FROM ROADS TO RUNWAYS: EVALUATING THE CONTRIBUTION OF TRANSPORT INFRASTRUCTURE TO ECONOMIC GROWTH IN CENTRAL JAVA

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Abstract

This study investigates the role of transportation infrastructure in driving regional economic growth in Central Java Province, Indonesia. Infrastructure, especially in transportation, is identified as a critical enabler of regional development, facilitating structural transformation from low to higher-productivity sectors. Employing a quantitative associative approach and secondary data from 35 Regencies/Cities for the period of 2023 to 2024, this research analyzes the impact of four key transportation indicators: road length (RL), road density (RD), number of motor vehicles (MV), and station availability (SA), on the Gross Regional Domestic Product (GRDP) per capita. The Random Effect Model (REM) was selected as the most suitable estimation model after conducting Chow, Hausman, and LM tests, and the model successfully passed classical assumption tests, ensuring statistical validity. The empirical results indicate that the number of motor vehicles, road density, and station availability all have a significant positive influence on GRDP per capita. This suggests that enhanced mobility, intensive road network utilization, and the presence of integrated transport facilities such as terminals, stations, ports, or airports are crucial drivers of economic activity. In contrast, road length demonstrates a negative impact, implying that simply expanding the road network quantitatively does not guarantee increased economic output if not strategically utilized or built in low-productivity areas. The findings underscore the critical importance of quality, strategic utilization, and connectivity in transport infrastructure development for sustainable regional economic growth.

Keywords: Transportation Infrastructure, Economic Growth, GRDP, Central Java

INTRODUCTION

Shifts in economic structure are a primary indicator of a country's economic growth. Research by Duernecker & Martinez (2023) highlights a transition in economic structure from low-productivity sectors, such as agriculture, towards higher-productivity sectors like trade and services. Similarly, (Todaro & Smith, 2020) assert that economic structural change is integral to economic development, aiming to enhance societal living standards by reducing unemployment, poverty, and income inequality.

Indonesia has undergone a significant economic structural transition, moving from an agriculture-dominated economy to one driven by industry and services (Hendarmin & Wahyudi, 2023). According to Chenery (1979) theory of economic structure, structural change in developing countries is characterized by a shift in growth contributions from low-productivity sectors like agriculture to high-productivity sectors such as industry and services. This shift is influenced by changes in production composition, labor absorption, trade, and other factors that can stimulate long-term per capita income growth. (Todaro & Smith, 2020) further explain that economic structural change is typically marked by a decline in the primary sector's (agriculture) contribution, followed by an increase in the secondary (industry) and tertiary (services) sectors' contributions, which aligns with rising economic growth.

Significant shifts in Indonesia's economic structure were observed during the periods of 1976-1980 and 2023. From 1976 to 1980, agriculture, mining, manufacturing, electricity, gas and water supply, and construction were the dominant sectors contributing to Indonesia's Gross Domestic Product (GDP). Conversely, in 2025 (based on constant prices), transportation and warehousing, accommodation and food service activities, professional services, information and communication, and mining and quarrying are projected to be the dominant sectors contributing to Indonesia's GDP (BPS, 2025).

The increased contribution of the secondary and tertiary sectors positively impacts national economic growth. This is evidenced by a decrease in agricultural employment and an increase in service sector employment, indicating a labor shift towards higher-productivity sectors (Martins, 2019). These economic structural changes have led to a re-prioritization of government development efforts, particularly in infrastructure.

Java Island, as the center of national economic growth, exhibits significant dynamism in its economic structural change. This is demonstrated by the substantial contribution of the industrial and service sectors to the Regional Gross Domestic Product (RGDP), especially in Central Java. In 2024, the industrial sector contributed 29.86% and the service sector 32.74%, both significantly higher than the agriculture sector's contribution of only 13.60% (BPS, 2025). Central Java Province holds a strategic position, connecting East Java and West Java, which are key economic growth hubs on the island. In essence, Central Java plays a crucial role as a primary connector for economic activities among Indonesia's central growth regions. Given these regional characteristics, the development of transportation infrastructure in Central Java has become a priority government policy, serving as a driving force for Indonesia's economic growth. However, according to data from the Central Statistics Agency (BPS) in 2025, Central Java's economic growth remains below that of West Java and East Java Provinces. Furthermore, the quality of road infrastructure in Central Java Province is still lower compared to its two neighboring provinces. This is substantiated by the percentage of stable national roads in Central Java in 2023, which only reached 90.2%, lower than West Java (95.4%) and East Java (97.8%) (KEMENPU, 2024b). Similarly, the percentage of stable provincial roads in Central Java was also lower (88.4%) compared to West Java (88.82%) and East Java (89.1%) (KEMENPU, 2024c). Likewise, the percentage of stable regency/city roads in Central Java, at 79.9%, was still lower than West Java (81.89%) and East Java (81.32%) (KEMENPU, 2024a).

One of the primary sectors contributing to Central Java's economic growth is transportation and warehousing, which contributed 8.12% in 2023, and despite a sluggish economic climate in 2024, still contributed a significant 5.56% to the RGDP (BPS, 2025). Moreover, in 2022, this sector recorded the highest growth and the largest contribution to Central Java's economic growth, accounting for 73%. The growth of the transportation sector is closely linked to the end of the Covid-19 pandemic and government policies focused on transportation infrastructure development. Transportation infrastructure plays a vital role in strengthening economic growth by enhancing community mobility and the efficiency of resource distribution (Cigu et al., 2019).

Data from BPS Central Java Province indicates a consistent upward trend in transportation infrastructure development during the 2019-2024 period. The total road length increased by 1,339.08 km, from 29,356 km in 2019 to 31,694.87 km in 2024. Nevertheless, this infrastructure growth has not been fully reflected in regional economic performance. Central Java's economic growth, which previously reached 5.41% in 2019, decelerated to 4.95% in 2024.

Based on the aforementioned background, it is crucial to analyze the significance of infrastructure for economic growth in Central Java. This study contributes by incorporating infrastructure variables beyond merely road length, also considering the flow of goods through ports and airports, and the number of motor vehicles as proxies for regional economic activity. Employing panel data analysis for regencies/cities in Central Java Province during the 2019-2023 period, the objective of this research is to analyze the influence of road length, the volume of goods flow through ports and airports, and the number of motor vehicles on economic growth in Central Java Province.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

The role of infrastructure in economic development has been a central focus in development economics literature. A relevant theoretical framework, the Harrod-Domar Model, posits that economic growth is highly dependent on the rate of societal savings and the efficiency of investment in generating output. However, the model also emphasizes that without supportive interventions or structural conditions, economic growth tends to be unstable. In this context, transportation infrastructure holds a strategic position as a form of investment that significantly contributes to a nation's economic growth. Transportation infrastructure is believed to accelerate the circulation of goods and services, expand inter-regional connectivity, and reduce logistical costs, thereby supporting overall economic efficiency and productivity. Infrastructure defines by Cambridge Learner's Dictionary & Thesaurus (2016) as the basic systems and services, such as transport and energy supplies, used to support the activities of an organization or country. (Grigg, 1988) adds that infrastructure includes physical systems like transport networks, drainage, and public buildings. More specifically, (Cooley, 1894) defines transportation as the activity of moving goods or people from one place to another, while (Steenbrink, 1974) defines transportation as a movement process that utilizes aids to overcome geographical barriers. Thus, transportation infrastructure can be understood as a physical system that supports the mobility of people and goods, playing a vital role in enhancing macroeconomic efficiency and performance.

(Cigu et al., 2019) state that transportation infrastructure significantly influences economic growth. Transportation infrastructure is proxied by indicators such as the status of railway infrastructure, roads, inland waterways, sea, and air, as well as the magnitude of investment in these sectors. Furthermore, this research emphasizes that the relationship between transportation infrastructure and economic growth is influenced by public sector performance indicators, such as corruption levels, environmental regulations, the size of the shadow economy, infant mortality rates, income inequality, inflation, and unemployment, which generally have a negative impact on growth. Conversely, indicators such as the quality of the judicial system, educational attainment, and life expectancy contribute positively to economic growth.

Studies by (Srinivasu & Rao, 2013) highlight that physical infrastructure, such as transportation and telecommunications, positively contributes to economic development through increased investment, job creation, and enhanced output and income. They refer to this as a cumulative causal chain that continuously strengthens growth. (Xueliang, 2013) emphasizes the strategic role of transportation infrastructure in strengthening a region's capacity to interact with the outside world, lowering transportation costs, and stimulating regional economic growth. Interestingly, this research also reveals the existence of a spillover effect, meaning that transportation infrastructure in one region can have economic impacts on other connected regions, both directly and indirectly. This underscores the importance of equitable and interconnected infrastructure development across regions. Transportation, as a basic input in the production process, is also a focus in (Pradhan & Bagchi, 2013) study, which demonstrates that highway infrastructure significantly affects economic growth in India. A decline in the quality or role of highways is even cited as a potential factor in slowing economic growth.

Research by (Ke et al., 2020) states that transportation infrastructure development, particularly roads and railways, has a significant and positive influence on economic growth. Improvements in quality and structural reforms in this sector can provide a strong impetus to the national economy. Another study by (B. Batkhishig & Dorzhieva, 2025) suggests that improved infrastructure connecting two economic growth areas will enhance economic cooperation and accelerate regional economic growth in Mongolia and Russia. (M. H. Rahman & Baldacci, 2025) state that highway infrastructure development will increase the movement of goods and trade flows at lower costs and enhance economic integration between regions, fostering long-term economic growth. The level of economic integration and openness between adjacent regions will accelerate the spillover effect of regional economic growth between China and the 10 ASEAN countries (J. Xu et al., 2025).

Another study by (Daldoul & Dakhlaoui, 2025) found empirical evidence that improved transport quality plays a crucial role in stimulating growth in other economic sectors in Tunisia. Enhanced infrastructure quality will encourage the emergence of new industries, thereby increasing regional output. Infrastructure also plays an important role in providing employment opportunities. A study by (W. Kuang et al., 2025) shows that investment in infrastructure, especially transportation, will increase the inflow of investment into a region. Additionally, investment in transportation infrastructure is considered a government commitment to fostering long-term economic growth.

However, not all impacts of infrastructure development are uniformly positive. (Acheampong et al., 2022) found that not all types of transportation infrastructure significantly influence economic growth. Cargo transportation infrastructure, for instance, proved to have a significant positive impact on growth, whereas railway infrastructure did not show a significant relationship. This finding suggests that the influence of infrastructure on the economy highly depends on its type, function, and specific regional conditions.

Overall, this literature review demonstrates that transportation infrastructure plays a strategic role in driving economic growth, both directly and indirectly. Its impact can vary depending on infrastructure quality, utilization efficiency, regional conditions, and other supporting factors such as public governance and human resources. Therefore, infrastructure development policies must be comprehensively and contextually designed to achieve inclusive and sustainable economic growth. Consequently, the proposed hypothesis is:

H1: Road length positively influences economic growth in Central Java Province.
H2: Road density positively influences economic growth in Central Java Province.
H3: The number of motor vehicles positively influences economic growth in Central Java Province.
H4: Station availability positively influences economic growth in Central Java Province.

RESEARCH METHODS

Sample and Variables

This research employs a quantitative associative approach to analyze the influence of transportation infrastructure on economic growth in Central Java Province. The study utilizes panel data, which allows for the analysis of relationships between variables across both cross-sectional and time dimensions. The research sample includes 35 Regencies/Cities in Central Java Province, with an observation period spanning from 2023 to 2024. A total of 70 balanced panel observations are used in the analysis. The variables analyzed in this study consist of one dependent variable and four independent variables representing transportation infrastructure.

Dependent Variable:

Economic Growth (PDRB Per Capita Central Java Province): This variable is measured using Gross Regional Domestic Product (GRDP) per capita of Central Java Province, serving as the main indicator of regional economic performance. The GRDP per capita data is obtained from the Central Statistics Agency (BPS) of Central Java.

Independent Variables:

The independent variables in this study are proxies for transportation infrastructure that are believed to influence economic growth. Data for all independent variables are also sourced from the Central Statistics Agency (BPS) of Central Java. The four variables include:

- **Road Length (RL)**: Measured in kilometers (km), this variable reflects the extent to which the road network has been expanded in a region.
- **Road Density (RD)**: Measured in kilometers per square kilometer (km/km^2), road density indicates the intensity and coverage of the road network relative to the area's size.
- **Number of Motor Vehicles (MV)**: Measured in units of vehicles, this variable serves as a proxy for economic activity and the mobility of people utilizing road infrastructure.

- Station Availability (SA): This is a dummy variable. It indicates the availability of major supporting transportation infrastructure such as terminals, stations, ports, or airports in a region. A value of 1 is assigned if the region, in addition to having a terminal, also possesses other transportation infrastructure facilities (station, airport, or port), and 0 if a region only has a terminal.

Empirical Model

The econometric model employed in this research is formulated to analyze the impact of transportation infrastructure on economic growth in Central Java Province. This formulation is grounded in relevant theoretical reviews and empirical studies, aiming to estimate the causal relationship between the chosen independent variables and Gross Regional Domestic Product (GRDP) per capita as the dependent variable. A panel data regression approach is applied to simultaneously accommodate both cross-sectional and time-series data characteristics.
The panel regression model used in this study is:

$$\mathbf{logGRDPit = \beta 0 + \beta_1 RL_{it} + \beta_2 RD_{it} + \beta_3 MV_{it} + \beta_4 SA_{it} + \mu_i + \epsilon_{it}}$$

Information:

- $logGRDP_{it}$: Logarithm of Gross Regional Domestic Product per capita for Regency/City i at time t
- RL_{it}: Road Length (km) in Regency/City *i* at period *t*
- RD_{it}: Road Density (km/km^2) in Regency/City *i* at period *t*
- MV_{it}: Number of Motor Vehicles (units) in Regency/City *i* at period *t*
- SA_{it}: *Station Availability (dummy variable) in Regency/City i at period t*
- β_0: Intercept
- $\beta_1,\beta_2,\beta_3,\beta_4$: Regression coefficients for each independent variable
- μ_i: Unobserved individual-specific effect (for Random Effect Model)
- ϵ_{it}: Random e*rror term*

This empirical model formulation serves as the foundational framework for estimating and testing the research hypotheses. By considering the characteristics of panel data, this model is expected to yield robust results and valid inferences regarding the relationship between transportation infrastructure and economic growth within the study area. This approach also aims to mitigate potential biases that might arise from both cross-sectional and time-series data observations.

Data Analysis Techniques

Data analysis in this study will follow several key stages. First, descriptive statistics will be performed to provide a general overview of the research variables' characteristics. Second, panel data regression analysis will be applied to the 35 Regencies/Cities in Central Java Province over the 2023–2024 period. The selection of the best panel model (Common Effect Model, Fixed Effect Model, or Random Effect Model) will be determined through a series of diagnostic tests: the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test.

The next crucial stage involves classical assumption tests, including tests for multicollinearity, heteroskedasticity, normality, and autocorrelation. These tests are essential to ensure that the chosen model meets the criteria for Best Linear Unbiased Estimation (BLUE). Finally, a model feasibility test (F-test) and partial significance tests (t-tests) will be conducted to evaluate the impact of the independent variables on the dependent variable. Additionally, an analysis of the coefficient of determination (R-squared) will be performed to assess the model's ability to explain the variation in the dependent variable.

Conceptual Framework

The conceptual framework for this research is developed by drawing upon established theories and prior studies concerning transportation infrastructure and economic growth. The following framework is designed to simply illustrate the core elements of the research topic:

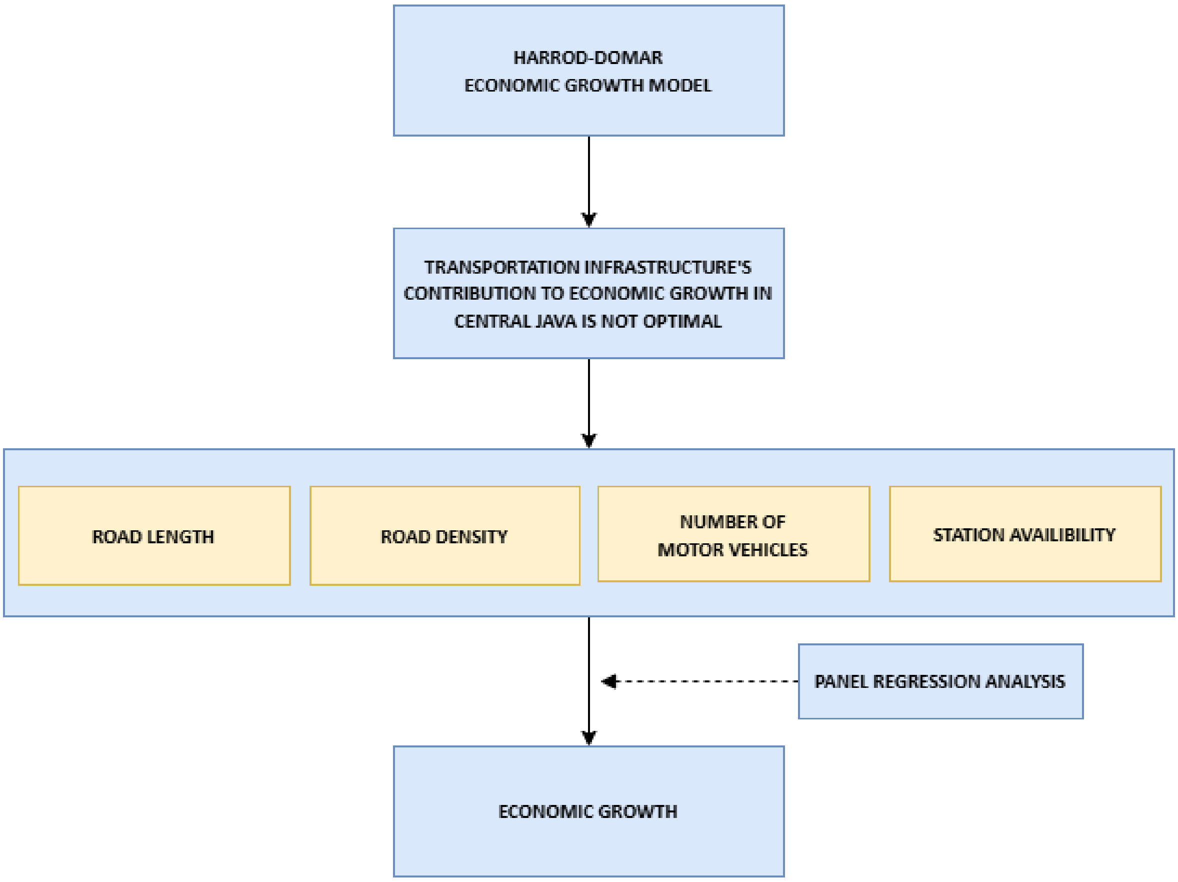

Figure 1. Conceptual Framework

RESULTS AND DISCUSSION

This section begins by presenting a comprehensive overview of the data characteristics through descriptive statistics. Table 1 summarizes the descriptive statistics for the dependent variable, Gross Regional Domestic Product (GRDP) per capita (Y), and the independent variables: Road Length (X1), Road Density (X2), Number of Motor Vehicles (X3), and Station Availability (X4).

Table 1. Descriptive Statistics Test Results

	Variables				
	GRDP	RL	RD	MV	SA
Mean	35079.27	891.2857	1.707019	603322.2	0.585714
Median	25255.00	925.5000	1.024230	619262.0	1.000000
Maximum	117711.0	1727.000	8.260870	1985109.	1.000000
Minimum	13540.00	127.0000	0.504630	127514.0	0.000000
Std. Dev.	25723.54	365.8308	1.801620	310244.0	0.496155

Source: Eviews Data Processing Results

The average Gross Regional Domestic Product (GRDP) of Rp35,079,270 with a standard deviation of Rp25,723,540 million indicates significant economic variation among regions. Furthermore, the average road length is 891.2857 km, and the average number of motorized vehicles is 601,603 units, both reflecting a substantial dispersion of data across observations. Road density averages 1.707019, where higher values are assumed to correlate with increased community mobility and efficient goods distribution. Meanwhile, station availability has an average of 0.585714 and a median of 1, suggesting that approximately 58.57% of the sampled regions possess at least one major transportation infrastructure, such as a terminal, station, port, or airport.

Table 2. Main Empirical Results

	Common Effect	Fixed Effect	Random Effect
RL	0.0032**	0.7731	0.0924*
	(-3.058140)	(-0.290865)	(-1.708196)
RD	0.0001**	0.2271	0.0001**
	(4.659017)	(1.232312)	(6.278279)
MV	0.0001**	0.2079	0.0015**
	(5.632529)	(1.286282)	(3.316160)
SA	0.7841	0.1612	0.0364**
	(5.632529)	(1.435294)	(2.136015)
Cons	0.0001**	0.0001**	0.0001**
	(46.83625)	(48.58240)	(68.74148)
F	25.16867**	335.6177**	10.80871**
Chow		0.0001	
Hausman			0.1069
LM			0.0001
N	70	70	70
Adjusted R^2	0.583521	0.994603	0.362497

Source: Eviews Data Processing Results. **, *, indicate statistical significance at the 5% and 10% levels, respectively (** $p < 0.05$, * $p < 0.1$)

In this study, the selection of the appropriate panel regression model was conducted through a series of comprehensive diagnostic tests: the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test. Referring to Table 2, the results of the Chow Test statistically indicated that the Fixed Effect Model was more suitable than the Common Effect Model. However, the Hausman Test yielded a probability value (p-value) of 0.1069, which exceeds the 0.05 significance level. This outcome supports the assumption that the Random Effect Model is more valid than the Fixed Effect Model. Furthermore, the LM Test confirmed the superiority of the panel model over the pooled model. Consequently, based on the consideration of all three tests, the Random Effect Model (REM) was identified as the most suitable model for estimation in this research.

Before proceeding to regression analysis, the REM underwent classical assumption tests to ensure statistical validity. These tests confirmed that the model is free from multicollinearity (correlation coefficients among independent variables are below 0.85), there is no heteroskedasticity (Glejser Test probability values for all variables are > 0.05), the data is normally distributed (Jarque-Bera Prob. value is > 0.05), and there is no autocorrelation (Durbin-Watson value of 1.842 falls within the 1.5–2.5 range).

The regression results obtained using the Random Effect Model (REM) approach confirm that transportation infrastructure plays a significant role in driving regional economic growth through enhanced mobility, connectivity, and economic efficiency. This finding aligns with the Harrod-Domar Economic Growth Theory, which emphasizes that economic growth depends on the rate of savings and the efficiency of investment in generating output. In this context, the development of transportation infrastructure can be viewed as a form of productive investment capable of accelerating capital turnover and increasing a region's productive capacity, thereby fostering sustainable economic growth.

The number of motor vehicles (KB) exhibits a positive and significant influence on GRDP per capita in Central Java Province. This finding suggests that an increase in the number of vehicles is a crucial indicator of rising intensity in public mobility, both in terms of labor movement and the distribution of goods and services between regions. In a strategically located area like Central Java, which serves as a major connecting corridor between West Java and East Java, the presence of motor vehicles not only reflects active economic activity but also efficiency in utilizing the available road network. This illustrates investment efficiency, where road infrastructure, as a form of fixed capital, is optimally utilized to support production and distribution activities. Consistent with (Pradhan & Bagchi, 2013), this result indicates that an increase in mobility capacity in areas with functional infrastructure can directly strengthen economic growth, particularly in regions like Central Java where the economic structure is shifting towards the tertiary sector.

Meanwhile, road density (KJ) also shows a positive and significant relationship with GRDP per capita. In regions with high road density, such as major cities in Central Java (e.g., Semarang, Surakarta, and Banyumas), transportation infrastructure is not only more available but also utilized more intensively. This indicates a high level of infrastructure utilization and efficiency in the use of public physical capital. This condition reflects high capital efficiency, where existing roads yield greater economic returns by supporting concentrated production activities. This finding also aligns with the economic aglomeration theory, which states that the density of activities and infrastructure can create economies of scale, strengthen economic interactions, and increase regional productivity. In the context of Central Java, road density can represent vibrant growth centers, such as industrial and commercial areas that develop around main roads.

In contrast to the two preceding variables, road length (PJ) demonstrates a negative influence on economic growth. Although there has been a quantitative increase in road length in Central Java in recent years, this finding suggests that the expansion of the road network does not necessarily translate into increased regional productivity. One possible reason is that road construction might not be directed towards areas with high economic potential, or that it is not accompanied by improvements in infrastructure quality and connectivity among economic nodes. This condition reflects inefficient investment, where the accumulation of physical capital (roads) is not proportionally converted into economic output. This argument is supported by (Daldoul & Dakhlaoui, 2025), who emphasize that infrastructure expansion will only have a positive impact if it is strategically designed and supports productive sectors. In other words, road construction in areas with low economic activity or without integration with main transportation networks can become a fiscal burden without significant growth benefits.

Furthermore, station availability (SA), such as terminals, stations, ports, or airports, is proven to contribute positively and significantly to regional economic growth. The existence of these transportation hubs is crucial in strengthening inter-regional connectivity and facilitating the flow of goods, services, and people, which are key elements in modern, integrated economic systems. In Central Java, transportation hubs like Tawang Station in Semarang, Adi Soemarmo Airport in Surakarta, and Tanjung Emas Port play strategic roles in connecting the region with domestic and global economic centers. Such transportation nodes accelerate capital turnover and reinforce the multiplier effect of infrastructure investment on economic output. Studies by Kuang et al., (2025) and Cigu et al., (2019) support this, showing that regions with access to integrated transportation facilities tend to be more attractive for investment, better connected to markets, and experience faster economic growth.

Overall, the findings of this research indicate that the efficiency and quality of transportation infrastructure utilization are far more important than mere quantitative expansion. Strategically designed and utilized infrastructure can accelerate the conversion of investment into economic output, as emphasized by Harrod-Domar. In the context of Central Java, transportation infrastructure development policies need to focus on spatial integration, inter-regional connectivity, and utilization based on sectoral and local needs. Although all four main variables show a significant influence, the moderate adjusted R^2 value suggests the important role of other factors outside the model. Therefore, to foster more inclusive and sustainable economic growth, a multidimensional development approach is necessary, involving improvements in human resource quality, technological innovation, and institutional governance responsive to regional dynamics.

CONLCLUSION

This research aimed to analyze the contribution of transportation infrastructure to economic growth in Central Java Province, focusing on four key indicators: road length, road density, the number of motor vehicles, and station availability. Based on panel data analysis using the Random Effect Model approach, empirical evidence was found that transportation infrastructure plays a significant role in the dynamics of regional economic growth.

The main findings indicate that road density, the number of motor vehicles, and station availability have a positive and significant impact on the increase in GRDP per capita in Central Java. These findings underscore that high mobility, intensive utilization of the road network, and access to transportation hubs such as stations, terminals, ports, and airports are crucial factors in strengthening economic connectivity and facilitating the flow of goods, services, and labor. These three indicators show that the efficient utilization of existing infrastructure assets is key to increasing regional productivity.

Conversely, the road length variable showed a negative impact on economic growth. This suggests that quantitative infrastructure expansion, without being supported by quality, proper spatial planning, and links to economic activity centers, risks becoming an inefficient form of investment. This highlights that infrastructure cannot be viewed solely from its physical aspect but also from its effectiveness and relevance to regional development needs.

Based on these findings, the following policy implications can be formulated:

1. Strategic Focus on Quality and Integration: Transportation infrastructure development should not just focus on network expansion. Instead, it needs to emphasize quality, efficient use, and spatial integration with productive sectors.
2. Sustainable Mobility Management: While the growth in the number of motor vehicles reflects increased economic activity, it must be balanced with sustainable mobility management policies, including the development of efficient and integrated public transportation systems.
3. Needs-Based Road Construction: New road construction should be based on a thorough analysis of regional needs and potential. This ensures that the infrastructure built genuinely supports local economic productivity and avoids resource waste.
4. Optimizing Existing Facilities: The optimization of existing transportation facilities—such as stations, ports, airports, and terminals—should be carried out through a synergistic, cross-sectoral policy approach grounded in the region's economic capacity. This will ensure these facilities act as levers for inclusive and sustainable economic growth.

Therefore, the results of this research not only provide an empirical contribution to the literature on infrastructure development at the regional level but also offer a foundation for formulating evidence-based transportation development policies. These policies should consider the spatial context, investment efficiency, and regional carrying capacity in efforts to accelerate regional economic growth in Central Java Province.

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