

# GIS-Based Land Suitability Analysis for a Tourism Airport in Bulukumba Regency, South Sulawesi, Indonesia

Qadriathi Dg Bau<sup>1,\*</sup>, Sakti Adji Adisasmita<sup>2</sup>, Yusi Kamin<sup>3</sup>, Sulaiman Abdullah<sup>4</sup>, Imam Basuki<sup>5</sup>

<sup>1</sup>Department of Civil Engineering and Planning Education, Universitas Negeri Makassar, Makassar, INDONESIA

<sup>2</sup>Department of Civil Engineering, Faculty of Engineering, Universitas Hasanuddin, Makassar, INDONESIA

<sup>3</sup>Department of Technical and Engineering Education, School of Education, Universiti Teknologi Malaysia, Johor Bahru, MALAYSIA

<sup>4</sup>Department of Electrical Engineering, Politeknik Negeri Kupang, Kupang, INDONESIA

<sup>5</sup>Department of Civil Engineering, Faculty of Engineering, Universitas Atma Jaya, Yogyakarta, INDONESIA

\*Corresponding author: [qadriathi.dg.bau@unm.ac.id](mailto:qadriathi.dg.bau@unm.ac.id)

SUBMITTED 28 November 2024 REVISED 11 August 2025 ACCEPTED 15 August 2025

**ABSTRACT** Bulukumba Regency is renowned for its rich cultural heritage and diverse tourism potential, positioning it as a prominent destination at both national and international levels. However, limited transportation infrastructure—particularly the absence of a local airport—presents significant accessibility challenges. Travel from Sultan Hasanuddin International Airport to Bulukumba requires approximately six hours by land, which hinders tourism development. This study aims to address this gap by: (1) identifying the most suitable location for a tourism-focused airport using the Analytical Hierarchy Process (AHP), and (2) generating a spatial suitability map for potential airport sites through GIS-based analysis. A weighted hierarchical quantitative approach was employed, using selection criteria based on the Indonesian Ministry of Transportation Regulation No. PM 55/2023 outlines seven key aspects and associated sub-criteria for airport site selection. Each criterion was assigned a weight reflecting its relative importance, followed by AHP analysis to determine the priority values of sub-criteria. The resulting weights were integrated into a Geographic Information System (GIS) to conduct spatial overlay analysis and identify optimal locations. The analysis identified Ara Village and Caramming Village as the most suitable locations for a tourism airport, with the highest composite score (226). Three alternative airport site maps were also produced, offering spatial options for future development. This study provides crucial insights to improve regional connectivity and support sustainable tourism growth in Bulukumba Regency.

**KEYWORDS** Tourist Airport; Land Suitability Analysis; Analytical Hierarchy Process (AHP); Geographic Information System (GIS); Bulukumba Regency.

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## 1 INTRODUCTION

Bulukumba Regency, located in South Sulawesi Province, is renowned for its rich cultural heritage and diverse tourism potential, positioning it as a prominent tourist destination at both national and international levels. According to data from the Bulukumba Regency Tourism Office (BPS Kabupaten Bulukumba, 2024), tourist visits significantly increased in 2022, with domestic tourists growing by 76%. Meanwhile, international tourist arrivals also rose sharply, from 57 to 744. Remarkably, even during the COVID-19 pandemic, the trend did not decline; instead, there was an increase of approximately 8% between 2019 and 2020, and 28% from 2020 to 2021.

Despite this growth, tourism development in Bulukumba faces several challenges, the chief of which is limited transportation infrastructure. Traveling from Sultan Hasanuddin International Airport in Makassar to Bulukumba requires approximately 6 hours by road. The absence of a regional airport is a major constraint,

creating a significant infrastructure gap and impeding efficient access for tourists.

Efficient air transportation is essential for tourism development, offering faster and more reliable access than other modes (Dileep and Pagliara, 2023; Diba and Roellyanti, 2022; Lubis and Bunahri, 2023). The development of a dedicated tourism airport in Bulukumba would not only enhance regional accessibility but also improve connectivity with other tourist hubs and airports, such as Toraja Airport, Aroepala Selayar Airport, Matahora Wakatobi Airport, Lombok International Airport, and Arung Palakka Bone Airport.

Airports serve as critical infrastructure, acting as gateways for air travel and playing a key role in improving the attractiveness and accessibility of tourist destinations (Dileep and Kurien, 2021). By reducing travel time and accommodating large passenger volumes, airports are often the first point of contact for international visitors (Cheung et al., 2022). The strategic loca-

tion of an airport significantly affects tourism growth, economic activity, and local accessibility (Adisasmita et al., 2017; Nugroho et al., 2024). In contrast, airports far from urban centers or economic zones may face reduced passenger volumes and lower aeronautical revenue (Candra and Afriyanto, 2024; Nugraha et al., 2018).

Unlike most regions in Indonesia, the Government of Bulukumba Regency has taken proactive steps by identifying three alternative sites to construct a dedicated tourism airport. The selection of the most suitable site must align with the criteria outlined in the Regulation of the Minister of Transportation of the Republic of Indonesia No. PM 55/2023 (Kementerian Perhubungan Republik Indonesia, 2023).

In this context, land suitability analysis is critical in identifying the optimal location for airport development. GIS offers a powerful spatial analysis platform, enabling the integration of diverse parameters such as topography, land use (Alam and Rahman, 2024), accessibility, and environmental conditions (Iamtrakul et al., 2024). It can even be used to predict land subsidence in underground coal mining (Djamaluddin et al., 2025). Complementing this, the AHP supports multi-criteria decision-making by assigning priority weights to each relevant factor (Alharasees and Kale, 2024; Dožić et al., 2023; Erkan and Elsharida, 2020).

While GIS- and AHP-based land suitability assessments have been widely applied across various domains (Nong et al., 2024), studies specifically targeting the identification of suitable sites for tourism-focused airports remain limited. This study addresses this gap by integrating GIS and AHP to evaluate potential locations for a tourism-specific airport in Bulukumba. GIS enables comprehensive spatial analysis by combining multiple datasets, while AHP enhances the decision-making process by systematically prioritizing multi-criteria considerations (Zewdie and Yeshanew, 2023; Erkan and Elsharida, 2020).

Therefore, the objectives of this study are: (1) to identify the most suitable locations for a tourism airport in Bulukumba Regency using the AHP approach; and (2) to produce a land suitability map for the airport development through spatial data analysis.

## 2 METHODS

### 2.1 Research Location

This research was conducted in Bulukumba Regency, South Sulawesi, Indonesia, which covers an area of approximately 1,176 km<sup>2</sup>. It borders Sinjai Regency to the north, Bone Bay to the east, Selayar Regency to the south, and Bantaeng Regency to the west. Geographi-

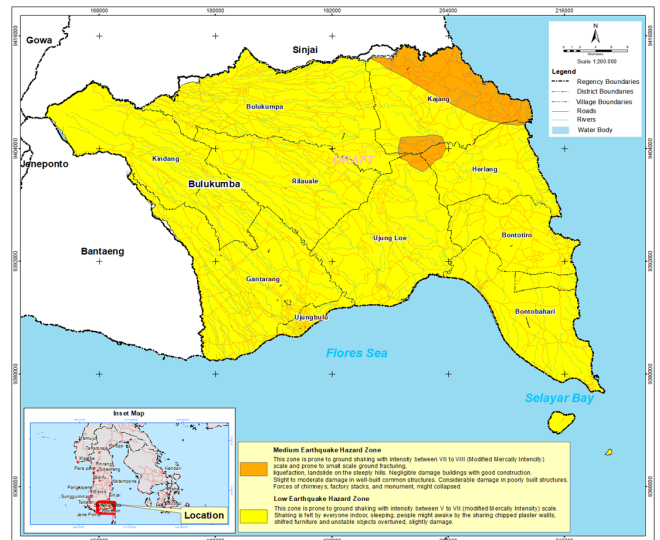


Figure 1 Research Location: Bulukumba Regency, South Sulawesi Province, Indonesia

cally, Bulukumba is located between 5°18'–5°40' South Latitude and 119°58'–120°28' East Longitude (Figure 1). Bulukumba is approximately 153 km from Makassar City, the capital of South Sulawesi province (BPS Kabupaten Bulukumba, 2024).

This regency has 14 tourist attractions, including nine beach destinations in three sub-districts and five cultural sites (BPS Kabupaten Bulukumba, 2024). The combination of natural, cultural, and economic features is crucial for the development of Bulukumba's regional tourism, particularly the need for infrastructure improvements, such as a dedicated tourism airport, to improve connectivity and accessibility with surrounding airports, particularly on Sulawesi Island, Bali, and Nusa Tenggara. The dedicated tourism airport can also accommodate travel for residents in surrounding regencies, such as Bantaeng Regency, Sinjai Regency, and the southern region of Bone Regency.

### 2.2 Data Collection

This study employed primary and secondary data collection techniques to ensure the accuracy and validity of the analysis. Primary data included topographic information obtained through the analysis of ASTER-GDEM imagery. The imagery was processed using ENVI 5.5 software to generate slope criteria, one of the indicators under the technical feasibility aspect. In addition, field measurements were conducted to collect soil samples, define the coordinates and boundaries of potential airport site polygons, and perform laboratory tests to assess soil conditions.

Furthermore, interviews were conducted to gather supporting data such as passenger potential and indicators related to social feasibility. These data sources

were used to assess the seven key aspects required for airport site selection, namely: technical, operational, economic, financial, environmental, social acceptance, and air transportation service aspects.

**Table 1. Aspects of Airport Site Selection**

No.	Aspect	Weight
1	Technical Feasibility	25
2	Operational Feasibility	26
3	Operational Feasibility	15
4	Economic and Financial Feasibility	10
5	Environmental Feasibility	10
6	Social Feasibility	10
7	Air Transport Service Feasibility	15

Source: ICAO and Ministry of Transportation (2023), with modifications.

Secondary data were obtained from relevant government institutions. These included documents such as the Local Transportation System Plan from the Bulukumba Regency Transportation Agency, the Regional Spatial Planning Documents from the Regional Development Planning, Research, and Innovation Agency of Bulukumba Regency, and statistical data from the Central Bureau of Statistics of Bulukumba.

### 2.3 Data Analysis

This study employed a weighted hierarchical quantitative approach to determine the most suitable airport location in Bulukumba Regency. The selection criteria were established based on the Regulation of the Minister of Transportation of the Republic of Indonesia No. PM 55/2023 (Kementerian Perhubungan Republik Indonesia, 2023), which outlines seven core aspects for airport site selection: technical feasibility, operational suitability, regional development potential, economic and financial viability, environmental sustainability, air transport service feasibility, and social acceptance.

Each aspect consists of several sub-criteria. Each aspect was assigned a specific weight, reflecting its relative importance in decision-making. The weighting process was guided by standards from the International Civil Aviation Organization (ICAO) and the Ministry of Transportation, with necessary modifications to suit local conditions (Table 1).

After the weights for each main aspect or criterion were established, the AHP was applied to determine the priority weights of the corresponding sub-criteria. AHP facilitates a structured comparison of variables through pairwise comparison, ensuring consistency and highlighting the relative significance of each sub-criterion in the decision-making process.

**Table 2. Rating Scale in A Decision Support System**

Intensity of Importance	Description	Explanation
1	Both elements are equally important	Both elements have the same level of influence
3	One element is slightly more important	Experience and judgment slightly favor one element over the other
5	One element is more important than the other	Experience and judgment strongly favor one element over the other
7	One element is more strongly important	One element is strongly supported and dominant in practice
9	One element is more critical.	There is the strongest possible evidence supporting one element over the other.
2, 4, 6, 8	Intermediate values between two judgments	These values are used when a compromise between two choices is needed

Source: Japari et al. (2020)

For instance, the technical feasibility aspect consists of six sub-criteria, each evaluated by assigning weights derived from the most influential variables using pairwise comparisons. This process ensures that each factor is appropriately prioritized.

The detailed weights and comparisons are presented in Table 2.

Each sub-criterion was scored using an ordinal scale, as the data has a clear ranking relationship. For instance, the topography variable is classified into four categories: a flat topography is assigned a score of 4, indicating it is highly suitable for airport development; very gently sloping areas receive a score of 3; gently sloping areas receive a score of 2; and moderately steep areas receive a score of 1. Another example: The score assessment for each aspect of operational feasibility is divided into three conditions, so the highest score is 3 and the lowest score is 1. Likewise, if there are only 2 conditions, this applies to all values for each condition based on the assessment sub-criteria for the seven aspects of location selection requirements.

The total scores from all seven aspects/criteria were then summed to determine the final composite score for each site. The site with the highest overall score was identified as the most suitable location. The resulting weights for the selected location were then integrated into a GIS for spatial analysis. GIS was employed to pro-

Table 3. Technical Feasibility Assessment for the Development of a Tourism Airport Location

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
1	Topography	Flat	4	5	15	20	15
		Very gently sloping	3				
		Gently sloping	2				
		Moderately steep	1				
2	Soil Surface Condition and Slope Suitability	Good and suitable	3	5	10	10	10
		Moderate and suitable	2				
		Poor	1				
3	Surface Water Flow / Drainage System	Flowing	2	4	8	8	8
		Stagnant	1				
4	Meteorology and Geophysics	Meets Requirements	2	3	6	6	6
		Does Not Meet Requirements	1				
5	Soil Bearing Capacity and Structure	CBR >6	2	5	10	10	10
		CBR <6	1				
6	Infrastructure and Utility Networks	Available	3	3	9	9	9
		Will Be Provided	2				
		Not Available	1				
Total Location Score					58	63	58

Source: Data analysis results (2023)

cess spatial data and generate a map suitable for the proposed tourism airport site in Bulukumba.

GIS provides an effective solution for representing spatial elements. GIS offers analytical advantages in the site selection process based on predefined parameters in this context. This approach is supported by recent studies such as Zewdie and Yeshanew (2023) and Erkan and Elsharida (2020).

Once the most suitable location was identified, the coordinates of the proposed airport area—obtained through field measurements—were plotted and stored in the GIS database as spatial and attribute data.

### 3 RESULTS

Based on the results of field data analysis, laboratory testing, and interviews conducted for the three alternative locations proposed for a special tourism airport—Alternative 1 in Jalanjang Village, Alternative 2 in Bal-leanging Village, and Alternative 3 in Ara and Caram-ming Villages—seven key aspects were evaluated to determine the most suitable location.

#### 3.1 Technical Feasibility Aspect

The technical feasibility aspect comprises six sub-criteria: topography, soil conditions, drainage, meteorology and geophysics, soil bearing capacity, and infrastructure or utility networks. Each sub-criterion was weighted using the AHP (Table 3) and multiplied by the sub-criterion score. An ordinal scale was used to assign scores from highest to lowest based on airport site selection requirements.

For example, the land should be relatively flat with minimal slope to facilitate the construction and operation of runways, aprons, and other required facilities. Thus, flat topography was given the highest score (4), while slightly steep terrain received the lowest score (1). The soil must have sufficient strength to support the aircraft load and airport infrastructure. The site should also have an effective drainage system to prevent waterlogging, which can disrupt airport operations.

Other considerations include wind direction and speed, as these factors affect the direction and speed of aircraft during landing and takeoff. Rainfall intensity and visibility are also critical—heavy rain and limited visibility can compromise flight safety, while extreme temperatures can impact aircraft engine performance.

Lastly, infrastructure and utility networks are essential. The airport must be easily accessible via road, rail, or other public transportation. Adequate access roads will facilitate the movement of passengers, cargo, and airport staff.

#### 3.2 Operational Feasibility Aspect

The operational feasibility aspect comprises eight sub-criteria closely related to standard operating procedures that must be well-established and properly implemented to ensure operational safety and efficiency. These sub-criteria serve as key considerations for the usability of air traffic, spatial conditions, aircraft type compatibility, and weather-related factors (Table 4).

Good visibility is critical for flight safety, especially during takeoff and landing. Therefore, the airport run-

Table 4. Operational Feasibility Assessment of Tourism Airport Location

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
1	Spatial Condition	No obstacle	3	4	4	4	12
		Obstacle present	2				
		Obstacle (removable)	1				
2	Usability Factor (including wind rose study)	Usability Factor >95%	2	4	8	8	8
		Usability Factor <95%	1				
3	Air Traffic Service Unit	POST ENTRY	3	2	6	6	6
		ADC	2				
		APPLICATION	1				
4	Planned Aircraft Type	Large	2	3	6	6	6
		Small (phased)	1				
5	Weather Influence	No Influence	2	2	4	4	4
		Affected	1				
6	Ceiling	Ceiling >300 m	2	3	6	6	6
		Ceiling <300 m	1				
7	Visibility	Visibility <4.8 km	2	4	8	8	8
		Visibility >4.8 km	1				
8	Landing and Takeoff Procedure	Both Directions Usable	2	4	8	8	8
		Only One Direction is Usable	1				
Total Location Score					50	50	58

Source: Data analysis results (2023)

Table 5. Regional Development Feasibility Assessment of the Tourism Airport Area

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
1	Compliance with National Spatial Plan (RTRW)	Compliant	3	2	4	4	4
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
2	Compliance with Provincial Spatial Plan (RTRW)	Compliant	3	2	6	6	6
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
3	Compliance with Regency/City Spatial Plan (RTRW Regency/City)	Compliant	3	2	6	6	6
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
4	Compliance with National Transportation Plan	Compliant	3	1	1	1	1
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
5	Compliance with Regional Transportation Plan	Compliant	3	1	3	3	3
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
6	Compliance with Local Transportation Policy	Compliant	3	1	2	2	2
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
7	Regional Disaster Risk Policy	Compliant	3	4	4	4	4
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
8	National Airport Master Plan Policy	Compliant	3	2	2	2	2
		Not Included, Will Be Adjusted	2				
		Non-Compliant	1				
Total Location Score					28	28	28

Source: Data analysis results (2023)

Table 6. Economic and Financial Feasibility Assessment of Tourism Airport Location

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
<b>Economic Feasibility</b>							
1	Net Present Value (NPV)	NPV >0	2	2	4	4	4
		NPV <0	1				
2	Economic Internal Rate of Return (EIRR)	EIRR >Bank Interest Rate	2	1	2	2	2
		EIRR <Bank Interest Rate	1				
3	Profitability Index (PI) / Benefit-Cost Ratio (BCR)	PI >1, BCR >1	2	1	2	2	2
		PI <1, BCR <1	1				
4	Payback Period (PP)	PP <20 Years	2	1	2	2	2
		PP >20 Years	1				
<b>Financial Feasibility</b>							
5	Net Present Value (NPV)	NPV >0	2	2	4	4	4
		NPV <0	1				
6	Financial Internal Rate of Return (FIRR)	FIRR >Bank Interest Rate	2	1	2	2	2
		FIRR <Bank Interest Rate	1				
7	Profitability Index (PI) / Benefit-Cost Ratio (BCR)	PI >1, BCR >1	2	1	2	2	2
		PI <1, BCR <1	1				
8	Payback Period (PP)	PP <20 Years	2	1	2	2	2
		PP >20 Years	1				
<b>Total Location Score</b>					20	20	20

Source: Data analysis results (2023)

way must be free from obstacles, including mountains, tall buildings, or structures that may interfere with flight paths. An ideal runway should be aligned with the prevailing wind direction and minimize crosswind impact to support safe aircraft operations.

The Federal Aviation Administration (FAA) recommends that runway orientation ensure 95% wind coverage, based on observations of wind data, to allow for safe aircraft movements under most weather conditions.

### 3.3 Regional Development Aspect

The regional development aspect includes eight sub-criteria (Table 5). The selected airport location must align with the Spatial Planning Policy (RTRW) at the national, provincial, and regency levels. Additionally, the site must be integrated into national, provincial, and local transportation systems. Therefore, spatial alignment with other regional development plans—such as industrial zones, residential areas, and public facilities—is essential. It is important to avoid locations that could trigger spatial conflicts or hinder regional development initiatives.

Considerations must include the provincial and regional RTRW, regional transportation frameworks, and the potential for natural disaster-prone areas. This alignment ensures coherence with broader development strategies. Evidence from airport development projects in East Kalimantan, Indonesia, has shown that

compliance with RTRW policies is crucial for securing project approval and ensuring long-term sustainability (Agustaniah et al., 2022).

Furthermore, the airport must have a disaster preparedness plan to address risks such as earthquakes, flooding, or strong winds. An integrated security system should also be in place to safeguard the airport and its passengers from potential security threats.

### 3.4 Economic and Financial Feasibility Aspect

The economic and financial feasibility aspect comprises eight sub-criteria related to construction and operational costs (Table 6). The development and operational costs of the airport must be affordable and aligned with the available budget. The airport's location should be strategically positioned to stimulate regional economic growth, particularly in tourism, trade, and industry sectors. It must generate positive economic impacts for surrounding communities, including job creation, income generation, and support for local business development.

Economic metrics such as Net Present Value (NPV), benefit-cost ratio, and payback period are analyzed to evaluate the economic and investment feasibility of the airport project. This analysis is essential for ensuring the long-term sustainability of the development.

In the case of the three proposed locations for the tourism airport, all alternatives received the same score of 20 for this aspect. This uniformity suggests that

Table 7. Environmental Feasibility Assessment of Tourism Airport Location

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
1	Natural Environment	No land conversion or nature reserve	2	3	6	6	6
		Land conversion or nature reserve present	1				
2	Land Allocation	Non-agricultural, non-residential	2	3	3	3	6
		Agricultural, residential	1				
3	Land Ownership	Owned by the local government and community	2	2	2	2	4
		Owned by the community	1				
4	Surface Water Flow/Drainage	Controllable	2	2	4	4	4
		Uncontrollable	1				
Total Location Score					15	15	20

Source: Data analysis results (2023)

Table 8. Social Feasibility Assessment of Tourism Airport Location

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
1	Population Relocation	No population/route relocation	2	2	2	2	4
		Population/route relocation required	1				
2	Cultural Compatibility	Compatible	2	2	4	4	4
		Not compatible	1				
3	Community Impact of Airport	Controllable and can be minimized	2	3	3	3	6
		Uncontrolled and not minimized	1				
4	Employment/Population Benefit	Creates job opportunities	2	3	6	6	6
		No job opportunities	1				
Total Location Score					15	15	20

Source: Data analysis results (2023)

while the project may be economically feasible, it might not yet be financially profitable. Studies on small-scale regional airports indicate that initial revenues are often insufficient to cover investment and operational costs, necessitating strategic interventions to enhance profitability (Samunderu, 2023).

### 3.5 Environmental Feasibility Aspect

The environmental feasibility aspect is divided into four sub-criteria: natural environment, land allocation, land ownership, and drainage control (Table 7). Airport development can have significant environmental and social impacts, such as land-use changes and disruptions to local communities. Therefore, the selected site must have sufficient land availability for constructing runways, terminals, supporting facilities, and future expansion areas.

An environmental impact assessment (EIA) should be conducted to minimize adverse effects and ensure that the airport development is socially acceptable, including obtaining community support through the voluntary release of privately owned land for the tourism airport project.

Among the three proposed alternatives, the third location received the highest score of 20, compared to the

other two alternatives, which each scored 15. This indicates that the third location offers the most favorable environmental conditions for airport development.

### 3.6 Social Feasibility Aspect

The social feasibility aspect consists of four sub-criteria: population relocation impact, cultural compatibility, impact of airport development on communities, and job creation (Table 8). The government is obligated to provide fair and transparent compensation for land or assets affected by the airport development, and to ensure that community rights—including land rights, environmental rights, and socio-cultural life—are protected throughout the development process. This helps to minimize potential social conflicts related to land acquisition, compensation, or unequal economic impacts experienced by the community.

A comprehensive assessment of social feasibility will help ensure that the airport project is not only technically and economically viable but also socially beneficial to residents and capable of minimizing conflict risks. By incorporating social feasibility considerations, the airport development can proceed smoothly and sustainably, while generating long-term positive impacts for the region.

Table 9. Air Transport Service Feasibility Assessment for Tourism Airport Location

No.	Evaluation Criteria Sub-criteria	Condition	Score	Weight	Location Score		
					Alternative 1	Alternative 2	Alternative 3
1	Service Coverage	Able to Reach All Planned Areas	3	2	6	6	6
		Partially Able to Reach Planned Areas	2				
		Unable to Reach Planned Areas	1				
2	Passenger Potential	Existing Potential	2	2	4	4	4
		No (Low) Passenger Potential	1				
3	Cargo Potential	Cargo Potential Exists	2	1	2	2	2
		No (Low) Cargo Potential	1				
4	Flight Route Potential	Existing Demand for Flight Routes	2	2	4	4	4
		No Demand for Flight Routes	1				
5	Airport System	Single Airport	2	1	2	2	2
		Multiple Airports	1				
6	Fleet Availability	Service Fleet Available	2	1	2	2	2
		No Available Service Fleet	1				
7	Multimodal Logistics	Available	2	1	2	2	2
		Not Available	1				
Total Location Score					22	22	22

Source: Data analysis results (2023)

Table 10. Final Scores for Airport Location Alternatives

Location	Technical	Operational	Regional Development	Economic & Financial	Environmental	Social	Air Transport Services	Total
Alternative 1 (Jalanjang Village)	58	50	28	20	15	15	22	208
Alternative 2 (Balleanging Village)	63	50	28	20	15	15	22	213
Alternative 3 (Ara and Caramming Villages)	58	58	28	20	20	20	22	226

The first and second alternative locations scored 15, which is lower than the third alternative, which received a score of 20, indicating a higher level of social acceptability for the third site.

### 3.7 Air Transport Service Feasibility Aspect

Air transport services (Table 9) must be able to reach all designated regions, with sufficient passenger potential and availability of multimodal logistics. Accessibility is also a crucial factor, including the availability of roads or other modes of transportation connecting the airport to city centers and surrounding areas. All three alternative locations received the same score of 22, indicating that each is considered equally feasible regarding air transport service provision.

After obtaining scores for each of the seven feasibility aspects across the three alternative locations for developing a special tourism airport, these scores were

summed to determine the final ranking and the most suitable location. The third alternative, encompassing Ara Village and Caramming Village, achieved the highest total score of 226, outperforming the first alternative (Jalanjang Village) with 208 and the second alternative (Balleanging Village) with 213 (Table 10).

## 4 DISCUSSION

The results of the land suitability analysis based on the seven aspects outlined in PM 55/2023 indicate that the third alternative location, namely Ara Village and Caramming Village, is the most appropriate site for developing a special tourism airport in Bulukumba Regency. This location received the highest score of 226 (Figure 4), surpassing the second location in Balleanging Village (score 213, Figure 3) and the first in Jalanjang Village (score 208, Figure 2). This advantage reflects spatial suitability and strategic technical, social, and economic strengths.

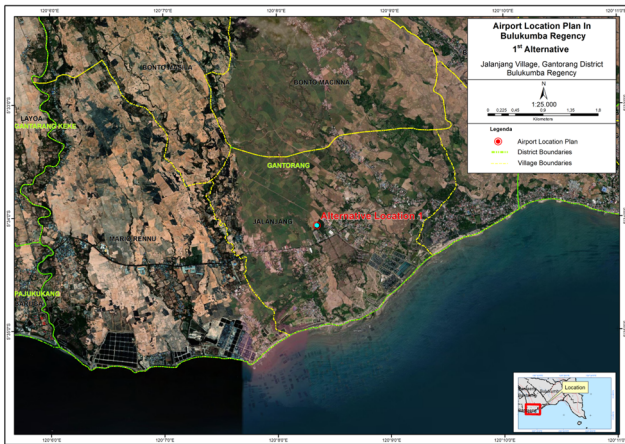


Figure 2 First alternative airport location in Jalanjang Village



Figure 3 Second alternative airport location in Balleanging Village

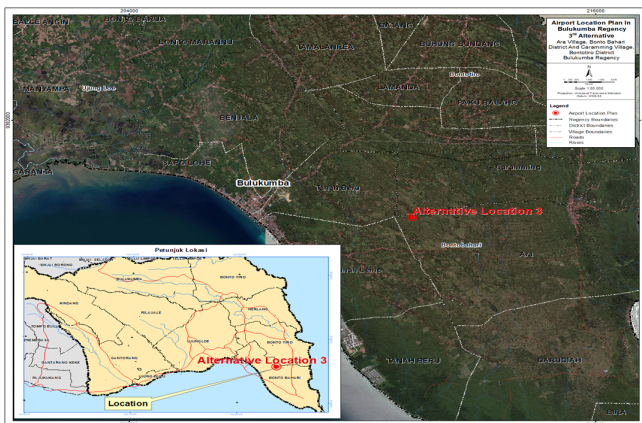


Figure 4 Third alternative airport location in Ara and Caramming Villages

From a technical standpoint, the gently sloping topography at the third location supports the construction of a runway with an average gradient that falls within the acceptable tolerance range according to ICAO standards, which allow a maximum slope variation of 1.5% (Lakshmanan, 2023). The absence of physical obstacles

around the proposed airport site enhances its operational and safety suitability. Obstacles in airport safety zones, as highlighted by Wandelt et al. (2024), significantly increase operational risks and may require costly mitigation efforts.

In Jalanjang Village (Figure 2), the first alternative location is situated on lowland topography near the coastline, with an elevation ranging from 0 to 25 meters above sea level. Agriculture, plantations, and residential areas dominate the land use. While this location is spatially suitable to some extent, its proximity to settlements increases potential social and land acquisition challenges, which contributed to its lower total score of 208.

The second alternative in Balleanging Village (Figure 3) offers relatively flat topography with predominant land use consisting of rubber plantations, agricultural fields, and scattered settlements. The site benefits from road access and diversified land utilization, including small-scale industries and trade activities. However, productive land and moderate settlement density increase acquisition costs and social sensitivity, resulting in a score of 213.

Regarding social and land acquisition factors, the third location demonstrates the most advantages (Figure 4). Most of the land is vacant or covered with shrubs, and ownership is held mainly by the government or residents willing to release their land. This significantly reduces potential social conflicts and lowers land acquisition costs. Monterrubio et al. (2020) emphasized that high levels of social acceptance strongly influence the success of transportation infrastructure projects, particularly in rural areas. Similarly, Isworo (2023) pointed out that efficient land acquisition processes significantly accelerate airport development timelines.

The environmental aspect is another important consideration. The third location is relatively free from conservation or protected areas that could pose ecological risks. This minimizes the likelihood of resistance from environmental advocacy groups and simplifies environmental permitting processes. Integrating GIS in spatial analysis enables the identification of ecologically sensitive areas and ensures that the selected site poses minimal environmental impact (Zewdie and Yeshanew, 2023).

## 5 CONCLUSION

This study highlights the spatial suitability of three alternative locations for a special tourism airport in Butukumba Regency, evaluated through a comprehensive analysis using the AHP and GIS methods. The first alternative location in Jalanjang Village received the lowest total score of 208 compared to the other two, while

the second alternative in Balleanging Village scored 213, benefiting primarily from its flat topography sub-criterion. In contrast, the third alternative in Ara and Caramming Villages achieved the highest total score of 226, making it the most suitable site for developing a tourism-specific airport.

The advantages of the third location include the absence of obstacles that could interfere with aircraft takeoff and landing, no need for resident relocation, and minimal social impact, which can be effectively managed. Thus, among the three options, the third location emerges as the most viable for the tourism airport in Bulukumba Regency.

This study provides valuable stakeholder insights, offering a systematic approach to evaluating airport development feasibility. Future research should focus on a more detailed cost-benefit analysis, EIA, and community engagement to ensure that the project aligns with local aspirations and contributes to the long-term socioeconomic growth of Bulukumba Regency.

## DISCLAIMER

The authors declare no conflict of interest.

## ACKNOWLEDGMENTS

The authors thank the Government of Bulukumba Regency for funding this research under Contract Number 01/SPKP/X/2023.

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