OPEN ACCESS

DOI: doi.org/10.64780/jeims.v1i1.3

Journal of Engineering Innovation and Management Science Vol 1 No 1. (2025)

Research Article

Infrastructure Development Priority Analysis of Road Networks Using the AHP Method (Study Case: Inter-District Capital Connector in Mesuji Regency, Lampung)

Aldi Dwi Mawardi[1,a*)]; Indah Marlina Ardianti[2,b]

Received : 04 April 2025	Revised : 02 May 2025	Accepted : 30 May 2025	Online : 30 June 2025

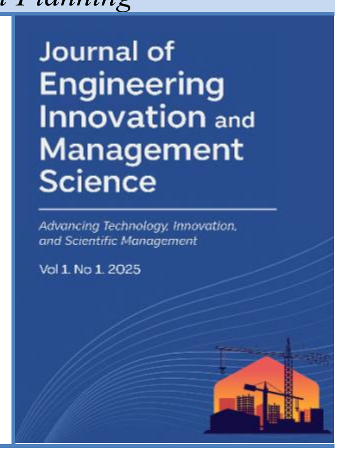
Abstract

Road infrastructure serves as a crucial component in supporting regional development by connecting administrative areas and facilitating economic and social mobility. In Mesuji Regency, Lampung Province, the limited accessibility between sub-district capitals due to poor road conditions and insufficient pavement quality poses a significant challenge to infrastructure planning and equitable regional growth. This study aims to analyze the priority of road infrastructure development using the Analytical Hierarchy Process (AHP), integrating both qualitative and quantitative data through field surveys, expert judgment, and Focus Group Discussions (FGD). The assessment employs four key criteria: road condition, pavement type, spatial/regional planning (RTRW), and social aspects. The results indicate that road condition is the most influential factor in determining development priority, followed by pavement type, spatial function, and social indicators. Among the six evaluated road segments, Segment E-characterized by unpaved, severely damaged roads in an agriculturally productive area emerged as the top priority with a score of 0.4425. Segment F ranks second (0.2516), followed by Segment D (0.2325), Segment A (0.2220), Segment B (0.2184), and Segment C (0.1803). These findings emphasize the importance of strategic infrastructure investment focused on enhancing connectivity and supporting local economies. The AHP-based framework provides a rational, transparent approach to guiding infrastructure development decisions, particularly in resource-limited regions. It also serves as a policy recommendation tool for regional planning authorities to ensure sustainable and inclusive development.

Keywords: *AHP; Development Priority; Mesuji; Road Infrastructure; Sppatial Planning*

How to Cite:

Mawardi, A. D., & Ardianti, I. M. (2025). Infrastructure Development Priority Analysis of Road Networks Using the AHP Method (Study Case: Inter-District Capital Connector in Mesuji Regency, Lampung). *Journal of Engineering Innovation and Management Science*, *1*(1), 25–40.



INTRODUCTION

Road infrastructure plays a crucial role in facilitating regional connectivity, enabling the movement of people, goods, and services, and thus fostering economic growth and social inclusion (Faber, 2014; Irefan & Adry, 2018; Nopiah et al., 2024). In many rural and developing regions, such as Mesuji Regency in Lampung Province, Indonesia, access to adequate road networks is essential for supporting agricultural distribution, trade, and public service delivery(Malhotra et al., 2021). Mesuji is characterized as an agrarian region, with a majority of its population relying on agriculture and plantation commodities especially rubber and palm oil as their primary livelihood. Effective road connectivity between sub-district capitals in the regency is crucial to facilitate the movement of agricultural products and stimulate rural economies (Manjunath & Kannan, 2017; Zolotarev et al., 2023). However, the current condition of road infrastructure in this area is significantly underdeveloped, with only a small proportion classified as being in good condition. The majority of roads are reported to be damaged or severely degraded, posing challenges for mobility and market access (Venna & Romulo, 2024; Zolotarev et al., 2023). These constraints are particularly evident during the rainy season, when unpaved roads become inaccessible and disrupt economic activities. Poor road conditions also contribute to spatial disparities and hinder equal opportunities for development across sub-districts.

Mesuji Regency has been identified in the Lampung Province Spatial Plan (RTRW 2009–2029) as a strategic growth area aimed at supporting economic decentralization through the development of agropolitan and minapolitan zones, trade and service centers, and rural terminals. These initiatives are expected to accelerate regional development by creating production and distribution hubs beyond the provincial capital. However, the realization of such spatial planning objectives requires corresponding investments in supporting infrastructure, particularly road networks(Liu et al., 2020; Schindler & Kanai, 2021). Roads serve not only as logistical corridors but also as enablers of equitable growth, especially in areas with geographically dispersed populations and economic centers. Without reliable transportation access, the intended regional integration and resource distribution will remain constrained (Nuutinen & Miina, 2023; Sumbal et al., 2023). Despite these ambitions, the development of road infrastructure in Mesuji remains uneven and fragmented. Many road segments critical to inter-district accessibility have not received sufficient attention in terms of systematic planning or prioritization. As a result, the infrastructure development process lacks the strategic coherence needed to maximize impact and align with long-term spatial development goals.

Given budgetary limitations and competing demands, local governments must make informed decisions about which infrastructure projects should be prioritized (Franklin & Carberry-George, 1999; Warner, 2010). Strategic planning in this context requires a structured approach to decision-making that integrates technical, spatial, and social considerations (Andersen, 2004; Radmehr et al., 2022; Wiek & Walter, 2009). Pavement quality, as a critical technical aspect, is directly influenced by material properties such as resilient modulus, which determines the structural capacity and long-term performance of road surfaces, particularly in rural areas (Karami et al., 2020). One widely recognized method for supporting such decision-making processes is the Analytical Hierarchy Process (AHP), which enables multi-criteria evaluations based on expert judgment and quantitative analysis. AHP facilitates the ranking of alternatives by assigning weights to different criteria, resulting in a transparent and replicable prioritization model. Although this method has been applied in various infrastructure planning studies, applications specifically focusing on rural or inter-sub-district roads especially in underdeveloped regions like Mesuji remain limited. Additionally, previous research tends to emphasize physical road conditions while overlooking the importance of regional spatial policies and social dynamics. These limitations point to the need for a more integrated assessment framework that can assist decision-makers at the local level. Developing such a framework is essential for aligning infrastructure investments with both community needs and strategic development plans (Esteves, 2008; He et al., 2011; Ran & Nedovic-Budic, 2016).

Although numerous studies have demonstrated the effectiveness of AHP in infrastructure planning, the majority have centered on urban roads or national-level projects. Little attention has been paid to how AHP can be adapted to prioritize rural roads that connect administrative centers within a regency. Moreover, past research rarely incorporates regional planning directives (RTRW) alongside technical and socioeconomic criteria in a single decision-making model. This creates a gap in knowledge, particularly regarding localized applications of AHP that reflect regional priorities and constraints. In Mesuji, where spatial planning identifies key growth zones and economic corridors, integrating these elements into infrastructure planning is essential. However, there is currently a lack of tools that effectively combine expert insights, planning regulations, and empirical field data to guide road development. Addressing this gap can enhance the strategic allocation of limited resources and improve the overall effectiveness of infrastructure programs. It also provides a pathway for developing scalable and replicable models applicable to other rural and underserved regions.

This study aims to develop a priority-based assessment model for inter-sub-district road infrastructure in Mesuji Regency using the Analytical Hierarchy Process (AHP). The research focuses on evaluating multiple road segments through a set of criteria, including road condition, pavement type, spatial alignment with RTRW, and social relevance. Primary data were collected through field surveys and expert consultations, while secondary data were sourced from regional planning documents and statistical records. The AHP model was applied to derive weighted scores for each criterion and rank the road segments accordingly. The outcome is a prioritized list of road segments that require urgent development attention. By presenting a data-driven and participatory decision-making tool, the study offers practical recommendations for local authorities to enhance infrastructure planning. The findings are expected to support evidence-based policymaking, ensure more equitable infrastructure allocation, and contribute to sustainable regional development strategies.

METHODS

This study employed an exploratory research design, integrating both qualitative and quantitative approaches to evaluate the prioritization of road infrastructure development in Mesuji Regency, Lampung Province. Data were collected through field surveys and expert consultations, supported by secondary data from regional planning documents. The research was structured into three primary stages: data collection, criteria structuring, and priority analysis using the Analytical Hierarchy Process (AHP).

Primary Data Collection

Primary data were obtained through direct field observations across selected inter-sub-district road segments. Two key aspects were observed: road condition and pavement type. Road condition was classified into three categories damaged, moderate, and good—based on visual assessments. Pavement types were categorized into four types: earth, gravel, asphalt, and concrete. These observations allowed the researchers to identify the existing physical condition of each road segment, which later informed the decision-making hierarchy in the AHP analysis.

Secondary Data Collection

Secondary data were sourced from the Mesuji Regional Development Planning Agency (BAPPEDA), particularly the Regional Spatial Plan (RTRW) 2011–2031 and its accompanying thematic maps. These documents were used to identify spatial planning objectives and development zones relevant to each road segment, such as tourism areas, agropolitan and minapolitan zones, trade and service centers, ASDP ferry network plans, and rural terminal development.

Hierarchy Development and Criteria Selection

Based on literature review and contextual relevance, the AHP model in this study adopted four main criteria: Road Condition (KJ), Pavement Type (PJ), Spatial Planning/Regional Function (RTK), and Social Aspects (SOS). Each criterion was further defined by sub-criteria. For example, the social criterion included income level and trip attraction intensity, while the spatial criterion reflected compliance with RTRW directives. A hierarchical structure was developed to represent the decision problem, with the ultimate goal of ranking the priority levels of six inter-sub-district road segments.

Pairwise Comparison and Weight Assignment

Pairwise comparisons were performed to assess the relative importance of each criterion and sub-criterion. A scale ranging from 1 (equal importance) to 9 (extreme importance) was used, as proposed by Saaty (1980). The comparisons were conducted based on expert judgment gathered through Focus Group Discussions (FGDs) involving relevant stakeholders, including officials from BAPPEDA, public works departments, and transportation planners. The resulting pairwise matrices were used to calculate eigenvalues and determine the relative weights of each criterion.

Consistency Ratio Analysis

To ensure the validity of the judgments, a consistency ratio (CR) was calculated for each pairwise matrix. A CR value less than or equal to 0.1 was considered acceptable, indicating logical consistency in the responses. If the CR exceeded 0.1, the matrix would be revised and re-evaluated. Only consistent matrices were used to proceed with the synthesis of priorities and final ranking of road segments.

Synthesis and Priority Ranking

Finally, weighted scores from all criteria were aggregated for each alternative (road segment) to derive a composite priority value. These values were used to rank the road segments from highest to lowest priority for development. The resulting ranking offers a transparent and evidence-based foundation for local decision-makers to allocate resources effectively and plan infrastructure interventions that are aligned with both physical needs and spatial development goals.

RESULT AND DISCUSSIONS

The AHP data analysis was conducted in two stages: individual assessments by competent practitioners and a collective evaluation through a Focus Group Discussion (FGD). The complete results of each analysis are presented in the Appendix. The priority weightings for each criterion, as assessed by the practitioner respondents, are summarized as follows:

Table 1. Recapitulation of Consistency Ratio (CR) Value for Each Responden

No	Practitioner Respondent	CR ≤ 0,1	Description
1	Secretary of Regional Development Planning, Research and Development Agency	0,0512	Consisten
2	Head of Planning, Control, and Evaluation of Regional Development Division	0,0256	Consisten
3	Head of Road and Bridge Division (Bina Marga)	0,0319	Consisten
4	Analyst Staff for Road and Bridge Network Systems	0,0512	Consisten
5	Secretary of the Department of Social Affairs	0,0319	Consisten
6	Staff of the Poverty Alleviation Division	0,0256	Consisten

The previous table demonstrates that all practitioner respondents yielded Consistency Ratio (CR) values ≤ 0.1, indicating that their assessments were consistent in evaluating the relative importance of each criterion. Subsequently, the analysis proceeded with the results derived from the Focus Group Discussion (FGD). The pairwise comparison matrix for the criteria is presented as follows:

Table 2. Pairwise Comparison Matrix (FGD Result)

Criteria	SOS	RTK	PJ	KJ
SOS	1,00	1,00	0,20	0,14
RTK	1,00	1,00	0,20	0,14
PJ	5,00	0,20	1,00	0,71
KJ	7,00	0,14	0,71	1,00
Total	14,00	2,34	2,11	2,00

Table 3. Normalized Matrix and Priority Weights (FGD Results)

Criteria	SOS	RTK	PJ	KJ	Total	Priority	Eigen Value
SOS	0,07	0,43	0,09	0,07	0,66	0,17	2,32
RTK	0,07	0,43	0,09	0,07	0,66	0,17	0,39
PJ	0,36	0,09	0,47	0,36	1,27	0,32	0,67
KJ	0,50	0,06	0,34	0,50	1,40	0,35	0,70
Total	1,00	1,00	1,00	1,00	4,00	1,00	4,09

Legend:
SOS = Social Aspect
RTK = Spatial Planning (RTRW)
PJ = Pavement Type
KJ = Road Condition

Table 4. Tabulation of Priority for All Criteria and Sub Criteria (FGD Results)

Main Criteria	Priority Weight	Sub Criteria	Priority Weight
Social	0,17	Income	0,25
		Trip Attraction	0,50
Spacial Planning (RTRW)	0,17	ASDP	0,06
		Terminal Type-C Development	0,15
		Tourism	0,17
		Agropolitan Minapolitan	0,29
		Trade and Service	0,40
Pavement Type	0,32	Concrete	0,08
		Asphalt	0,28
		Gravel	0,31
		Earth	0,33
Road Condition	0,35	Good	0,13
		Moderate	0,16
		Severely Damaged	0,71

Table 5. Tabulation of Priority Weights Based on Practitioner Assessments

No	Criteria/Sub Criteria	Secretary of Bappelitbangda	Head of Regional Planning & Evaluation	Head of Road Infrastructure Division	Road Network System Analyst	Seecretary of Social Services	Poverty Alleviation Staff
1	Road Condition	0,35	0,37	0,35	0,35	0,35	0,37
	Good	0,13	0,11	0,13	0,13	0,13	0,11
	Moderate	0,21	0,18	0,16	0,21	0,16	0,18
	Severely Damaged	0,66	0,70	0,71	0,66	0,71	0,70
2	Pavement Type	0,33	0,27	0,32	0,33	0,32	0,27
	Concrete	0,07	0,11	0,08	0,07	0,08	0,11
	Earth	0,33	0,32	0,33	0,33	0,33	0,32
	Gravel	0,32	0,31	0,31	0,32	0,31	0,31
	Asphalt	0,28	0,26	0,28	0,28	0,28	0,26
3	Spatial Planning (RTRW)	0,19	0,18	0,17	0,19	0,17	0,18
	ASDP Ferry Network	0,05	0,09	0,06	0,05	0,06	0,09
	Terminal Type C Development	0,14	0,15	0,15	0,14	0,15	0,15
	Tourism	0,24	0,17	0,17	0,24	0,17	0,17
	Agropolitan	0,24	0,26	0,29	0,24	0,29	0,26
	Minapolitan						
	Trade and Service	0,44	0,44	0,40	0,44	0,40	0,44
4	Social	0,13	0,18	0,17	0,13	0,17	0,18
	Income	0,17	0,13	0,25	0,17	0,25	0,13
	Trip Attraction	0,56	0,58	0,50	0,56	0,50	0,58

Road Segment A connects the capital of Way Serdang District to the capital of Simpang Pematang District in Mesuji Regency. This segment is predominantly paved with asphalt and is in good condition, as most of the road is under provincial jurisdiction. The land use along this segment is primarily agricultural plantations. Road Segment B connects the capital of Simpang Pematang District to the capital of Panca Jaya District. This segment is mainly paved with concrete and is also in good condition. The land use along this road consists of plantations. Additionally, the presence of a market in Simpang Pematang acts as a major activity center, generating significant trip attractions along this segment. Road Segment C connects the capital of Panca Jaya District to the capital of Tanjung Raya District. It is predominantly concrete-paved and in good condition. The surrounding land is used for plantations. Tanjung Raya District is also home to the Kehati Park, a local tourist attraction that draws visitors on certain days. Road Segment D links the capital of Tanjung Raya District with the capital of East Mesuji District. The segment is primarily paved with gravel and is in good condition. The surrounding land comprises both plantation and rice fields. During certain seasons, this segment is heavily trafficked by trucks transporting harvested rice. Road Segment E connects the capital of East Mesuji District to the capital of Mesuji District. It is mostly composed of unpaved (earthen) roads in poor condition. The land use includes both plantations and rice fields. During the rainy season, road conditions pose a significant challenge for local residents in transporting their rice harvests. Poor infrastructure here contributes to the area's isolation and hinders its development relative to other regions. Road Segment F connects the capital of East Mesuji District with the capital of Rawa Jitu Utara District. This segment predominantly consists of earthen pavement in moderately damaged condition. The area serves as both agropolitan and minapolitan zones. Rice is a key agricultural commodity in this area, highlighting the need for increased government attention to improve this road segment.

Table 6. Existing Road Section According to Practitioner Responden

No	Practitioner	Alternative Road Segment	Criteria: Social	District Spatial Plan (RTRW)	Road Pavement	Road Condition	
		Road Segment A	**Sub-Criteria: Income**	**Agropolitan Minapolitan**	**Asphalt**	**Good**	**Total**
1	Secretary of Bappelitbangda		0,0313	0,0538	0,0931	0,0445	0,2226
2	Head of Planning and Evaluation		0,0449	0,0515	0,0745	0,0470	0,2179
3	Head of Bina Marga Division		0,0415	0,0476	0,0891	0,0439	0,2220
4	Road Network Analyst		0,0313	0,0538	0,0931	0,0445	0,2226
5	Secretary of Social Service		0,0415	0,0476	0,0891	0,0439	0,2220
6	Poverty Management Staff		0,0449	0,0515	0,0745	0,0470	0,2179
		Road Segment B	**Sub-Criteria: Trip Attraction**	**Trade and Service**	**Concrete**	**Good**	**Total**
1	Secretary of Bappelitbangda		0,0626	0,0753	0,0260	0,0445	0,2083

2	Head of Planning and Evaluation	0,0898	0,0721	0,0208	0,0470	0,2297
3	Head of Bina Marga Division	0,0830	0,0666	0,0249	0,0439	0,2184
4	Road Network Analyst	0,0626	0,0753	0,0260	0,0445	0,2083
5	Secretary of Social Service	0,0830	0,0666	0,0249	0,0439	0,2184
6	Poverty Management Staff	0,0898	0,0721	0,0208	0,0470	0,2297
	Road Segment C	**Sub-Criteria**				
		Trip Attraction	**Tourism**	**Concrete**	**Damaged**	**Total**
1	Secretary of Bappelitbangda	0,0626	0,0323	0,0260	0,0445	0,1653
2	Head of Planning and Evaluation	0,0898	0,0721	0,0208	0,0470	0,1885
3	Head of Bina Marga Division	0,0830	0,0286	0,0249	0,0439	0,1803
4	Road Network Analyst	0,0626	0,0323	0,0260	0,0445	0,1653
5	Secretary of Social Service	0,0830	0,0286	0,0249	0,0439	0,1803
6	Poverty Management Staff	0,0898	0,0721	0,0208	0,0470	0,1885
	Road Segment D	**Sub-Criteria**				
		Trip Attraction	**Tourism**	**Concrete**	**Damaged**	**Total**
1	Secretary of Bappelitbangda	0,0313	0,0538	0,1040	0,0445	0,2336
2	Head of Planning and Evaluation	0,0449	0,0515	0,0833	0,0470	0,2266
3	Head of Bina Marga Division	0,0415	0,0476	0,0995	0,0439	0,2325
4	Road Network Analyst	0,0313	0,0538	0,1040	0,0445	0,2336
5	Secretary of Social Service	0,0415	0,0476	0,0995	0,0439	0,2325
6	Poverty Management Staff	0,0449	0,0515	0,0833	0,0470	0,2266
	Road Segment E	**Sub-Criteria**				
		Trip Attraction	**Tourism**	**Concrete**	**Damaged**	**Total**
1	Secretary of Bappelitbangda	0,0313	0,0538	0,1097	0,2519	0,4467
2	Head of Planning and Evaluation	0,0449	0,0515	0,0879	0,2660	0,4502
3	Head of Bina Marga Division	0,0415	0,0476	0,1050	0,2484	0,4425
4	Road Network Analyst	0,0313	0,0538	0,1097	0,2519	0,4467

5	Secretary of Social Service	0,0415	0,0476	0,1050	0,2484	0,4425
6	Poverty Management Staff	0,0449	0,0515	0,0879	0,2660	0,4502
	Road Segment F	**Sub-Criteria**				**Total**
		Trip Attraction	**Tourism**	**Concrete**	**Damaged**	
1	Secretary of Bappelitbangda	0,0313	0,0538	0,1097	0,0583	0,2531
2	Head of Planning and Evaluation	0,0449	0,0515	0,0879	0,0615	0,2458
3	Head of Bina Marga Division	0,0415	0,0476	0,1050	0,0575	0,3516
4	Road Network Analyst	0,0313	0,0538	0,1097	0,0583	0,2531
5	Secretary of Social Service	0,0415	0,0476	0,1050	0,0575	0,3516
6	Poverty Management Staff	0,0415	0,0476	0,1050	0,0575	0,3516

Table 7. Existing Road Segment Conditions Based on FGD

No	Alternatif Ruas Jalan	Criteria				
		Social	**District Spatial Plan (RTRW)**	**Road Pavement**	**Road Condition**	
1	Road Segment A	Sub Criteria				Total
		Income	Agropolitan Minapolitan	Asphalt	Good	
		0,0415	0,0476	0,0891	0,0439	0,2220
2	Road Segment B	Sub Kriteria				Total
		Trip Attraction	Trade and Service	Concrete	Good	
		0,0830	0,0666	0,0249	0,0439	0,2184
3	Road Segment C	Sub Criteria				Total
		Trip Attraction	Tourism	Concrete	Damaged	
		0,0830	0,0286	0,0249	0,0439	0,1803
4	Road Segment D	Sub Criteria				Total
		Income	Agropolitan Minapolitan	Agregat	Good	
		0,0415	0,0476	0,0995	0,0439	0,2325
5	Road Segment E	Sub Kriteria				Total
		Income	Agropolitan Minapolitan	Soil	Damaged	
		0,0415	0,0476	0,1050	0,2484	0,4425
6	Road Segment F	Sub Kriteria				Total
		Income	Agropolitan Minapolitan	Soil	Fair	
		0,0415	0,0476	0,1050	0,0575	0,2516

Priority Scale Analysis of Road Development in Mesuji Regency

Based on the data analysis conducted, the highest priority scale value was found on Road Segment E, with a priority score of 0.4425. This road segment is located in an income-generating, agropolitan-minapolitan area, yet its pavement condition remains unpaved (red soil) and is classified as damaged. Such poor road conditions significantly limit community activities during the rainy season, especially considering that the majority of the population are rice farmers. Road Segment F ranks second in priority with a score of 0.2516, also located in an income-generating, agropolitan-minapolitan area. The road is unpaved and moderately damaged.

The third priority level is held by Road Segment D, with a score of 0.2325. This segment is in a similar agropolitan area with gravel pavement and is currently in good condition. In fourth place is Road Segment A with a score of 0.2220, located in an agropolitan area with asphalt pavement and good road conditions. Fifth on the priority scale is Road Segment B, scoring 0.2184, categorized as a movement attraction and trade services area, with concrete pavement and good road conditions. Lastly, Road Segment C holds the lowest priority score of 0.1803, classified as a movement attraction and tourism area with concrete pavement but in a damaged condition. According to the Lampung Province Spatial Planning (RTRW) 2009–2029, Mesuji Regency is designated as one of the province's strategic zones specifically, the Mesuji Strategic Area, which is envisioned as a regional growth center functioning as a production and distribution hub to support surrounding sectors such as agriculture, plantations, agro industry, and livestock farming.

Within this strategic framework, the provincial government has identified a key development area in Mesuji: an integrated trade zone based on local potential managed through agribusiness. This will be developed near Lampung's first agropolitan area in Central Lampung Regency, including a Self-Sustained Transmigration Area (KTM) in Mesuji Regency spanning from Tanjung Mas Makmur to Tanjung Mas Mulya. The development of these areas is expected to distribute economic growth more evenly and reduce concentration in Bandar Lampung City, allowing the KTM to serve as a new growth center for northern Lampung Province. Physical road infrastructure, as a determinant of national spatial structure, plays a critical role in both the economic growth and socio-cultural dynamics of a region. Roads, as social capital, are fundamental for economic development, and achieving high economic growth is difficult without adequate road availability. Development itself is a continuous process of transformation from less favorable to better conditions, aiming to establish a new environmental balance. Given the high costs associated with construction projects, planning and control are crucial aspects of construction management. These two components are closely linked and significantly affect project success. Planning is viewed as a process for determining the right course of action after evaluating various alternatives and considering available resources to achieve a specific objective. Due to limited national government funding for road infrastructure development, not all needs can be met whether for new road construction, road improvement, or rehabilitation. Therefore, the implementation of a priority scale system is essential as a reference for compiling project programs for the following fiscal year. This prioritization must consider multiple criteria to ensure accurate and effective decision-making.

Discussion

The results of this research underscore the strategic significance of road infrastructure development as a catalyst for enhancing regional accessibility and economic integration in Mesuji Regency. Prioritizing road segments based on multidimensional criteria reveals a clear disparity between existing infrastructure conditions and regional development objectives. Road segments in deteriorated conditions, particularly those situated in zones with high agricultural productivity, emerge as critical points requiring immediate attention. This prioritization reflects the broader need to allocate limited infrastructure budgets effectively, with consideration for both technical feasibility and social urgency. By integrating technical, spatial, and social parameters into the decision-making process, this study contributes to a more nuanced understanding of development priorities in regions with resource limitations. Furthermore, the application of a multi-criteria analysis framework within this study addresses the pressing need for a systematic, transparent approach to infrastructure planning in peripheral regions. The inclusion of regional spatial planning elements alongside road conditions and pavement types allows for a more holistic assessment that aligns with long-term territorial development goals. This integrative approach enhances the relevance and applicability of infrastructure prioritization models in contexts where policy coherence and developmental equity remain key challenges. As such, the findings presented offer not only a methodological contribution but also a practical planning instrument for regional authorities aiming to foster inclusive, balanced growth across sub-district capitals.

Implication

The findings of this study hold significant implications for regional infrastructure policy, particularly in areas facing limited fiscal capacity and uneven development. By demonstrating the effectiveness of a structured multi-criteria decision-making framework, this research provides a practical reference for local governments in prioritizing road development programs based on objective and measurable indicators. The integration of physical infrastructure conditions, regional spatial planning considerations, and social relevance into the prioritization model enables policymakers to align infrastructure investments with actual needs and long-term planning objectives. This alignment is crucial for improving the efficiency of public spending and enhancing the connectivity of economically strategic but underserved areas. In a broader context, the approach adopted in this study can serve as a replicable model for other regions with similar geographic and socio-economic characteristics. The use of the Analytical Hierarchy Process (AHP) as a tool to support participatory and data-driven decision-making strengthens institutional capacity to plan infrastructure systematically and transparently. Additionally, the prioritization framework developed through this research may support more equitable development outcomes by ensuring that infrastructure initiatives do not disproportionately benefit already-advantaged areas. Ultimately, the study reinforces the importance of evidence-based planning in bridging development gaps and promoting sustainable regional growth.

Limitation and Suggestion for Further Research

This study, while providing a systematic approach to infrastructure prioritization using the AHP method, is subject to certain limitations that may influence the generalizability of its findings. The prioritization framework was developed based on a limited number of road segments and expert respondents within a specific regional context. The reliance on subjective judgments from a focused group of practitioners, although validated through consistency ratios, may not fully capture the diversity of perspectives from a broader set of stakeholders, including local communities or end-users. Additionally, the study focused predominantly on static variables such as current road condition, spatial designation, and basic social indicators, without incorporating dynamic factors like seasonal traffic volume, future land use changes, or economic projections. To enhance the robustness and applicability of future research, it is recommended to expand the scope of analysis by including a wider range of road networks and integrating more comprehensive stakeholder input, particularly from communities directly affected by infrastructure disparities. Future studies could also explore the incorporation of geospatial analysis, traffic simulation, or cost-benefit modelling to enrich the decision making framework. Moreover, longitudinal studies that assess the actual outcomes of implemented prioritization strategies would provide valuable insights into the long-term effectiveness of the proposed approach. By addressing these aspects, subsequent research could offer a more adaptive and scalable infrastructure planning model that supports inclusive and sustainable regional development.

CONCLUSION

Based on the research conducted, the existing conditions of the inter-district capital connecting roads in Mesuji Regency can be classified into several criteria, including social aspects, regional spatial planning (RTRW), road pavement type, and current road condition. Overall, the existing road infrastructure is predominantly characterized by damaged surfaces and clay roads. From a social perspective, the majority of these roads are situated in income-generating areas, while spatially, according to the RTRW of the regency, the regions are designated as agropolitan and minapolitan zones. Using the Analytic Hierarchy Process (AHP) analysis, the results indicate that Road Segment E holds the highest priority for development, with a priority scale score of 0.4425. This is followed by Road Segment F with a score of 0.2516, and Road Segment D with a score of 0.2325. Road Segment A ranks fourth with a priority score of 0.2220, followed by Road Segment B with 0.2184, and finally Road Segment C with 0.1803. The findings of this study are expected to serve as a valuable input for relevant government agencies in making informed decisions, thereby ensuring a more effective and efficient road development program. Ultimately, this will help to maximize the positive impact on local governance and community development efforts in Mesuji Regency.

AUTHORS INFORMATION

Corresponding Authors
Aldi Dwi Mawardi – Master's Program in Civil Engineering, University of Lampung (Indonesia)
Email: aldidwimawardi@gmail.com

Authors
Indah Marlina Ardianti – Biology Program, Universitas Islam Negeri Raden Intan Lampung (Indonesia)
Email: indahmarlinaardianti@radenintan.ac.id

AUTHORS CONTIBUTIONS STATEMENT

Aldi Dwi Mawardi developed the research concept, designed the methodological framework, conducted field surveys and expert consultations, and was responsible for the initial drafting and analysis of the manuscript. Indah Marlina Ardianti contributed to the selection and refinement of the AHP criteria, supported data interpretation in the context of spatial planning and social aspects, and reviewed the manuscript for accuracy and clarity. Both authors discussed the results, collaborated throughout the research process, and approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest. The research was conducted independently, and no financial or personal relationships existed that could have influenced the outcome or interpretation of the study.

REFERENCES

Andersen, T. J., "Integrating Decentralized Strategy Making and Strategic Planning Processes in Dynamic Environments," Journal of Management Studies, vol. 41, no. 8, pp. 1271–1299, 2004. https://doi.org/10.1111/j.1467-6486.2004.00475.x

Esteves, A. M., "Evaluating community investments in the mining sector using multi-criteria decision analysis to integrate SIA with business planning," Environmental Impact Assessment Review, vol. 28, no. 4, pp. 338–348, 2008. https://doi.org/10.1016/j.eiar.2007.09.003

Faber, B., "Trade Integration, Market Size, and Industrialization: Evidence from China's National Trunk Highway System," The Review of Economic Studies, vol. 81, no. 3, 2014. https://doi.org/10.1093/restud/rdu010

Franklin, A. L., and Carberry-George, B., "Analyzing How Local Governments Establish Service Priorities," Public Budgeting & Finance, vol. 19, no. 3, pp. 31–46, 1999. https://doi.org/10.1046/j.0275-1100.1999.01170.x

He, J., Bao, C.-K., Shu, T.-F., Yun, X.-X., Jiang, D., and Brown, L., "Framework for integration of urban planning, strategic environmental assessment and ecological planning for urban sustainability within the context of China," Environmental Impact Assessment Review, vol. 31, no. 6, pp. 549–560, 2011. https://doi.org/10.1016/j.eiar.2010.09.002

Irefan, S., and Adry, M. R., "Pengaruh Infrastruktur Terhadap Pertumbuhan Ekonomi Di Indonesia," Ecosains: Jurnal Ilmiah Ekonomi Dan Pembangunan, vol. 7, no. 1, 2018. https://doi.org/10.24036/ecosains.11065957.00

Karami, M., Sulistyorini, R., and Ardianti, I. M., "Resilient modulus master curve for BRA-modified asphalt mixtures," Roads and Bridges - Drogi i Mosty, vol. 19, no. 4, pp. 315–331, 2020. https://doi.org/10.7409/rabdim.020.020

Liu, Z., Schindler, S., and Liu, W., "Demystifying Chinese overseas investment in infrastructure: Port development, the Belt and Road Initiative and regional development," Journal of Transport Geography, vol. 87, 2020. https://doi.org/10.1016/j.jtrangeo.2020.102812

Malhotra, S. K., et al., "Studies of the effectiveness of transport sector interventions in low- and middle-income countries: An evidence and gap map," Campbell Systematic Reviews, vol. 17, no. 4, 2021. https://doi.org/10.1002/cl2.1203

Manjunath, S. J., and Kannan, E., "Effects of Rural Infrastructure on Agricultural Development," Journal of Infrastructure Development, vol. 9, no. 2, 2017. https://doi.org/10.1177/0974930617732258

Nopiah, R., et al., "Connectivity Infrastructure Spending and Its Indicator Achievement: Case Study of Southern Sumatra Region," Journal of Sustainable Economics, vol. 2, no. 2, 2024. https://doi.org/10.32734/jse.v2i2.18708

Nuutinen, Y., and Miina, J., "Effect of boom corridor and selective thinning on the post-treatment growth of young Scots pine and birch stands," Silva Fennica, vol. 57, no. 2, 2023. https://doi.org/10.14214/sf.23017

Radmehr, A., Bozorg-Haddad, O., and Loáiciga, H. A., "Integrated strategic planning and multi-criteria decision-making framework with its application to agricultural water management," Scientific Reports, vol. 12, no. 1, p. 8406, 2022. https://doi.org/10.1038/s41598-022-12194-5

Ran, J., and Nedovic-Budic, Z., "Integrating spatial planning and flood risk management: A new conceptual framework for the spatially integrated policy infrastructure," Computers, Environment and Urban Systems, vol. 57, pp. 68–79, 2016. https://doi.org/10.1016/j.compenvurbsys.2016.01.008

Schindler, S., and Kanai, J. M., "Getting the territory right: Infrastructure-led development and the re-emergence of spatial planning strategies," Regional Studies, vol. 55, no. 1, pp. 40–51, 2021. https://doi.org/10.1080/00343404.2019.1661984

Sumbal, M. S., et al., "Logistics performance system and their impact on economic corridors: A developing economy perspective," Industrial Management & Data Systems, vol. 124, no. 3, 2023. https://doi.org/10.1108/IMDS-03-2023-0151

Venna, S. L., and Romulo, A., "Role of Agriculture on Rural Household Food Security: A Systematic Review from Indonesia," IOP Conference Series: Earth and Environmental Science, vol. 1324, no. 1, 2024. https://doi.org/10.1088/1755-1315/1324/1/012132

Warner, M. E., “The Future of Local Government: Twenty-First-Century Challenges,” Public Administration Review, vol. 70, no. s1, pp. s145–s147, 2010. https://doi.org/10.1111/j.1540-6210.2010.02257.x

Wiek, A., and Walter, A. I., “A transdisciplinary approach for formalized integrated planning and decision-making in complex systems,” European Journal of Operational Research, vol. 197, no. 1, pp. 360–370, 2009. https://doi.org/10.1016/j.ejor.2008.06.013

Zolotarev, S., et al., “Transport accessibility assessment of rural tourism facilities,” E3S Web of Conferences, vol. 376, 2023. https://doi.org/10.1051/e3sconf/202337604005