candidate models. The SARIMAX $(0,1,1)(1,1,0)_{12}$ specification produced the lowest average RMSE, at approximately IDR 112.06 million, followed by SARIMAX $(1,1,1)(1,1,0)_{12}$ at approximately IDR 114.90 million.

These findings indicate that the selected SARIMAX $(2,1,1)(1,1,0)_{12}$ model does not dominate all forecasting-error measures. Nevertheless, its lowest average MAE and MAPE, combined with its lowest AIC and satisfactory residual diagnostics, provide support for retaining the specification as the main forecasting model. The results also show that the more parsimonious specifications perform relatively similarly in several validation periods, which suggests that model complexity should be interpreted cautiously given the limited number of seasonal cycles.

The validation results therefore provide stronger evidence for the use of the selected model than relying on AIC and residual diagnostics alone. However, the model should be regarded as a competitive forecasting specification rather than an unequivocally superior model. Given the limited number of observations and seasonal cycles, the resulting 2026 forecasts should be interpreted as indicative planning projections rather than definitive revenue targets.

Table 6. Rolling-Origin Time-Series Cross-Validation Results

Model	Fold	MAE IDR milion	RMSE IDR milion	MAPE percentage
SARIMAX $(2,1,1)(1,1,0)_{12}$	1	157.49	271.48	79.26%
	2	25.03	31.77	27.01%
	3	73.33	116.50	298.88%
	4	31.75	53.09	24.63%
Mean	-	71.90	118.21	107.45%
SARIMAX $(2,1,0)(1,1,0)_{12}$	1	192.77	310.07	114.80%
	2	89.31	99.06	99.14%
	3	75.24	118.19	303.98%
	4	37.21	55.00	36.31%
Mean	-	98.64	145.58	138.56%
SARIMAX $(1,1,1)(1,1,0)_{12}$	1	143.23	256.13	69.34%
	2	24.82	28.25	24.03%
	3	77.88	116.64	301.89%
	4	46.83	58.58	56.66%
Mean	-	73.19	114.90	112.98%
SARIMAX $(1,1,0)(1,1,0)_{12}$	1	185.92	282.59	120.86%
	2	154.96	178.51	142.76%
	3	79.13	116.47	301.22%
	4	34.97	54.66	30.78%
Mean	-	113.75	158.06	148.90%
SARIMAX $(0,1,1)(1,1,0)_{12}$	1	146.06	233.61	72.06%
	2	20.95	27.79	27.89%
	3	83.69	127.70	330.46%
	4	52.05	59.13	71.12%
Mean	-	75.69	112.06	125.38%

The AR(1) and AR(2) coefficients are not statistically significant, with p-values of 0.122 and 0.794, respectively. This suggests that the autoregressive terms do not provide strong individual evidence of persistence in the selected specification. The insignificant AR terms, particularly AR(2), should therefore be interpreted cautiously given the limited number of seasonal cycles and the relatively small sample size. The rolling-origin cross-validation results show that forecasting performance varied across validation folds and error measures. The SARIMAX $(2,1,1)(1,1,0)_{12}$ specification achieved the lowest average MAE (IDR 71.90 million) and MAPE (107.45%) among the candidate models. However,

its average RMSE (IDR 118.21 million) was slightly higher than that of the more parsimonious SARIMAX $(0,1,1)(1,1,0)_{12}$ specification (IDR 112.06 million). The fold-level results also show substantial variation in forecasting errors, particularly in Fold 3, where MAPE was high across all candidate models. Therefore, the selected SARIMAX $(2,1,1)(1,1,0)_{12}$ specification should be regarded as a competitive forecasting model rather than an unequivocally superior model.

SARIMAX Parameter Estimation and Interpretation of the Mobility Restriction Dummy and Eid al-Fitr Dummy Variables

Table 7. Parameter Estimates of the SARIMAX $(2,1,1)(1,1,0)_{12}$ Model

Parameter	Coefficient	Std. Error	*p*-value	Interpretation
Mobility Restriction Dummy	0.000	–	NaN	Not stably estimated
Eid al-Fitr Dummy	132,800,000	2.51×10^{-9}	0.000	Significant
AR(1)	-0.5377	0.348	0.122	Not significant
AR(2)	-0.2016	0.774	0.794	Not significant
MA(1)	-1.0298	0.023	0.000	Significant
Seasonal AR(12)	-0.3902	0.122	0.001	Significant
σ^2 (Sigma^2)	2.732×10^{16}	3.19×10^{-18}	0.000	Significant

The Eid al-Fitr dummy has a positive coefficient of IDR 132.80 million and is statistically significant at the 5% significance level. This coefficient represents an association between the coded Eid al-Fitr period and tourism levy revenue conditional on the SARIMAX model specification, rather than a causal effect of the holiday. The estimated effect should therefore be interpreted cautiously because other factors, such as school holidays, collective leave, tourism promotions, and changes in tourist mobility, may overlap with the Eid period.

In contrast, the mobility restriction dummy could not be interpreted reliably because its coefficient was not statistically identifiable in the final model. The dummy was coded as 1 only for July–September 2021, while the corresponding tourism levy revenue observations for these months were unavailable in the dataset. As a result, the model could not obtain sufficient observed information to estimate the association between the mobility-restriction episode and tourism levy revenue, leading to a coefficient of 0 with an undefined standard error and p-value. This result should therefore not be interpreted as evidence that mobility restrictions or the COVID-19 pandemic had no effect on tourism levy revenue. Rather, it reflects a data-identification limitation. Future studies should incorporate complete revenue observations together with detailed information on mobility restrictions and tourism activity to estimate such intervention effects more reliably.

Residual Diagnostics, White Noise Assessment, and Model Fit to the Historical Data

Table 8. Residual Diagnostic Results of the Model

Diagnostic Test	Test Statistic	*p*-value	Decision
Ljung–Box (Lag 12)	17.8650	0.119851	Residuals satisfy the white noise assumption
Shapiro–Wilk	0.8063	5.76×10^{-7}	Residuals are not normally distributed
ARCH-LM (12 lags)	29.2661	0.0036	Evidence of conditional heteroskedasticity

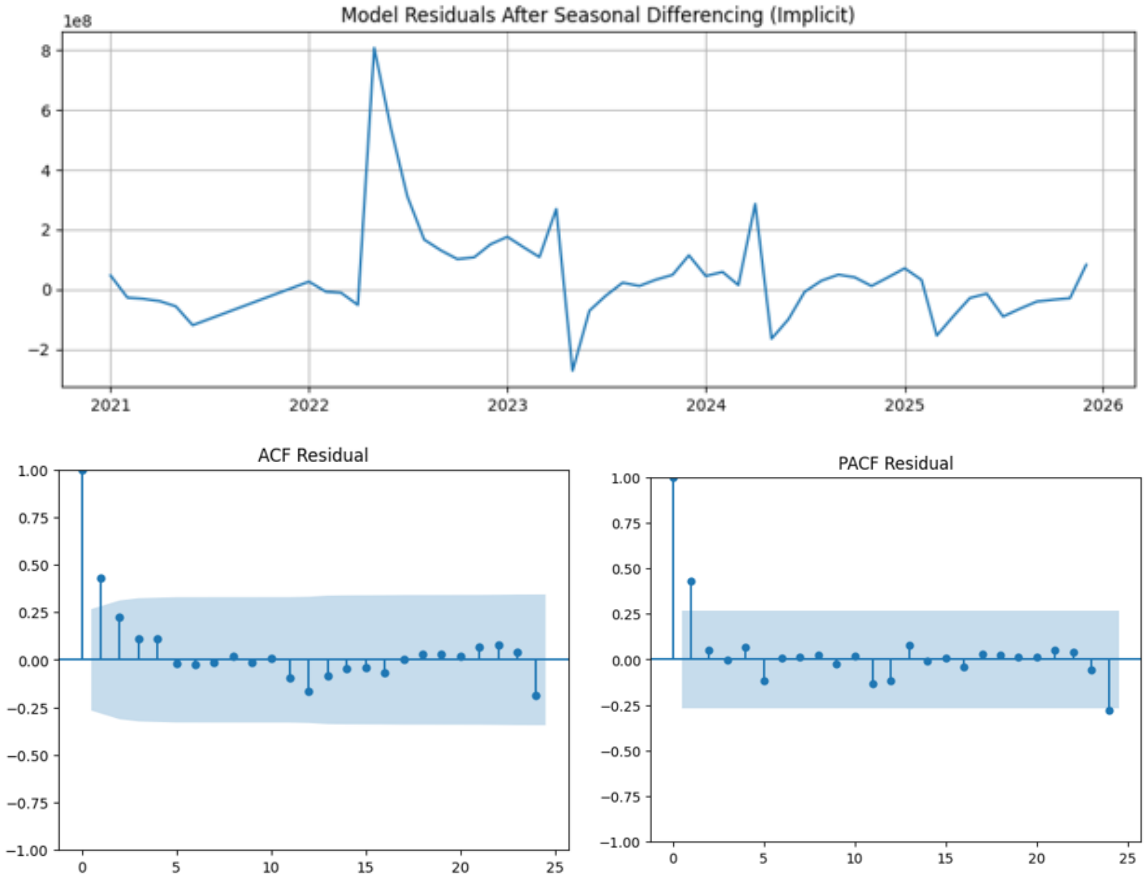

Figure 5. Residual Diagnostic Plots of the SARIMAX Model

The Ljung–Box test indicates that the residuals satisfy the white-noise assumption, suggesting that the model has captured the main systematic structure of the series. Although the Shapiro–Wilk test indicates that the residuals are not normally distributed, this does not invalidate the forecasting model. However, white-noise residuals alone do not establish forecasting suitability for fiscal planning; forecast accuracy, parameter stability, and prediction uncertainty must also be considered. The non-normality of the residuals may affect the reliability of conventional prediction intervals, particularly in the presence of extreme observations. Therefore, the prediction intervals should be interpreted as approximate measures of forecast uncertainty rather than exact probability bounds. An ARCH-LM test with 12 lags produced an LM statistic of 29.2661 with a p-value of 0.0036, indicating evidence of conditional heteroskedasticity. This finding further supports cautious interpretation of the conventional prediction intervals, particularly given the wide uncertainty ranges observed for several months.

A logarithmic transformation was additionally examined as a robustness specification to address the observed heteroskedasticity and the negative lower bounds of the conventional prediction intervals. However, the log-transformed SARIMAX specification produced substantially poorer rolling-origin forecasting performance than the model estimated on the original scale, with mean MAE, RMSE, and MAPE of IDR 10.298 billion, IDR 21.174 billion, and 7,885.46%, respectively. Therefore, the logarithmic specification was not retained as the final model. The original-scale SARIMAX specification was retained because it provided substantially better out-of-sample forecasting performance, although its prediction intervals should still be interpreted cautiously given the evidence of heteroskedasticity.

Given the relatively small sample size of 60 monthly observations and only five annual seasonal cycles, parameter stability and the risk of overfitting were also considered when evaluating the selected specification. The selected SARIMAX $(2,1,1)(1,1,0)_{12}$ model was compared with more parsimonious candidate specifications through rolling-origin cross-validation. Although the selected model did not achieve the lowest RMSE, it obtained the lowest average MAE and MAPE, indicating that its forecasting performance remained competitive across the validation periods. Therefore, the selected specification was retained as a competitive forecasting model rather than being interpreted as unequivocally superior or free from overfitting risk.

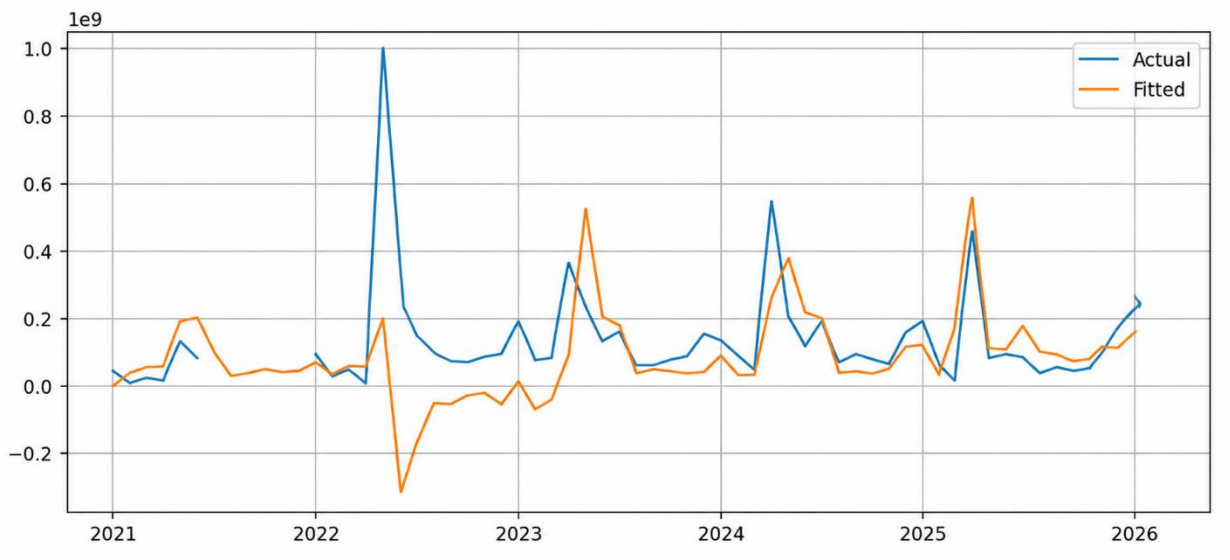

Figure 6. Comparison of the Actual Values and the Fitted Values of the Selected SARIMAX Model

Figure 6 shows that the fitted values generally follow the overall trend of the observed data, although they do not fully capture all extreme fluctuations. From a policy perspective, the differences between the observed and fitted values serve as a reminder that forecasting should not be interpreted as absolute certainty. Instead, the model provides evidence-based expectations derived from historical patterns. Nevertheless, local governments should maintain sufficient flexibility to adjust their fiscal planning in response to external factors, such as weather conditions, tourists' purchasing power, tourism event schedules, changes in levy rates, and operational policies affecting tourism destinations.

Forecast of Tourism Levy Revenue for 2026 as a Basis for Setting Regional Own-Source Revenue (PAD) Targets

Table 9. Forecast of Monthly Tourism Levy Revenue in Garut Regency for 2026

Month	Forecast (IDR)	Lower 95% Prediction Interval (IDR)	Upper 95% Prediction Interval (IDR)	Contribution
January	112.012.100	-213.576.100	437.600.300	7,85%
February	73.965.010	-298.802.700	446.732.800	5,19%
March	77.157.740	-296.502.000	450.817.500	5,41%
April	480.492.200	106.446.600	854.537.800	33,69%
May	73.173.810	-301.450.700	447.798.300	5,13%
June	93.536.040	-281.113.100	468.185.100	6,56%
July	117.949.000	-256.734.900	492.632.900	8,27%
August	41.634.410	-333.106.600	416.375.400	2,92%

September	60.747.380	-314.029.200	435.524.000	4,26%
October	49.323.340	-325.494.700	424.141.400	3,46%
November	46.874.590	-327.985.400	421.734.600	3,29%
December	199.484.200	-175.416.200	574.384.600	13,99%
Total	1.426.349.820	-	-	100,00%

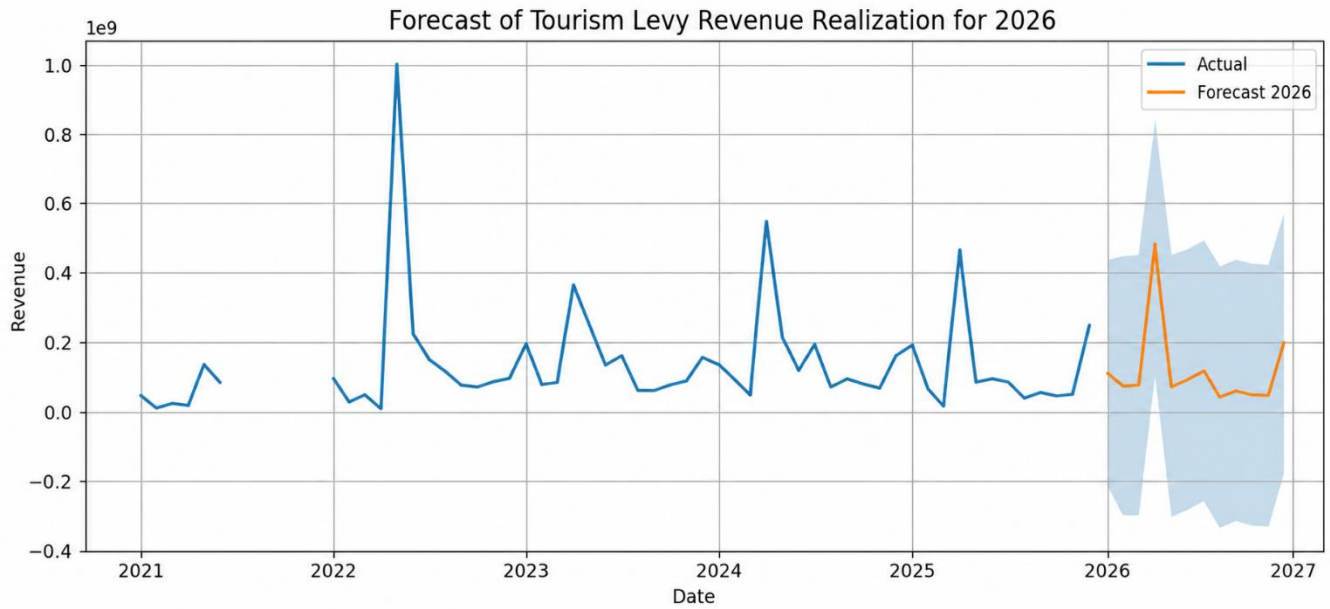

Figure 7. Forecast of Monthly Tourism Levy Revenue in Garut Regency for 2026

The total forecasted tourism levy revenue for 2026 is estimated at IDR 1.426 billion. April is projected to record the highest monthly revenue at IDR 480.49 million, accounting for 33.69% of the annual forecast. December represents the second-highest peak, with an estimated revenue of IDR 199.48 million or 13.99% of the annual total. Combined, these two months contribute approximately 47.67% of the projected tourism levy revenue for 2026. In contrast, August is forecasted to generate the lowest revenue, amounting to IDR 41.63 million, equivalent to 2.92% of the annual projection.

The high April forecast is consistent with the Eid al-Fitr dummy being active in both March and April 2026. However, the model does not produce a comparable March peak because the forecast also reflects the underlying seasonal pattern, autoregressive structure, and other model components rather than the Eid dummy alone. December is projected as the second-highest revenue month despite the absence of a specific year-end holiday dummy. To examine whether this pattern represented an additional December-specific intervention effect, a December dummy was tested by assigning a value of 1 to December observations and 0 otherwise. The inclusion of this variable did not improve model performance. The AIC increased from 1337.429 to 1339.429, while the Ljung–Box p-value and rolling-origin cross-validation errors remained unchanged. Therefore, the December peak is more appropriately interpreted as being captured by the existing seasonal structure of the SARIMAX model rather than as an independently estimated year-end intervention effect.

The concentration of revenue within these two peak months indicates that tourism levy revenue in Garut Regency remains highly seasonal. From a public finance perspective, this pattern should be carefully considered in the formulation of Regional Own-Source Revenue (PAD) targets and regional cash flow planning. Rather than relying solely on annual revenue targets, local governments should translate these targets into monthly revenue plans that better reflect the expected seasonal distribution of tourism

levy collections. Such an approach would facilitate more realistic budget implementation and improve the alignment between expenditure planning and actual revenue capacity.

The 95% prediction intervals for several months include negative lower bounds, indicating substantial uncertainty surrounding the monthly forecasts. Although negative tourism levy revenue is not economically meaningful, such values can arise from the unconstrained SARIMAX prediction interval on the original scale. Therefore, the lower bounds should not be interpreted as possible negative revenue outcomes, but as an indication of the uncertainty associated with the point forecasts. Given this uncertainty, the 2026 point forecast of approximately IDR 1.426 billion should not be treated as a standalone fiscal target. Instead, it should be used together with the prediction intervals and other fiscal and tourism information when establishing regional revenue targets. For planning purposes, the point forecast can be treated as the moderate scenario, while the conservative and optimistic scenarios should be interpreted as planning ranges rather than fixed revenue targets.

Public Administration Implications and Policy Recommendations

The findings of this study indicate that the primary challenge associated with tourism levy revenue in Garut Regency is not merely the fluctuation of revenue levels but the ability of the local government to manage revenue uncertainty within the regional fiscal planning cycle. From an evidence-based policy perspective, the forecasting model provides empirical evidence that can be used to identify periods of potentially high and low revenue, as well as the degree of uncertainty that should be incorporated into fiscal planning.

First, tourism levy revenue targets within the Regional Own-Source Revenue (PAD) framework should be established using a range-based approach rather than a single-point estimate. The 2026 forecast can be translated into three planning scenarios: a conservative scenario of approximately IDR 106.45 million, a moderate scenario of IDR 1.426 billion based on the point forecast, and an optimistic scenario of approximately IDR 5.870 billion based on the upper 95% prediction bounds. The conservative scenario treats negative lower prediction bounds as zero because negative tourism levy revenue is not economically meaningful. These scenarios should be used as planning ranges rather than as statistically guaranteed revenue targets. Such an approach is more appropriate given the inherent sensitivity of tourism revenue to holiday calendars, weather conditions, operational policies, and tourists' purchasing power.

Second, local governments should adopt cash flow planning that reflects the seasonal nature of tourism levy revenue. Since April and December are projected to account for nearly half of the annual revenue, expenditure programs dependent on tourism levy collections should not assume that revenue is received evenly throughout the year. Aligning cash flow planning with the monthly revenue pattern would reduce the risk of mismatches between expected revenue and expenditure commitments, thereby improving fiscal discipline and budget execution.

Third, the relevant government agencies should reduce their dependence on the Eid al-Fitr holiday period by diversifying tourism activities throughout the year. Months with relatively low projected revenue, such as August, October, and November, should be prioritized for tourism promotion campaigns, thematic events, local tourism packages, partnerships with tourism businesses, and improvements in destination management

and service quality. These measures are managerial recommendations derived from the observed low-revenue periods and are not direct effects estimated by the forecasting model. Their potential effects on tourism levy revenue require further empirical evaluation.

Finally, the local government should strengthen its tourism revenue information system by integrating monthly tourism levy data with complementary datasets, including tourist arrivals, levy rates, weather conditions, tourism event schedules, national holidays, collective leave periods, inflation, and changes in destination management policies. A more comprehensive database would improve the stability and predictive performance of future forecasting models and facilitate the application of SARIMAX with a richer set of exogenous variables, such as December or year-end holiday dummy variables, thereby providing a stronger empirical foundation for evidence-based regional fiscal policy.

Table 10. Summary of the Policy Implications of the Tourism Levy Revenue Forecasting Results

Policy Area	Empirical Basis	Recommendation
Regional Own-Source Revenue (PAD) Target Setting	The 2026 point forecast **is** IDR 1.426 billion, with relatively wide forecast uncertainty.	Establish PAD targets using conservative, moderate, and optimistic scenarios rather than relying on a single target value.
Regional Cash Flow Planning	April and December are projected to contribute approximately 47.67% of the annual forecast.	Develop monthly cash flow plans that reflect the seasonal revenue pattern rather than assuming an even distribution over the twelve-month period.
Tourism Development	August, October, and November are projected to generate relatively low tourism levy revenue.	Strengthen tourism events, promotional campaigns, and local tourism packages during low-revenue months.
Data Management	The forecasting model was estimated using only two dummy variables and monthly data from **2021–2025**.	Integrate tourism levy data with tourist arrivals, weather conditions, inflation, tourism events, levy rates, and holiday calendar data to improve future forecasting performance.
Policy Evaluation	Seasonal revenue patterns may change in response to calendar shifts and external conditions.	Update the forecasting model annually using the latest realized data to ensure that policy decisions remain evidence-based and adaptive.

D. CONCLUSION

From the perspective of public administration decision theory, tourism levy revenue forecasting should not be viewed merely as a statistical output but also as decision-support information for local governments. Decision theory suggests that policymakers often operate under constraints of limited information, time, and resources. Consequently, public decisions should be supported by systematic analysis to facilitate more effective policy outcomes. In the context of public administration, decision theory emphasizes how decisions can be made effectively, efficiently, and equitably in addressing the complexity of dynamic public issues (Albrecht et al., 2020, as cited in Nadjib & Khairunnas, 2024). Therefore, the SARIMAX forecasting results presented in this study can serve as a tool for reducing uncertainty in setting regional revenue targets, preparing budget plans, and anticipating changes in regional revenue patterns.

This approach is also consistent with the concept of Evidence-Based Decision Making (EBDM) in public administration, which emphasizes that government decisions

should be based not only on intuition or experience but also on credible data and empirical evidence. (Vandenbroucke et al. 2019) define evidence-based decision making as a systematic process of utilizing relevant data and information to improve the quality of public policy outcomes. In this study, the SARIMAX modeling results, the Akaike Information Criterion (AIC), residual diagnostic tests, and the projected tourism levy revenue for 2026 constitute empirical evidence that can assist local governments in establishing more realistic Regional Own-Source Revenue (PAD) targets. This is consistent with the Evidence-Based Policy (EBP) approach, which regards empirical evidence and research findings as the primary foundation for public policy formulation (Haniyuhana et al., 2023).

Furthermore, the forecasting results should be interpreted through a systems approach in public administration, as tourism levy revenue does not exist in isolation but is influenced by the interactions among various factors, including tourism activities, holiday calendars, destination promotion, tourism destination management, and regional financial planning systems. Public administration examines the structure, functions, and dynamics of public institutions, as well as how government organizations interact with their social and political environments in the policy-making process (Nadjib & Khairunnas, 2024). Therefore, the forecasting results not only provide projected tourism levy revenue but also serve as a basis for interagency coordination in designing more adaptive strategies to strengthen regional revenue generation.

This study demonstrates that tourism levy revenue in Garut Regency during the 2021–2025 period exhibited pronounced seasonal fluctuations. The Eid al-Fitr holiday period emerged as a significant factor associated with increased tourism activity, whereas the COVID-19 pandemic represented an important external factor that should be taken into account, although its statistical effect could not be stably estimated in the final SARIMAX model.

The SARIMAX $(2,1,1)(1,1,0)_{12}$ specification was identified as the preferred model based on its lowest AIC and satisfactory residual diagnostics and remained competitive in out-of-sample validation. The model achieved the lowest average MAE and MAPE among the candidate specifications, although a more parsimonious model produced a slightly lower average RMSE. Therefore, the selected specification should be interpreted as a competitive forecasting model rather than an unequivocally superior model.

The 2026 forecast projects total tourism levy revenue of approximately IDR 1.426 billion. April is expected to generate the highest monthly revenue at IDR 480.49 million, while December is projected to represent the second-highest peak with IDR 199.48 million. Together, these two months account for approximately 47.67% of the annual forecast. These findings indicate that tourism levy revenue in Garut Regency remains highly concentrated during specific periods and has not yet achieved a stable distribution throughout the year.

From a public administration perspective, the forecasting results provide an empirical basis for local governments to establish more realistic Regional Own-Source Revenue (PAD) targets, align regional cash flow planning with seasonal revenue patterns, and design tourism policies that reduce dependence on peak tourism periods. Accordingly, the findings of this study support the implementation of evidence-based policy in regional public financial management.

Policy Recommendations:

1) The Government of Garut Regency should establish tourism levy revenue targets within the Regional Own-Source Revenue (PAD) framework using a scenario-based approach. The 2026 forecast can be represented by a conservative planning scenario of approximately IDR 106.45 million, obtained by treating negative monthly lower prediction bounds as zero; a moderate scenario of IDR 1.426 billion based on the point forecast; and an optimistic scenario of approximately IDR 5.870 billion based on the upper 95% prediction bounds. These scenarios should be used as planning ranges rather than fixed revenue targets, considering the substantial forecast uncertainty.
2) The Regional Revenue Agency (Bapenda) and other relevant government agencies should develop more detailed monthly revenue plans, particularly to anticipate the substantial contributions projected for April and December. Such an approach would enable regional cash flow planning to be better aligned with the expected timing of revenue collections.
3) The Tourism Office should implement strategies to promote a more balanced distribution of tourist visits beyond the Eid al-Fitr holiday period. These strategies may include organizing tourism events during low-demand months, strengthening destination promotion, improving tourism destination services, and expanding partnerships with local tourism businesses. These measures are managerial recommendations derived from the observed low-revenue periods and are not direct effects estimated by the forecasting model. Their potential effects on tourism levy revenue require further empirical evaluation.
4) The local government should establish a more integrated tourism levy database by combining revenue data with information on tourist arrivals, tourism events, weather conditions, inflation, levy rate adjustments, national holidays, and collective leave periods. Strengthening the availability and quality of these data will improve the stability and predictive performance of future forecasting models, enabling them to generate more reliable and informative projections for regional fiscal planning.

The SARIMAX model should therefore be regarded as a decision-support tool and should not replace managerial judgment, tourism-demand information, or broader fiscal analysis.

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