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Analysis of the Number of Departures and Arrivals of Commercial Air Transport Passengers in Central Java in 2023-2024

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Abstract

Air transportation plays an important role in supporting community mobility and economic activities in Central Java. This study aims to analyze the number of departures and arrivals of commercial air transportation passengers in Central Java during the period 2023-2024. The data used includes the number of domestic and international passengers analyzed based on monthly trends, annual cumulative, and year-on-year (yoy) and month-to-month (m-to-m) changes. The results of the analysis show fluctuations in the number of passengers influenced by seasonal factors such as long holidays, Hajj departures, and community economic dynamics. In 2023, the trend of increasing passenger numbers was seen significantly from May to June, but decreased in September. Conversely, in 2024, there was a cumulative decrease until June of 11.46% for departures and 8.70% for arrivals compared to the same period in the previous year. Factors influencing this trend include people's purchasing power, economic policies, and post-pandemic recovery. This study is expected to contribute to the strategic planning of the air transportation sector, especially in Central Java, to support sustainable economic and tourism growth.

Keywords: Air Transportation, Central Java, Departure, Arrival, Trend Analysis, Passenger.

1. INTRODUCTION

Air transport plays a vital role in improving community mobility while supporting regional economic growth (WTTC, 2023). Airports not only serve as transportation facilities but also as the main gateway to facilitate connectivity, trade, and the flow of domestic and international tourists. As such, the development of air transportation is a key factor in enhancing a region's competitiveness, including in Central Java, which has significant potential in the tourism and trade sectors (Janić, 2019).

There are six airports in Central Java: Ahmad Yani Airport in Semarang, Adi Sumarmo Airport in Surakarta, Tunggul Wulung Airport in Cilacap, Dewadaru Airport in Jepara and JB. Soedirman Airport in Purbalingga, and Ngloram Airport in Blora. However, only two of these airports currently operate scheduled regular flights: Ahmad Yani Airport and Adi Sumarmo Airport. This situation indicates that the utilisation of air transport infrastructure in Central Java is not yet optimal. In fact, the presence of airports can drive regional economic growth by improving accessibility and connectivity for both residents and tourists. This poses a challenge in optimising the role of the air transport sector as the main driver of tourist and economic growth in Central Java (ADB, 2020).

Based on data from the Central Java Statistics Agency (BPS), the number of passengers at Central Java airports fluctuated in 2024. In June 2024, the number of departing passengers was recorded at

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100,604, a decrease of 14.73 percent compared to the previous month. The largest decline was seen in international passengers, which dropped by 61.96 per cent following the end of the Hajj and Umrah departure season. This indicates that seasonal factors significantly influence international aviation activities in Central Java (BPS, 2024).

Conversely, the number of arriving passengers increased by 10.13 per cent during the same period, primarily due to the return of Hajj pilgrims from Saudi Arabia. This phenomenon shows that passenger movement trends in Central Java are heavily influenced by religious activities, in addition to economic and social factors. Nevertheless, opportunities to increase the number of arriving passengers remain open, particularly from the domestic and international tourist segments, which are the primary targets for regional tourism development (Kemenpar, 2023).

The imbalance is also evident in the distribution of passenger numbers among existing airports. Ahmad Yani and Adi Sumarmo airports dominate air traffic, while other airports such as Dewadaru, Tunggul Wulung, JB. Soedirman and Ngloram are not yet operating optimally due to a lack of scheduled flights. This situation indicates the need for a special strategy to optimise all airports in Central Java so that their roles can be balanced and support equitable development across various regions (Pemprov Jawa Tengah, 2023).

Based on these conditions, the development of air transport in Central Java requires serious attention. Optimising flight networks, increasing airport infrastructure capacity, and expanding international connectivity are strategic steps to drive growth in the tourism and regional economy sectors (ICAO, 2022). By maximising the potential of all existing airports, Central Java is expected to enhance its competitiveness in the air transport sector while strengthening its role as one of Indonesia's tourist destinations and economic hubs.

2. LITERATURE REVIEW

2.1 Air Transportation

Air transportation plays an important role in supporting the mobility of the community, both domestically and internationally, and is a determining factor in economic and tourism development. According to a study conducted by BPS (2023), the increase in the number of passengers at Central Java airports reflects an increase in economic and social activity. According to BPS (2023), the growth of the tourism sector is in line with the increase in the number of air transport passengers, with popular destinations such as Yogyakarta, Semarang, and Salatiga being visited more frequently. Passengers arriving and departing from these areas are not only tourists but also businesspeople and individuals travelling for work or personal reasons. In Central Java, the presence of airports such as Ahmad Yani International Airport in Semarang plays a key role in facilitating inter-regional connectivity while supporting the business and tourism sectors.

Data from the Kemenhub (2024), shows that the increase in the number of air passengers reflects growth in social and economic activity, although this trend is heavily influenced by seasonal factors such as long holidays, the Hajj season, and post-COVID-19 pandemic conditions. In addition to seasonal factors, consumer purchasing power and economic conditions also significantly influence air travel trends. When the economy improves, the number of passengers tends to increase, consistent with research by Setiawan & Yuliana (2022), which confirms that economic growth drives air travel growth. The fluctuations in passenger numbers reported by the BPS (2024) highlight the importance of developing strategies to make air transport more stable and sustainable. Given Central Java's high tourism potential, optimising air services is expected to attract more domestic and international tourists and make a significant contribution to regional economic development.

2.2 Development of Domestic and International Flights in Central Java

Central Java has six major airports that support the mobility of residents and the regional economy, namely Adi Sumarmo Airport (Surakarta), Ahmad Yani Airport (Semarang), Tunggul Wulung Airport (Cilacap), Dewadaru Airport (Jepara), JB. Soedirman Airport (Purbalingga), and Ngloram Airport (Blora). Among these six airports, Adi Sumarmo is the only one that operates regular international flights, particularly for umrah and hajj routes to Jeddah and Madinah, making it crucial for the people of Solo Raya and surrounding areas. Meanwhile, Ahmad Yani Airport plays a significant role in domestic passenger movement, with main routes to major cities such as Jakarta, Surabaya, and Denpasar, making it one of the primary domestic air transport hubs in Central Java (Kemenhub, 2024).

Fluctuations are also evident in international flights, where in June 2024, international departures dropped sharply by 61.96% due to the end of the Hajj and Umrah season. However, international arrivals surged by 100%, reflecting the return of pilgrims and potential increases in international tourist visits to Central Java. In addition to religious factors, school holidays, the end of the year, global economic conditions, government policies related to aviation, and ticket promotions from airlines also influence passenger movement patterns. This confirms that air transportation in Central Java is greatly influenced by a combination of seasonal, economic, and government policy factors (BPS, 2024).

2.3 Challenges and Opportunities in Air Transport Development

The development of air transportation in Central Java faces a number of significant challenges, including the optimisation of airports that are not yet fully operational, limited international connectivity, and a lack of diversification in domestic routes. Several airports, such as Adi Soemarmo, Ahmad Yani, Ngloram, and JB. Soedirman, actually have adequate infrastructure, but it has not been utilised to its full potential. This situation means that Central Java's potential as a gateway for both domestic and international aviation has not been fully realised. Additionally, international flights are still limited to certain routes with low frequencies, while domestic routes are generally concentrated on the Semarang and Solo routes to major cities such as Jakarta and Surabaya (ADB, 2020).

To address these challenges, strategic efforts are needed, including airport infrastructure development, diversification of domestic flight routes, and improvement of international flight service quality. The government has an important role to play by providing incentives to airlines to open new routes, especially to remote areas and through small airports. In addition, improvements in facilities such as runway extensions, terminal modernisation, and more advanced air navigation systems are also urgently needed. These steps are expected to strengthen passenger mobility, support the tourism sector, and drive economic growth in Central Java.

3. METHODOLOGY

3.1 Data and Data Sources

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This study is a quantitative approach. According to Gujarati & Porter (2009), quantitative analysis is a scientific approach that uses numerical data to understand and measure relationships between variables through statistical and econometric techniques. The research population is data on the number of air passengers in Central Java during the period from January 2023 to June 2024. The research sample includes monthly data on domestic and international flight departures and arrivals from all airports in Central Java, obtained from airport authorities and the Central Java Transportation Agency. The sampling technique used is a saturated sample, where all data in the population is used. This study uses multiple linear regression analysis.

3.2 Analysis Methods

i. Descriptive Statistical Tests

According to Ghozali (2018), descriptive statistical tests are analysis techniques used to provide an overview or description of the data being studied without the intention of testing hypotheses or making broader conclusions. Descriptive statistics present a summary of data through measures such as mean, median, maximum, minimum, standard deviation, variance, and frequency distribution so that the main characteristics of the research data can be seen. In this study, descriptive statistical tests aim to describe the distribution of passenger departure and arrival data and identify data trends based on monthly comparisons.

ii. Multiple Linear Regression Test

This analysis is used to determine the effect of independent variables (X) on dependent variables (Y) in research (Ghozali, 2018). The model equation is formulated as follows:

$$Y = a + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + e$$

Where:

Y: Number of passenger arrivals
X: Number of passenger departures
β0 : Intercept
β1-4: Regression coefficients (slope)
ϵ: Error

The regression coefficients (β0 and β1) are analysed to determine:

a. Intercept (β0): The value of Y when X = 0
b. Slope (β1): The change in Y for each unit change in X.

iii. Annova Test (Analysis of Variance)

ANOVA (Analysis of Variance) testing is a statistical method used to test differences in means between three or more groups to determine whether there are significant differences between them. The basic principle of ANOVA is to compare the variation between groups with the variation within groups. If the variation between groups is greater than the variation within groups, it can be concluded that there are significant differences in means.

- H0: There is no relationship between the number of departures and arrivals of passengers.
- Ha: There is a significant relationship between the number of departures and arrivals of passengers.

iv. Coefficient of Determination Test

The regression line formed from a set of observational data must be evaluated to determine how well the model represents the actual conditions. In regression analysis, a commonly used measure for this purpose is the Coefficient of Determination (R^2). The coefficient of determination is used to assess the strength of the relationship between the dependent and independent variables, as reflected by the value of R-square (Ghozali, 2018).

The R-square value ranges from zero to one, with zero indicating the lowest explanatory power and one indicating the highest. A low R-square value suggests that the independent variables are not able to sufficiently explain the variation in the dependent variable. Conversely, a high R-square value indicates that the independent variables provide the necessary information to predict the dependent variable (Ghozali, 2018).

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

This data includes passenger numbers for both domestic and international flights, each reflecting the dynamics of the air transport sector.

Table 1. Number of Air Passenger Departures and Arrivals in Central Java in 2023 and 2024

		Domestic		International		Total	
Year	Month	Departures	Arrival	Departures	Arrival	Departures	Arrival
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2023	January	121.764	116.275	-	-	121.764	116.275
	February	112.396	118.029	-	-	112.396	118.029
	March	121.836	125.390	-	-	121.836	125.390
	April	114.825	134.006	-	-	114.825	134.006
	May	169.992	145.585	5.028	-	175.020	145.585
	June	132.837	136.769	27.407	-	160.244	136.769
	July	157.603	141.398	-	30.629	157.603	172.027
	August	133.900	138.036	1.646	5.204	135.546	143.240
	September	98.625	99.086	1.248	865	99.873	99.951
	October	140.380	132.464	1.633	2.083	142.013	134.547
	November	135.554	132.779	1.670	1.676	137.224	134.455
	December	139.235	138.079	1.521	1.939	140.756	140.018
Cumulative January-June 2023		773.650	776.054	32.435	-	806.085	776.054
2024	January	121.343	113.071	1.293	1.057	122.636	114.128
	February	115.538	118.124	1.565	1.565	117.103	119.689
	March	108.065	115.923	1.550	1.674	109.615	117.597
	April	144.984	157.024	789	860	145.773	157.884
	May	92.422	94.823	25.554	-	117.976	94.823
	June	90.884	94.008	9.720	10.419	100.604	104.427

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Cumulative January-June 2024		673.236	692.973	40.471	15.575	713.707	708.548
Change from June 24 to June 23 (y-o-y)	Passengers (persons)	-41.953	-42.761	-17.687	10.419	-59.640	-32.342
	Percent	-31,58	-31,27	-64,53	100,00	-37,22	-23,65
Change from June 24 to May 24 (m-to-m)	Passengers (persons)	-1.538	-815	-15.834	10.419	-17.372	9.604
	Percent	-1,66	-0,86	-61,96	100,00	-14,73	10,13
Cumulative change to June	Passengers (persons)	-100.414	-83.081	8.036	15.575	-92.378	-67.506
	Percent	-12,98	-10,71	24,78	100,00	-11,46	-8,70

During the period from January to June 2023 to 2024, domestic flights experienced fluctuations with a downward trend in both departures and arrivals, as seen from the decline in cumulative figures up to June 2024 compared to the same period the previous year. A surge in domestic passengers occurred in certain months, such as May, influenced by the holiday season or the annual migration back to hometowns, but then declined again in the following month. Conversely, international flights showed a different dynamic, where despite a sharp decline in departures in June 2024, international arrivals increased significantly compared to the same period the previous year. This indicates a shift in air travel trends, where domestic flights are facing a decline in demand, while the international sector is beginning to experience growth, albeit still limited to certain periods.

4.2 Domestic Departures

4.2.1 Linear Regression Test

The results of the multiple linear test are presented in the following table:

Table 2. Multiple Linear Regression Test

Model		Sum of Squares		Standardized Coefficients Beta	F	Sig.
		B	Std. Error			
1	(Constant)	33.247	12.205		2.724	.015
	Departures	.734	.096	.886	.015	.000

Based on Table 2, it can be concluded that the departure variable has a positive and significant effect on the arrival variable. The constant of 33.247 indicates that even if there are no departures, there is still a potential for 33,247 passengers to arrive. The regression coefficient value of 0.734 indicates that every one-unit increase in departures will increase the number of arrivals by 0.734 units. Additionally, the standardised Beta value of 0.886 reinforces the finding that departures have a very strong influence on arrivals. The significance test results (t = 7.625; Sig. = 0.000) prove that this influence is statistically significant at the 95% confidence level.

4.2.2 Determination Coefficient Test

The results of the coefficient of determination test are presented in the following table:

Table 3. Coefficient of Determination Test Results

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	.886[a]	.784	.771	8.48282

Based on Table 3, it is explained that the R value of 0.886 indicates a very strong and positive relationship between passenger departures and arrivals. As the number of departures increases, the number of arrivals also tends to increase significantly. The R-Square value of 0.784 indicates that 78.4% of the variation or change in the number of arrivals can be explained by the number of departures. Departures have a significant contribution to influencing arrivals. The remaining 21.6% is influenced by other factors outside this model.

4.2.3 Annova Test

The results of Annova test are presented in the following table:

Table 4. Annova Test Results

Model		Sum of Squares	Df	Mean Sqaure	F	Sig.
1	Regression	4183.174	1	4183.174	58.133	.000[b]
2	Residual	1151.332	16	71.958		
Total		5334.506	17			

Based on Table 4, it is explained that the Sum of Squares (SS) value for Regression is 4183.174, which indicates the amount of variation in the dependent variable (arrivals) that can be explained by the independent variable (departures). With a degree of freedom (df) of 1, this value is calculated based on the number of independent variables in the model. The Mean Square (MS) value is 4183.174. The p-value (Sig.) is 0.000, which is significantly smaller than the standard significance level of 0.05, indicating that the regression model is statistically significant. Departure has a significant influence on arrival, so the regression model is suitable for explaining the relationship between the two variables.

4.3 Domestic Arrivals

4.3.1 Linear Regression Test

The results of the multiple linear test are presented in the following table:

Table 5. Multiple Linear Regression Test

Model		Sum of Squares		Standardized Coefficients Beta	F	Sig.
		B	Std. Error			
1	(Constant)	-8.530	17.694		1	(Constant)
	Arrivals	1.069	.140	.886		

Based on Table 5, it can be concluded that the arrival variable has a positive and significant effect on departure, where each increase of one unit of arrival will increase departure by 1.069 units with a Beta value of 0.886, indicating a very strong effect. Although the constant has a negative value (-8.530) and is not statistically significant (p > 0.05), it only serves as an adjustment to the model's starting point. Conversely, the arrival coefficient is significant with a t-value of 7.625 and Sig. = 0.000 (p < 0.05), confirming that

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arrivals are the primary and valid predictor in explaining variations in departures.

4.3.2 Determination Coefficient Test

The results of the coefficient of determination test are presented in the following table:

Table 6. Coefficient of Determination Test Results

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	.886[a]	.784	.771	10.23837

Based on Table 6, it is explained that the R Square value of 0.784 indicates that 78.4% of the variation or change in the number of departures can be explained by the number of arrivals. The remaining 21.6% is influenced by other factors outside this regression model. The Adjusted R Square value of 0.771 is slightly lower than the R Square. The Standard Error of the Estimate (SEE) value of 10.23837 indicates the average level of prediction error of the model in the same units as the dependent variable (departures).

4.3.3 Annova Test

The results of Annova test are presented in the following table:

Table 7. Annova Test Results

Model		Sum of Squares	Df	Mean Sqaure	F	Sig.
1	Regression	6093.780	1	6093.780	58.133	.000[b]
	Residual	1677.186	16	104.824		
	Total	7770.966	17			

Based on Table 7, it is explained that the regression value of 6093.780 indicates that most of the variation in departures can be explained by arrivals, while the residual value of 1677.186 indicates that there is variation that cannot be explained by the model. Additionally, the significance of the F-test is 0.000 ($p < 0.05$), indicating that arrivals have a significant effect on departures, and this regression model can be considered reliable in explaining the variation that occurs.

4.4 Domestic International Arrivals

4.4.1 Linear Regression Test

The results of the multiple linear test are presented in the following table:

Table 8. Multiple Linear Regression Test

Model		Sum of Squares		Standardized Coefficients Beta	F	Sig.
		B	Std. Error			
1	(Constant)	3.506	35.141		.100	.922
	Arrivals	.452	.122	.679	3.702	.002

Based on Table 8, it can be concluded that arrivals have a positive and significant effect on departures, where each increase of one unit in arrivals will increase departures by 0.452 units with a Beta value of 0.679, indicating a fairly strong effect. The t-value of 3.702 with a significance level of 0.002 ($p < 0.05$) confirms that arrivals are a significant predictor in the model. Meanwhile, the intercept of 3.506, although indicating the number of departures when arrivals are zero, is not statistically significant ($t = 0.100$; Sig. = 0.922), thus not contributing significantly to explaining the relationship between variables.

4.4.2 Determination Coefficient Test

The results of the coefficient of determination test are presented in the following table:

Table 9. Coefficient of Determination Test Results

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	.679[a]	.461	.428	139.98658

Based on Table 9, it is explained that the R value of 0.679 indicates a fairly strong positive relationship between the number of arrivals and the dependent variable. As the number of arrivals increases, the dependent variable also tends to increase, although not entirely strongly. The R Square value of 0.461 indicates that 46.1% of the variation or change in the dependent variable can be explained by the number of arrivals. The remaining 53.9% is explained by other factors not included in this model.

4.4.3 Annova Test

The results of Annova test are presented in the following table:

Table 10. Annova Test Results

Model		Sum of Squares	Df	Mean Sqaure	F	Sig.
1	Regression	268586.108	1	268586.108	13.706	.002[b]
	Residual	313539.902	16	19596.244		
	Total	582126.010	17			

Based on Table 10, it is explained that the arrival variable has a positive and significant effect on departure, where each increase of one unit of arrival will increase departure by 1.069 units with a Beta value of 0.886, indicating a very strong effect. Although the constant has a negative value (-8.530) and is not statistically significant ($p > 0.05$), it only serves as an adjustment for the model's starting point. Conversely, the arrival coefficient is significant with a t-value of 7.625 and Sig. = 0.000 ($p < 0.05$), confirming that arrivals are the primary and valid predictor in explaining variations in departures.

4.5 Domestic International Departures

4.5.1 Linear Regression Test

The results of the multiple linear test are presented in the following table:

Table 11. Multiple Linear Regression Test

Model		Sum of Squares		Standardized Coefficients Beta	F	Sig.
		B	Std. Error			
1	(Constant)	49.724	51.300		.969	.347
	Departures	1.020	.276	.679	3.702	.002

Based on Table 11, it can be concluded that the departure variable has a positive and significant effect on passenger arrivals. This is evident from the coefficient value B = 1.020 with a t-value of 3.702 and significance of 0.002 (< 0.05), indicating that each one-unit increase in departures will increase arrivals by 1.020 units. The standardised Beta value of 0.679 further reinforces that departures are a fairly important predictor in explaining arrivals.

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Meanwhile, the constant (intercept) of 49.724 is not significant (Sig. = 0.347), so its contribution to the model is not considered significant. Therefore, it can be concluded that departures are the primary factor significantly influencing the prediction of passenger arrivals.

4.5.2 Determination Coefficient Test

The results of the coefficient of determination test are presented in the following table:

Table 12. Coefficient of Determination Test Results

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	.679[a]	.461	.428	210.20931

Based on Table 12, it is explained that the departure variable has a fairly strong relationship with the dependent variable, as indicated by an R value of 0.679. The R Square value of 0.461 indicates that 46.1% of the variation in the dependent variable can be explained by departure, while the remaining 53.9% is influenced by other factors outside the model. However, the Standard Error of the Estimate (SEE) value of 210.20931 indicates that the model still has a relatively high level of prediction error, so while departure plays an important role, other factors must still be considered in explaining the dependent variable.

4.5.3 Annova Test

The results of Annova test are presented in the following table:

Table 13. Annova Test Results

Model		Sum of Squares	Df	Mean Sqaure	F	Sig.
1	Regression	605640.061	1	605640.061	13.706	.002[b]
	Residual	707007.248	16	44187.953		
	Total	1312647.310	17			

Based on Table 13, it is explained that the regression model is feasible to use because departures are proven to have a significant effect on passenger arrivals. This is indicated by an F value of 13.706 with a significance of 0.002 (< 0.05), which means that the null hypothesis is rejected and the model has better predictive power than a model without predictors. Thus, variations in passenger arrivals can be significantly explained by departures, although there are still other factors outside the model that also influence them.

4.6 Discussion

Based on the analysis results, the number of air passengers in Central Java in 2023 showed an upward trend, especially in May and June, which were influenced by long holidays and the Hajj season. Economic stability at the beginning of the year also encouraged community mobility, so that both domestic and international passenger departures and arrivals recorded fairly high numbers. This situation confirms that air transport is an important mode of transportation that supports the economic, social, and religious activities of the community in the region. However, in 2024, there was a significant decline in the number of domestic passengers due to global economic pressures and inflation, which impacted people's purchasing power.

Nevertheless, there was an increase in the number of international passengers, reflecting the recovery of interest in overseas travel post-pandemic. The decline in domestic passengers requires new strategies to enhance the appeal of local destinations, while the surge in international travel presents opportunities to expand flight networks and promote international tourism. This situation presents both challenges and opportunities, where the aviation and tourism sectors in Central Java must adapt through strengthened promotion of international tourist destinations and the development of air connectivity to maintain growth in mobility and its contribution to the regional economy.

5. CONCLUSION

The conclusion of this analysis indicates that air transportation in Central Java experienced significant fluctuations between 2023 and 2024. The year 2023 was marked by an increase in passenger numbers, particularly during long holidays and the Hajj pilgrimage, while 2024 saw a cumulative decline in domestic passenger numbers. The primary factors influencing this situation include consumer purchasing power, seasonal factors, and global economic dynamics. However, the trend of increasing international passengers presents a significant opportunity for the development of the international tourism sector in Central Java through the optimisation of air connectivity.

The limitation of this analysis is that it does not include non-quantitative factors such as customer satisfaction, airport and airline service quality, or more specific government policies related to aviation. Therefore, further research is recommended to include these variables to provide a more comprehensive picture. Additionally, local governments, airlines, and tourism stakeholders are advised to enhance international tourism promotion, expand flight routes, and improve air transport infrastructure and services to increase Central Java's appeal both domestically and globally.

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