This study investigates the impact of the newly constructed Kediri Airport on air passenger movement patterns in East Java, with a focus on its effect on the existing Juanda and Abdulrachman Saleh Airports. The research addresses the issue of congestion at these primary airports and explores the potential for passenger redistribution with the introduction of a new airport. Using stated preference methods, this study examines how variations in travel costs and time influence passengers' choices between airports and their shifting patterns.

The results indicate that Kediri Airport, due to its improved accessibility and service quality, holds significant potential to divert passenger traffic from Juanda and Abdulrachman Saleh. Projections show that by 2024, Kediri could capture up to 42 % of the passenger traffic currently centered at these primary airports, significantly easing congestion at the main airports. Additionally, the study suggests that the implementation of a Multi-Airport System (MAS) could effectively manage this redistribution, optimizing the use of regional airports and enhancing overall connectivity across East Java.

The findings contribute valuable insights into strategic airport network planning and emphasize Kediri's role in enhancing regional mobility and supporting economic growth. These results are highly relevant for infrastructure planning, where MAS can be leveraged to optimize airport operations and ensure sustainable growth

Keywords: multi-airport system, passenger preferences, regional air traffic distribution, transport infrastructure

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IDENTIFYING THE IMPACT OF NEW AIRPORTS ON AIR PASSENGER MOVEMENT PATTERNS: A STUDY OF REGIONAL CONNECTIVITY

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1. Introduction

The rapid growth of air travel, driven by increasing global mobility and economic integration, has prompted significant changes in transportation infrastructure across various regions. This is especially evident in areas with multiple airports competing for passenger traffic, where the introduction of new airports can radically alter existing dynamics. The development of new airports is not just a response to increasing demand but also a strategic move to reduce congestion, enhance connectivity, and stimulate local economic growth. For East Java, Indonesia, the construction of Kediri Airport represents a pivotal moment in the region's air transport network. As a new airport, Kediri aims to alleviate the pressure on Juanda Airport in Surabaya and Abdulrachman Saleh Airport in Malang, both of which are already handling significant traffic volumes. The potential for Kediri to redistribute passenger traffic and influence the competitive landscape of East Java's air travel system is a topic of great academic and practical interest.

The rapid expansion of air travel, driven by increasing global mobility and economic integration, has significantly impacted transportation infrastructure across various regions. This is particularly evident in areas where multiple airports compete for passenger traffic. The introduction of new airports in such regions can fundamentally alter existing dynamics by alleviating congestion, improving connectivity, and fostering local economic growth. Given these transformations, the development of new airports is not merely a response to growing demand but also a strategic maneuver aimed at enhancing operational efficiency and promoting regional development.

In the context of East Java, Indonesia, the construction of Kediri Airport represents a critical milestone in the region's air transport infrastructure. Kediri Airport's primary objective is to relieve pressure on the already congested Juanda Airport in Surabaya and Abdulrachman Saleh Airport in Malang, which are currently handling substantial traffic volumes. The potential for Kediri to redistribute passenger traffic and influence the competitive dynamics of East Java's air travel system has garnered increasing academic and practical interest.

The relevance of this research lies in the ongoing challenges faced by regions with multiple competing airports. As air travel becomes more competitive, airports must adapt to changes in passenger behavior and preferences. Factors such as travel cost, travel time, and accessibility have always been important determinants of passenger choice [1]. However, recent concerns regarding land transportation – such as traffic accidents caused by human error, overloaded vehicles, and pollution from motor vehicles-have added another layer of

complexity to air travel preferences. As a result, it is vital to explore how new airports can offer a more sustainable and efficient solution for managing regional air transport.

New airports, such as Kediri, are expected to become critical hubs not only for relieving congestion but also for enhancing regional mobility. Previous studies have emphasized that the establishment of new airports can be a catalyst for local economic development by increasing accessibility, creating employment opportunities, and stimulating various economic activities [2, 3]. Additionally, airports play a central role in improving regional connectivity by linking cities, industries, and markets [4]. Therefore, it is essential to assess the socio-economic implications of Kediri Airport and understand its potential role in reshaping the region's air transport dynamics.

As highlighted by earlier research, the success of new airports depends on several interrelated factors, such as service quality, connectivity, and affordability [1] as well as concerns related to land transportation accidents caused by human error, road damage, vehicle load, and air pollution resulting from motor vehicle emissions in Indonesia [5–10]. Kediri's ability to attract passengers from the surrounding areas, including Nganjuk, Kediri, Blitar, Tulungagung, and Trenggalek, depends on its competitiveness compared to the established airports in Surabaya and Malang. As passenger movement patterns continue to shift, understanding these factors will provide insights into how new airports can play a strategic role in regional development.

Furthermore, the establishment of Kediri Airport raises critical questions about how the existing airports will adjust to these shifts. The opening of Kediri Airport introduces an opportunity to examine how competing airports in East Java will respond to changes in passenger flow. The potential redistribution of passenger traffic through the integration of multiple airports in the region highlights the importance of exploring the concept of a Multi-Airport System (MAS). MAS enables the efficient management of air traffic by balancing the distribution of passengers across multiple airports, improving connectivity, and optimizing resource utilization [11, 12]. This study will explore how Kediri's integration into East Java's air transport system could be managed within the framework of MAS, contributing to the ongoing discourse on managing multiple airports in densely populated areas [13, 14]. Thus, the necessity of the studies in this area is clear: understanding the impact of new airports on passenger movement and regional air transport dynamics is crucial for effective infrastructure planning and development.

2. Literature review and problem statement

The growth of air travel, particularly in regions with multiple competing airports, has garnered significant attention in academic literature. The development of new airports, such as Kediri Airport, is strategically driven to address the growing demand for air services, alleviate congestion at primary airports like Juanda and Abdulrachman Saleh, and provide solutions to regional transportation challenges. It is shown that the introduction of new airports can lead to positive economic impacts, improve accessibility, and reduce congestion at already congested airports [2, 3]. This reflects the growing demand for regional air connectivity and the critical role airports play in fostering economic integration and regional development. However, there remain unresolved questions related to the effects of new airports on shifting air passenger traffic and the optimal strategies for redistributing traffic between competing airports.

While previous studies have demonstrated that the construction of new airports can relieve congestion and promote regional economic development, challenges persist in understanding how exactly new airports influence travel behavior and passenger preferences, especially when competition arises from nearby existing airports. Objective difficulties related to forecasting passenger behavior, competition, and regional economic impacts make this an ongoing challenge. For instance, even though a new airport may offer better accessibility, it may not automatically attract passengers from existing airports due to perceived differences in service quality, cost, and travel time. Furthermore, airport competition presents additional complexity in understanding how passengers make decisions to switch airports [1, 4]. Principal impossibilities in accurately predicting long-term effects arise due to the variety of influencing factors, such as infrastructure development, economic fluctuations, and the changing preferences of passengers.

One approach to overcoming these difficulties is using stated preference methods and gravity models, as employed in previous studies [5, 6]. These methods allow researchers to quantify how changes in travel time, cost, and accessibility influence passenger choices and the redistribution of air traffic. Such approaches have been used effectively in understanding airport network dynamics in other regions, such as Brazil [15], where a differentiation between primary and secondary airports allowed for better assessment of competitive impacts. However, challenges remain when applying these methods to the specific context of Kediri Airport and its competitive positioning within East Java's existing network of airports.

This ongoing gap in knowledge highlights the need for further research into the impact of Kediri Airport on passenger distribution and regional air traffic dynamics. Furthermore, the potential for implementing a Multi-Airport System (MAS) in East Java to manage airport traffic more efficiently presents another important area of inquiry. MAS, which has shown success in other global regions [7, 8], offers an effective means of redistributing traffic, improving connectivity, and optimizing resource utilization. However, its successful implementation requires a careful assessment of airport complementarity, capacity, and competition [12, 13]. In addition, as air travel becomes more competitive, factors such as flight pricing, travel time, and accessibility must be considered to fully understand how airports can attract passengers and balance demand effectively.

Previous literature has emphasized that airports act as crucial nodes for regional economic development, improving trade, tourism, and local employment opportunities [13, 14]. However, the environmental and operational challenges of managing multiple airports within the same region, such as the risk of inefficiencies and the need for environmental sustainability, must be addressed through strategic planning and policy implementation [16, 17]. Thus, while there is substantial evidence supporting the benefits of new airports, further investigation is necessary to understand the complex dynamics at play and the practical measures that can enhance the performance of a multi-airport system in East Java.

Understanding the factors that influence passenger demand is crucial for evaluating the potential impact of the new Kediri Airport on regional development. As mentioned in [18], factors such as income, travel time, and distance significantly influence passenger demand, but their applicability may vary. While the potential benefits of the new Kediri Airport-such as job creation, increased local business activity, and boosted tourism-are

clear [19], the underlying mechanisms through which these benefits impact passenger behavior, competition, and regional development must be considered. To enhance regional connectivity, Kediri Airport can also focus on developing a Multi-Airport System (MAS). However, challenges such as competition, coordination, and environmental impacts must be addressed to ensure sustainable growth [20]. This study will focus on these unresolved questions, specifically examining how Kediri Airport will impact passenger traffic distribution, competition between airports, and the broader economic landscape of East Java.

Therefore, this research aims to contribute to the understanding of how new airports like Kediri influence regional transport dynamics. It will also investigate the potential application of a Multi-Airport System (MAS) in East Java, focusing on the key factors that determine passenger airport choice and the redistribution of air traffic across competing airports.

3. The aim and objectives of the study

The aim of this study is to assess the impact of the new Kediri Airport on air passenger movement patterns in East Java, by determining the number of passengers originating from the study areas (Nganjuk, Kediri, Blitar, Tulungagung, and Trenggalek) who currently use Juanda and Abdulrachman Saleh Airports. This research is expected to reveal how passenger preferences may change, leading to developments in transportation infrastructure, redistribution of passenger volumes, alterations in flight routes and schedules, and even impacting the local economies surrounding the airports.

To achieve this aim, the following objectives were set:

– to analyze the characteristics and existing movement patterns of travelers at Juanda Airport Surabaya and Abdulrachman Saleh Airport Malang;

– to identify the opportunity to move airplane passengers from existing airports to Kediri Airport;

– to identify the influence of Kediri Airport on the passenger movement patterns of existing airports in East Java.

4. Materials and Methods

The primary object of the study is the movement patterns of air passengers across the three airports in East Java: Juanda, Abdulrachman Saleh, and Kediri. The study investigates how passenger behavior and the distribution of traffic at these airports change with the introduction of a new airport, Kediri. The analysis focuses on the passengers originating from five key regions in East Java: Kediri, Nganjuk, Blitar, Tulungagung, and Trenggalek. These regions are selected based on their proximity to the airports and the potential for shifts in traffic from existing airports to Kediri.

The central hypothesis of this research is that the introduction of Kediri Airport will significantly alter the distribution of air passenger traffic in East Java. Specifically, it is hypothesized that Kediri Airport will attract a proportion of passengers from Juanda and Abdulrachman Saleh, particularly from those areas that are geographically closer to Kediri as shown in Fig. 1. The hypothesis also suggests that factors such as travel time, costs, and convenience will drive passenger preference toward Kediri, thereby redistributing air traffic.

The study is based on several assumptions. First, it is assumed that the data provided by passengers are representative of the broader passenger base across the region, which can be generalized to the entire East Java province. Second, the study assumes that the socio-economic characteristics of the respondents, such as age, income, and occupation, influence their travel behavior in a consistent manner. Third, it is assumed that factors such as weather and security do not significantly impact the passengers' airport choice in the context of this study, allowing the focus to remain on travel time, costs, and convenience.

Additionally, the research assumes that there will be a measurable shift in passenger behavior, which can be effectively captured using stated preference surveys and other modeling techniques.

This study will focus on domestic passengers or airport users originating from Nganjuk, Kediri, Blitar, Tulungagung, and Trenggalek only as shown in Fig. 2. Data will also be collected from relevant agencies, assuming that the data is accurate and representative. The characteristics of passenger shifts will be based on the same parameters, namely the difference in travel costs and travel time to the destination airport, while other factors such as weather and security will be excluded from the analysis.

The research methodology involves gathering information on passenger demand at specific airports. Passenger data will be collected through questionnaires designed based on predefined variables. These questionnaires will be distributed to passengers at Juanda Airport and Abdulrachman Saleh Airport (from Kediri and surrounding areas), as well as to air travelers within the study area. The data will be processed using several methods, with passenger characteristics being analyzed through descriptive statistical analysis. This descriptive analysis will help determine the proportion of respondents at Juanda Airport, Abdulrachman Saleh Airport, and those from the study area.

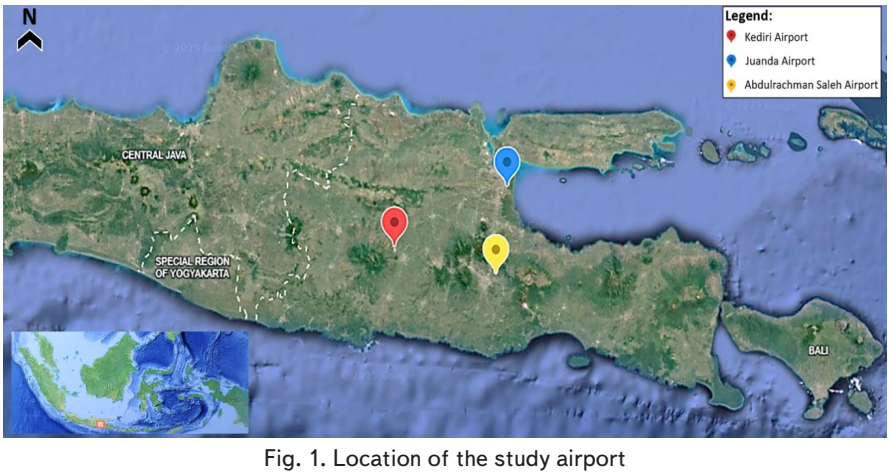

Fig. 1. Location of the study airport

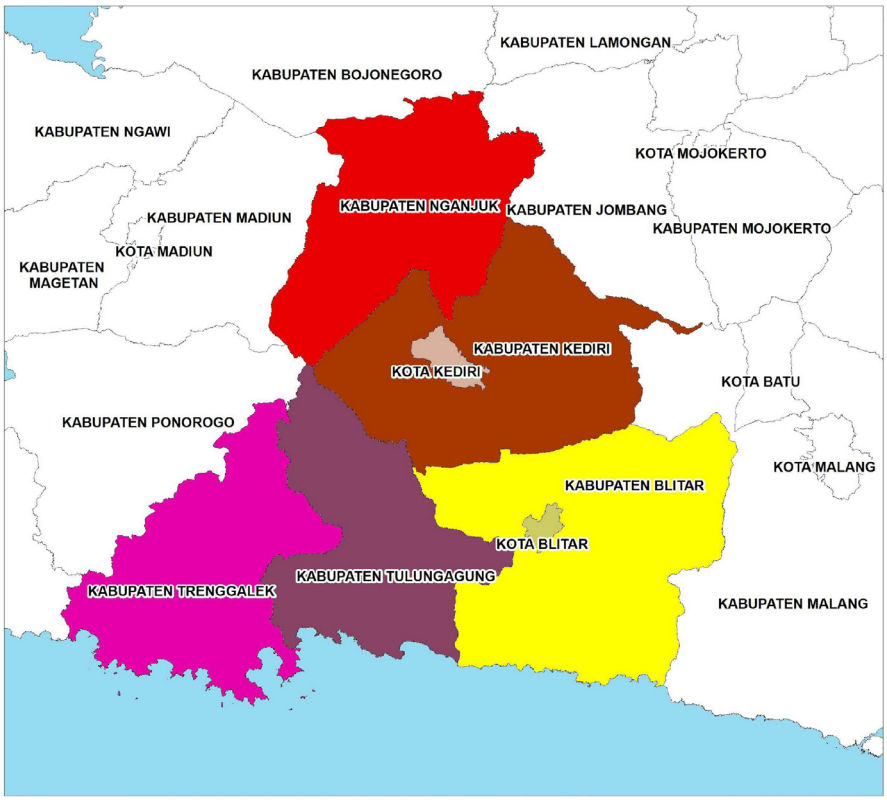

Fig. 2. Airport study area boundary

The survey conducted received responses from a total of 1,187 individuals, with 877 respondents completing the survey in person and 278 respondents completing it online via Google Forms. Thirty-two responses were excluded due to incomplete or unfinished questionnaires. Regarding the travel characteristics, the survey provides inputs from respondents regarding the purpose and destination of their trip, their place of origin, travel frequency (using air travel), travel cost types, reasons for choosing existing airports (Juanda/Abdulrachman Saleh), as well as their approval of the construction of Kediri Airport and their willingness to switch to Kediri Airport.

Furthermore, the study will explore the potential for passenger shift using the stated preference method, passenger movement projections using a gravity model, and identify the potential implementation of a multi-airport system.

5. Results of impact of new airports on air passenger movement patterns

5. 1. Characteristics and movement patterns of existing travelers at Juanda Airport Surabaya and Abdulrachman Saleh Airport Malang

With the realization of the Kediri Airport development, access for travelers from the Kediri region and its surrounding areas will become easier, faster, and more efficient, reducing travel time to the airport.

Based on the socio-economic characteristics and travel data of the respondents, several key traits of air transport users from the study areas (Kediri, Nganjuk, Tulungagung, Trenggalek, and Blitar) can be summarized in the following Tables 1, 2.

Table 1

Socio-economic characteristics of air transportation user respondents

No.	Socio-economic characteristics			%
1	Respondent characteristics		Gender	
	Majority	Juanda	Male	56
		Abd. Saleh		62
		Study Area		61
2	Respondent characteristics		Age	
	Majority	Majority	31–40	32
		Abd. Saleh	21–30	44
		Study Area	31–40	42
3	Respondent characteristics		Last education	
	Majority	Juanda	Bachelor degree	60
		Abd. Saleh		56
		Study Area		55
4	Respondent characteristics		Job	
	Majority	Juanda	Civil servant	28
		Abd. Saleh		26
		Study Area		25
5	Respondent characteristics		Average income/month	
	Majority	Juanda	≥5 – 7 million IDR	47
		Abd. Saleh		40
		Study Area		37

Table 2

Travel characteristics of air transportation user respondents

No.	Travel characteristics			%
1	Respondent characteristics		Trip purpose and objective	
	Majority	Juanda	Non-business	55
		Abd. Saleh	Business	42
		Study Area	Business	58
2	Respondent characteristics		Trip frequency	
	Majority	Juanda	<1x	60
		Abd. Saleh		50
		Study Area		62
3	Respondent characteristics		Trip expenses types	
	Majority	Juanda	Personal expenses	59
		Abd. Saleh	Personal expenses	49
		Study Area	Office expenses	61
4	Respondent characteristics		Choosing reasons Juanda/Abdulrachman Saleh Airport	
	Majority	Juanda	High flight frequency	46
		Abd. Saleh	Fast travel time	64
		Study Area	High flight frequency	45
5	Respondent characteristics		Kediri Airport development approval	
	Majority	Juanda	Yes	100
		Abd. Saleh		100
		Study Area		99
6	Respondent characteristics		Move willingness to Kediri Airport	
	Majority	Juanda	Yes	90
		Abd. Saleh	No	91
		Study Area	Yes	83

Based on the data presented, the characteristics of air transport users from the Kediri, Nganjuk, Tulungagung, Trenggalek, and Blitar regions reveal several notable patterns. The majority of respondents are aged between 31–40 years, with most holding a bachelor's degree. The dominant occupation is civil servants, and most respondents have an average monthly income ranging from IDR 5 million to 7 million. The primary reason for choosing an airport is the high frequency of flights, particularly at Juanda Airport. Meanwhile, the most common travel purpose is non-business for Juanda and business for Abdulrachman Saleh. Respondents from the study area are more likely to travel using office funds compared to those using personal funds.

The findings on the willingness to switch to Kediri Airport show that the majority of respondents from Juanda and the study area are willing to switch to this new airport, with percentages of 90 % and 83 %, respectively. On the other hand, the majority of respondents at Abdulrachman Saleh (91 %) chose not to switch, mainly due to cost issues and flight frequency mismatches. Overall, the development of Kediri Airport has received strong support, with almost all respondents from Juanda and Abdulrachman Saleh agreeing that its construction will facilitate easier access for travelers from the surrounding regions.

Focusing on the potential number of passengers using Juanda Airport and Abdulrachman Saleh Airport from the study area (Nganjuk, Kediri, Blitar, Tulungagung, and Trenggalek), the survey results indicate that the average number of passengers potentially originating from the study area is 28 passengers per day. This value is then multiplied by a growth factor of 125 %, resulting in a potential of 34 passengers per day traveling through Juanda Airport.

Similarly, for Abdulrachman Saleh Airport, the calculation shows that the average number of passengers originating from the study area is also 28 passengers per day. With the same growth factor of 125 %, the potential number of passengers departing from Abdulrachman Saleh Airport is also 34 passengers per day.

In total, the potential number of passengers from the study area using Juanda and Abdulrachman Saleh Airports is approximately 28 passengers per day, as derived from the total survey conducted at both airports.

5. 2. Opportunities for airplane passenger movements from existing airports to Kediri Airport

In this study, data was collected regarding respondents' preferences for transportation mode choices through Juanda Airport, Abdulrachman Saleh Airport, or Kediri Airport. The respondents came from five regions within the study area: Kediri, Nganjuk, Blitar, Tulungagung, and Trenggalek. Data collection was carried out using the Stated Preference method, which involved altering two main attributes: the difference in travel cost ($\Delta X1$) and the difference in travel time ($\Delta X2$). Each respondent was asked to assess their choice based on a comparison between the changes in cost and travel time. To facilitate further analysis, the qualitative results were then converted into quantitative data.

This conversion process involved using a probability scale ranging from 1 to 5, where each number represented the likelihood of choosing a particular airport. A score of 1 indicated a very strong preference for Juanda/Abdulrachman Saleh, while a score of 5 indicated a very strong preference for Kediri Airport. After obtaining the probability values, the data was further processed using a logit transformation, which converted the probabilities into logit values. These logit values were then used in the formulation of a utility model, which would map the probability of mode shift based on the changes in cost and travel time differences, serving as the basis for further analysis.

The formulation of the transportation mode choice model between Juanda Airport and Kediri Airport, based on the Stated Preference method, resulted in a probability model influenced by two main factors: the difference in travel cost ($\Delta X1$) and the difference in travel time ($\Delta X2$). The utility equation for both airports was calculated using logistic regression, which generated in the following utility equations for Kediri Airport (UKDR) and Juanda Airport (UJND):

$$\left(U_{KDR}-U_{JND}\right)= \\ =1.160-0.000004227\left(\Delta X1\right)+0.006\left(\Delta X2\right), \quad (1)$$

where is the mode shift probability model:

$$P_{KDR}=\frac{e^{(U_{KDR}-U_{JND})}}{1+e^{(U_{KDR}-U_{JND})}}= \\ =\frac{e^{1.160-0.000004227(\Delta X1)+0.006(\Delta X2)}}{1+e^{1.160-0.000004227(\Delta X1)+0.006(\Delta X2)}}, \quad (2)$$

$$P_{JND} = 1 - P_{KDR} = \frac{1}{1 + e^{1.160 - 0.000004227(\Delta X1) + 0.006(\Delta X2)}}. \quad (3)$$

Using this equation, the probability of selecting Kediri Airport (PKDR) is calculated using the logistic formula, while the probability of choosing Juanda Airport (PJND) is its complement. The model shows that the probability of mode choice changes significantly as the value of the difference between cost and travel time changes, which is reflected in the probabilities presented in Fig. 3.

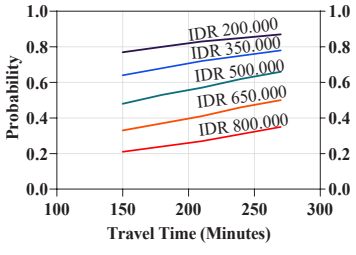

Fig. 3. Probability of Juanda and Kediri Airports

Fig. 3 illustrates the relationship between the probability of mode choice and the differences in cost and travel time. When the cost is low and the travel time is long, the probability of choosing Juanda Airport is very high, reaching 99 %. Conversely, when the cost is higher and the travel time is shorter, the probability of choosing Kediri Airport increases to 83 %. This indicates that passengers tend to prefer Kediri when the cost and time are more favorable, while Juanda is preferred when the cost is higher and the travel time is longer.

For the formulation of the model comparing Abdulrachman Saleh Airport and Kediri, the regression analysis results show the utility equation for the comparison between Kediri Airport (UKDR) and Abdulrachman Saleh Airport (UABD) as follows:

$$\left(U_{KDR} - U_{ABD}\right) = \\ = -2.088 + 0.0000004231\left(\Delta X1\right) - 0.00005749\left(\Delta X2\right). \quad (4)$$

The probability model of mode shift between the two airports can be written as:

$$P_{KDR} = \frac{e^{(U_{KDR} - U_{ABD})}}{1 + e^{(U_{KDR} - U_{ABD})}} = \\ = \frac{e^{-2.088 + 0.0000004231(\Delta X1) - 0.00005749(\Delta X2)}}{1 + e^{-2.088 + 0.0000004231(\Delta X1) - 0.00005749(\Delta X2)}}, \quad (5)$$

$$P_{ABD} = 1 - P_{KDR} = \frac{1}{1 + e^{-2.088 + 0.0000004231(\Delta X1) - 0.0005749(\Delta X2)}}. \quad (6)$$

The results show the probability of mode choice between Abdulrachman Saleh Airport and Kediri based on the differences in cost and travel time, as calculated in the regression analysis. Fig. 4 illustrates that the probability of mode choice at both airports remains relatively constant despite changes in the differences in cost and travel time. In other words, although there are variations in cost and time, passengers at Abdulrachman Saleh Airport tend not to switch to Kediri Airport based solely on these changes. This suggests that cost and time factors alone are not significant enough to drive a dramatic shift in mode choice.

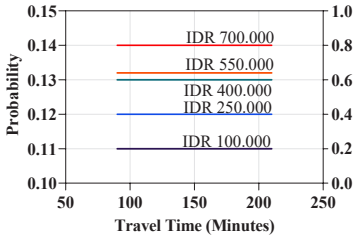

Fig. 4. Probability of Abdulrachman Saleh and Kediri Airports

In the formulation of the model for the study area, the utility model used to measure mode choice between Juanda/Abdulrachman Saleh (UKS) and Kediri Airports (UKDR) in the study area is based on the following equation:

$$\left(U_{KDR} - U_{KS}\right) = \\ = 2.494 - 0.000004254\left(\Delta X1\right) - 0.002412\left(\Delta X2\right), \quad (7)$$

with the mode shift probability model written as:

$$P_{KDR} = \frac{e^{(U_{KDR} - U_{KS})}}{1 + e^{(U_{KDR} - U_{KS})}} = \\ = \frac{e^{2.494 - 0.000004254(\Delta X1) - 0.002412(\Delta X2)}}{1 + e^{2.494 - 0.000004254(\Delta X1) - 0.002412(\Delta X2)}}, \quad (8)$$

$$P_{KS} = 1 - P_{KDR} = \frac{1}{1 + e^{2.494 - 0.000004254(\Delta X1) - 0.002412(\Delta X2)}}. \quad (9)$$

The results of this model as show in Fig. 5, depict the probability of mode choice between Juanda/Abdulrachman Saleh and Kediri Airports based on changes in the cost difference and travel time.

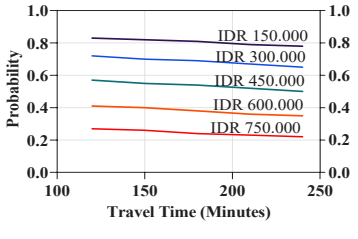

Fig. 5. Probability of the study area and Kediri Airport

Fig. 5 illustrates these results, showing that as the difference in cost and travel time increases, the likelihood of choosing Kediri Airport decreases. The probability of choosing a mode tends to decline as travel time increases. With a low-cost difference (IDR 150,000) and a short travel time (120 minutes), the probability of choosing Kediri Airport can reach 83 %, while the probability of choosing Juanda/Abdulrachman Saleh is 17 %. However, with a high cost difference (IDR 750,000) and a longer travel time (240 minutes), the probability of choosing Kediri Airport is very low (22 %), and the choice of Juanda/Abdulrachman Saleh becomes dominant at 78 %.

5. 3. The influence of Kediri Airport on the passenger movement patterns of existing airports in East Java

The results of this study show in Table 3, that indicate that Kediri Airport has good accessibility and is well-connected to an efficient transportation network, providing a strategic potential to alleviate the passenger load at Juanda and

Abdulrachman Saleh Airports. With its relatively close proximity to major cities in East Java, Kediri has the potential to attract passengers who previously used these two main airports, thereby positively impacting the distribution of air traffic in the region.

Table 3

Attractiveness and proportion of passengers in the study area

Study Area	Attractiveness			Passenger proportion		
	Juanda	Abd. Saleh	Kediri	Juanda	Abd. Saleh	Kediri
Kediri	0.21	0.15	0.31	32 %	23 %	46 %
Nganjuk	0.08	0.05	0.10	34 %	21 %	44 %
Blitar	0.09	0.12	0.13	27 %	35 %	39 %
Tulungagung	0.14	0.14	0.20	29 %	30 %	41 %
Trenggalek	0.08	0.08	0.11	31 %	28 %	41 %
Averages				31 %	27 %	42 %

Based on the research findings, Kediri Airport is predicted to play a significant role in redistributing air traffic, which has traditionally been concentrated at Juanda and Abdulrachman Saleh Airports. With the proportion of passengers from the Kediri area reaching 42 % in 2024 and a projected increase to 48 % by 2034, Kediri Airport is becoming an increasingly preferred choice for passengers from the surrounding regions. The passenger forecast for Kediri Airport shows rapid growth, starting with 14,235 passengers in 2024 and expected to reach 2,547,593 passengers by 2043. This projection underscores Kediri's importance in alleviating pressure on the main airports and enhancing the overall efficiency of the air transport system in East Java.

Fig. 6 illustrates the passenger forecast for Kediri Airport from 2024 to 2043. The graph shows a significant increase in passenger numbers, in line with the development of infrastructure and the growing appeal of the Kediri region. This projection reflects a continuous rise in demand, particularly supported by the construction of new toll roads and the rapidly developing local economy, further strengthening Kediri Airport's position as a key alternative for domestic flights in East Java.

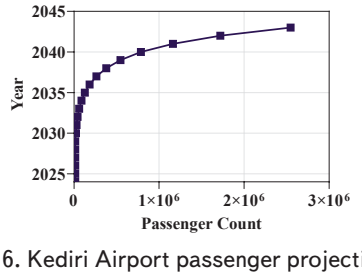

Fig. 6. Kediri Airport passenger projections

Furthermore, the potential for implementing a Multi-Airport System (MAS) in East Java presents very promising prospects in addressing the passenger congestion issues at major airports, such as Juanda Airport and Abdulrachman Saleh Airport. The adoption of MAS, which involves the simultaneous development and utilization of multiple airports, can alleviate the pressure on primary airports and distribute flight traffic more evenly across the region. Kediri Airport, with its strong accessibility and projected significant increase in passenger numbers, becomes a crucial component of this system. While the current passenger movement among the three airports, Kediri Airport is starting to increase slowly as shown in Fig. 7.

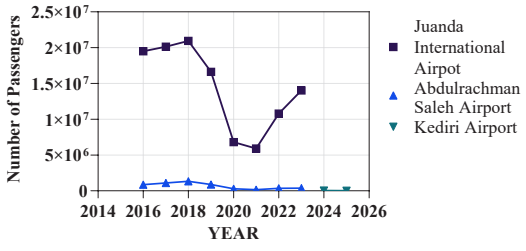

Fig. 7. Airport passenger movement

Based on the analysis of the passenger movement graph in Fig. 7, it is evident that although Kediri Airport has a lower passenger count, the demand at this airport continues to grow, indicating that it is successfully attracting passenger interest in a short period. Moving forward, with the expansion of capacity and facilities, it is anticipated that the number of passengers at Kediri will continue to increase, further influencing the distribution patterns of passengers across airports in East Java.

As comparison of the passenger projection in 2024, a review of passenger movements was conducted in 2025 when Kediri Airport was operational. Based on interviews on March 21, 2025, 192 passengers were record, with 98 % coming from Juanda and 2 % from Abdulrachman Saleh. The majority of passengers switched to Kediri because of the closer distance and cheaper fares.

6. Discussion on the impact of Kediri Airport on air passenger movement patterns in East Java

The findings of this study provide important insights into the dynamics of air passenger movement patterns in East Java, particularly focusing on the impact of the new Kediri Airport on existing airports such as Juanda and Abdulrachman Saleh. By analyzing factors such as passenger preferences, the influence of various attributes on airport choice, and the potential impact of Kediri Airport on the regional air transport system, this research contributes significantly to the discourse on transportation planning and infrastructure development. The findings align with and expand upon existing studies in the literature, offering nuanced perspectives on the development of multi-airport systems (MAS) and their role in improving regional connectivity, operational efficiency, and passenger satisfaction.

The study's results reveal that flight price sensitivity is a critical factor influencing passenger decisions when choosing between Juanda, Abdulrachman Saleh, and Kediri Airport. Previous research, such as the studies by [1, 19], supports these findings by emphasizing that lower airfares significantly enhance an airport's attractiveness. In this study, Kediri Airport becomes an increasingly viable option for passengers when the travel costs are lower and the travel time is shorter. As illustrated in Fig. 3, when the travel costs are lower and the time is more favorable, passengers prefer Kediri as their departure point. Conversely, when the travel costs rise and time becomes a critical factor, passengers opt for Juanda, reflecting the fundamental principle of passenger price sensitivity [1].

The importance of service quality in airport choice further corroborates the findings in this study. As highlighted by [19],

improving service quality significantly influences passengers' decisions to use an airport, which has implications for Kediri Airport. Enhanced services and customer satisfaction are critical in ensuring that Kediri competes effectively with the well-established Juanda and Abdulrachman Saleh Airports. The increasing importance of service quality in shaping passenger behavior is evident in Fig. 5, where the probability of choosing Kediri increases significantly with improvements in service standards, demonstrating that passengers are willing to switch airports when service enhancements meet their expectations.

The issue of intermodal connectivity is another crucial determinant in airport choice. As noted in studies by [19, 20], improving connectivity between various transport modes, particularly air and ground transport, plays a vital role in attracting passengers to regional airports. Kediri Airport, with its excellent access to major roadways and potential future rail connections, offers enhanced convenience to passengers from surrounding areas. The development of Kediri Airport has the potential to reduce the overall travel time for passengers in East Java, making it a more attractive option compared to Juanda and Abdulrachman Saleh. This is particularly evident from the data provided in Figure 6, which shows that the growing accessibility of Kediri is directly linked to its increasing passenger share, projected to reach over 2.6 million passengers by 2043. The integration of air-rail services, particularly high-speed rail, could further enhance Kediri's competitiveness by offering a seamless intermodal experience for passengers, as suggested by [21].

The introduction of Kediri Airport as a new hub in the region is expected to have a significant impact on the distribution of passenger traffic between the existing airports of Juanda and Abdulrachman Saleh. Kediri's strategic location in the central part of East Java and its enhanced transportation links make it a prime candidate to alleviate pressure on the two established airports. As [15, 22] argue, the construction of new airports often leads to a redistribution of traffic. In this study, Kediri shows significant potential to absorb traffic from Juanda and Abdulrachman Saleh, especially as Fig. 6 demonstrates that Kediri is projected to handle a larger share of passengers, thus reducing congestion at the main airports.

This redistribution of air traffic is an important development for East Java, as it enables more balanced regional growth and improves the economic and social mobility of surrounding areas. The growth in Kediri's passenger numbers, highlighted in Fig. 7, reflects the strong demand for improved regional connectivity, which is further supported by the development of supporting infrastructure such as toll roads. This infrastructure development, alongside Kediri's growing popularity, suggests that the airport will increasingly become a key component in the region's air transport network, thereby enhancing the overall efficiency of the air transport system.

The implementation of a Multi-airport system (MAS) in East Java presents both challenges and opportunities for managing the growing demand for air travel. According to [23, 24], the integration of multiple airports within a region requires careful coordination in infrastructure, operations, and policies to ensure that they complement each other rather than create inefficiencies. This research aligns with those findings by showing that Kediri Airport can play a vital role in balancing the distribution of traffic in East Java, reducing congestion at Juanda and Abdulrachman Saleh. However, the findings also highlight that without adequate planning and management, competitive dynamics between the airports could undermine operational efficiency, a concern raised by Qian [23].

For MAS to be successful in East Java, there must be a focus on enhancing service quality, improving airport infrastructure, and facilitating smoother connections between the airports. As [1, 17] suggest, enhancing connectivity between airports and improving service standards will increase passenger satisfaction and loyalty. Kediri, as a new airport with ample room for expansion, presents an opportunity for East Java to foster a highly efficient multi-airport network that not only relieves congestion but also promotes economic and social benefits across the region.

The development of Kediri Airport is expected to have a positive socio-economic impact on the surrounding areas. As [2, 3] indicate, the establishment of new airports serves as a catalyst for local economic growth, creating jobs and stimulating business activities. The growth of Kediri Airport will likely follow this pattern, contributing to the economic development of the surrounding districts of Kediri, Nganjuk, Blitar, Tulungagung, and Trenggalek. The availability of increased employment opportunities and the expansion of business activities are critical factors that will likely drive the region's long-term economic prosperity. Moreover, the enhanced accessibility provided by Kediri's airport will make it easier for businesses to expand into new markets, benefiting both the local and regional economy.

The socio-economic impact of Kediri's airport also extends beyond economic factors, contributing to the improved mobility of people within East Java. As [2] suggests, airports act as gateways that foster regional exchanges, promoting cultural, economic, and social connections. This is particularly relevant for Kediri, which is strategically positioned to become a regional hub for travel, connecting East Java to the rest of Indonesia and beyond. This inter-regional connectivity will play a key role in reducing travel time, which in turn, supports business development and tourism in the region.

In summary, Kediri Airport holds substantial potential to transform the dynamics of air transport in East Java. The findings of this study demonstrate that the airport can play a central role in easing congestion at Juanda and Abdulrachman Saleh, while simultaneously enhancing regional connectivity and economic growth. However, the success of Kediri Airport will depend on continued investment in infrastructure, service quality, and the implementation of strategic management within a Multi-airport system. The projections for passenger growth suggest that Kediri will not only help alleviate current pressure on the existing airports but will also contribute significantly to the development of a more efficient and sustainable air transport system in the region.

The limitations of this study are the influence of new airport in Kediri on potential passenger demand and its impact on other existing airports. Data collection was conducted at Juanda and Abdulrachman Saleh Airports departure terminals, as well as five study area in the region. Descriptive methods and econometric models are used to analyze travel characteristics, demand, and passenger movement. This research also uses the stated preference method to analyze passenger movement opportunities. The gravity model is employed to project passenger numbers at Kediri Airport. Furthermore, the research highlights the potential for the implementation of a Multi Airport System (MAS) in Kediri for the future. However, this study did not address aircraft plans, operational costs, and airport landside/airside planning.

Disadvantages of this study can be seen from some misunderstandings by respondents in filling out/determining stated preference options. In the future, other researchers can

provide a detailed and thorough explanation to respondents when distributing questionnaires. Lack of time management in the process of obtaining passengers (respondents) at the study location (direct data collection), in the future it is necessary to maximize schedule mapping to meet the data acquisition target. The limited location of data collection can reduce the accuracy of the results, expansion of locations that cover more potential areas affected by Kediri Airport is needed.

Development of selected attributes based on other factors in consideration of passenger movement from one airport to another needs to be done for more diverse results. Meanwhile, the difficulty that may be encountered is that selection of attributes used must be able to truly interpret passengers' desire to switch modes. MAS can be further developed with a significant consideration process from various aspects. However, the obstacles that can be encountered are the difficult acquisition of passenger data, the complexity of inter-airport interactions, or policy and investment uncertainties. In addition, it is possible to analyze the economic and social impacts of Kediri Airport, but sometimes it is difficult to involve local communities around the airport in the research process.

7. Conclusions

1. Flight frequency and travel time are the primary factors for many respondents when choosing their airport. At Juanda Airport, the high frequency of flights is the main determining factor, while at Abdulrachman Saleh Airport, shorter travel time is prioritized by passengers. The development of Kediri Airport has received broad support, especially from air travelers in the Kediri region and its surroundings. The majority of respondents at Juanda and in the study area expressed willingness to switch to Kediri Airport, whereas respondents at Abdulrachman Saleh were more inclined to continue using the existing airport, primarily due to factors related to accessibility and specific local needs. The potential number of passengers from the study area (Nganjuk, Kediri, Blitar, Tulungagung, and Kediri) using both Juanda Airport and Abdulrachman Saleh Airport is estimated to be 34 passengers per day for each airport. This calculation indicates a significant potential for the development of capacity and services at both airports. These airports demonstrate considerable appeal to air travelers, which is crucial for future flight service planning. Additionally, the total potential number of passengers calculated across both airports is 28 passengers per day. This provides insight into the demand and potential for enhancing flight services from the study area, which should be considered in future development strategies.

2. The mode shift from Juanda Airport/Abdulrachman Saleh Airport to Kediri Airport is influenced by the differences in travel costs and travel time. Probability analysis indicates that passengers are more likely to choose Kediri if the travel cost is lower and the travel time is shorter. However, when the travel costs are high and the travel time is longer, passengers are more likely to stick with Juanda/Abdulrachman Saleh. Overall, the probability of shifting is higher when the cost and time differences between the two airports are small. However, if the differences in cost and time are too significant, passengers prefer to continue using the existing airports. Therefore, to enhance the likelihood of a shift, policies should be implemented that reduce the cost and travel time at Kediri Airport to make it more competitive compared to Juanda/Abdulrachman Saleh.

3. The shift in passenger choice from Juanda Airport/Abdulrachman Saleh Airport to Kediri Airport is primarily influenced by the variations in travel costs and travel times. Probability analysis reveals that passengers are more inclined to select Kediri when the travel cost is lower and the travel time is shorter. However, when the travel costs are high and the travel time is longer, passengers tend to favor Juanda/Abdulrachman Saleh. In general, the likelihood of a shift is higher when the differences in cost and time between the two airports are minimal. Conversely, when these differences are significant, passengers prefer to remain with the existing airports. Consequently, to increase the likelihood of passengers shifting to Kediri, it is essential to implement policies that reduce both the travel costs and travel time at Kediri Airport, making it a more competitive alternative to Juanda and Abdulrachman Saleh. In addition, the increase in passengers switching has been shown to be directly influenced by demand factors, infrastructure, or passenger preferences themselves.

Conflict of interest

The authors declare that they have no conflicts of interest regarding this research, whether financial, personal, authorship-related, or otherwise, that could influence the research and the results presented in this paper.

Financing

The study was performed without financial support.

Data availability

Data will be made available on reasonable request.

Use of artificial intelligence

The authors have used artificial intelligence technologies within acceptable limits to provide their own verified data, which is described in the research methodology section.

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