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Economic Development Conditions and Their Effects on Growth Indicators Drawn from Statistics Indonesia Economic Data

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ABSTRACT

Background:
Understanding how economic development conditions interact to influence growth outcomes is critical for policymakers in emerging economies, especially as nations navigate post-pandemic recovery and address challenges from technological disruption and climate change.

Objective:
This study examines the relationship between multidimensional development conditions and growth indicators in West Java Province, Indonesia's most populous and economically diverse region. The goal is to assess how various development factors impact economic growth outcomes, such as GDP growth, employment creation, poverty reduction, and human development index outcomes.

Method:
The research analyzes panel data from 27 districts and cities over the period 2019–2023. Fixed-effects regression models are employed to assess the effects of infrastructure quality, human capital levels, institutional capacity, sectoral composition, and trade openness on economic performance indicators.

Findings and Implications:
The findings reveal that infrastructure investment significantly enhances GDP growth (coefficient 0.048, $p<0.01$), while human capital emerges as the strongest driver of employment growth (0.041, $p<0.01$) and poverty reduction (-0.095, $p<0.01$). These results provide evidence-based guidance for policymakers on how to prioritize development investments and create integrated strategies that leverage the synergies between infrastructure, human capital, and institutional improvements tailored to regional contexts.

Conclusion:
The study emphasizes that sustainable regional development requires a multidimensional approach rather than single-factor interventions. Policymakers should focus on developing integrated strategies that combine investments in infrastructure, human capital, and institutional capacity. Future research should explore spatial spillover effects and the long-term causal mechanisms that drive economic transformation.

INTRODUCTION

Economic development remains a central concern for policymakers and researchers worldwide, particularly in emerging economies where sustained growth is essential for improving living standards and achieving long-term prosperity. The complexity of economic development processes necessitates comprehensive understanding of how various conditions interact to influence growth outcomes (Fombad & Onyancha, 2017; Leigh, 2024; Mizushima, 2021; Ramaano, 2022). Indonesia, as Southeast Asia's largest economy and the world's fourth most populous nation, presents a compelling case for examining these dynamics.

The country's diverse economic landscape, spanning from resource-rich regions to manufacturing hubs and service-oriented urban centers, offers valuable insights into the multifaceted nature of economic development. Recent studies have emphasized that economic growth is not merely a function of capital accumulation or technological advancement but rather emerges from intricate interactions among institutional quality, human capital development, infrastructure provision, and macroeconomic stability (Acemoglu & Robinson, 2019; Alexiou et al., 2020). Understanding these relationships has become increasingly critical as nations navigate post-pandemic recovery trajectories and confront challenges posed by climate change, technological disruption, and shifting global trade patterns.

The scholarly literature on economic development has evolved considerably over recent decades, moving beyond simplistic growth models to embrace more nuanced frameworks that acknowledge spatial heterogeneity, temporal dynamics, and contextual specificities. Contemporary research has demonstrated that development outcomes vary significantly across regions within the same country due to differences in initial conditions, resource endowments, and policy implementation effectiveness (Beramendi & Rogers, 2022; Fajgelbaum & Gaubert, 2020). Studies focusing on developing economies have revealed that conventional growth theories often fail to capture the unique constraints and opportunities faced by these nations, including informal sector dynamics, institutional weaknesses, and external dependency patterns.

Specifically, research on Indonesian economic development has highlighted the persistent challenges of regional inequality, sectoral imbalances, and the quality of governance structures (Hornok & Raeskyesa, 2024; Sanga & Aziakpono, 2025). Recent empirical investigations have employed increasingly sophisticated analytical techniques to disentangle causal relationships between development conditions and growth indicators, recognizing that endogeneity and measurement errors can substantially bias conventional estimates (Baltagi, 2021; Hsiao & Bell, 2024). Furthermore, the availability of comprehensive statistical databases, such as those maintained by Statistics Indonesia (Badan Pusat Statistik), has enabled more granular analyses of economic phenomena at multiple administrative levels.

Despite significant progress in economic development theory and practice, substantial gaps remain in our understanding of how specific development conditions translate into measurable growth outcomes. The primary research problem centers on the difficulty of establishing robust empirical relationships between multidimensional development conditions and various growth indicators in contexts characterized by data limitations, structural changes, and policy interventions. Traditional approaches to growth analysis often rely on aggregate national-level data, which may obscure

important subnational variations and fail to capture the heterogeneous effects of development conditions across different regions or sectors (Abdulai, 2017).

This aggregation problem becomes particularly acute in large, diverse countries like Indonesia, where provinces exhibit substantial differences in economic structure, demographic characteristics, and institutional capacity. Moreover, the temporal dimension of economic development poses additional challenges, as the effects of certain conditions may manifest only after considerable time lags, while others generate immediate but transitory impacts. Another critical issue concerns the appropriate selection and measurement of both explanatory variables representing development conditions and dependent variables capturing growth outcomes, given that economic development is inherently multidimensional and encompasses not only income growth but also improvements in health, education, infrastructure, and environmental sustainability.

Addressing these research challenges requires methodological approaches that can accommodate complexity while maintaining analytical rigor. The general solution framework involves employing comprehensive datasets that capture multiple dimensions of economic development across spatial and temporal dimensions, combined with econometric techniques designed to handle panel data structures and control for potential confounding factors. Researchers have increasingly advocated for disaggregated analysis that examines economic development at subnational levels, recognizing that provincial or district-level data can reveal patterns obscured in national aggregates (Akita & Miyata, 2018; Refqi & Hidayat, 2019).

This approach aligns with the growing emphasis on place-based economic policies that recognize the importance of local conditions and context-specific interventions (Fajgelbaum & Gaubert, 2020). Furthermore, the solution framework must address identification challenges inherent in observational studies of economic development, where establishing causal relationships rather than mere correlations requires careful attention to potential endogeneity, omitted variable bias, and reverse causality (Babii et al., 2024). Advanced panel data techniques, including fixed effects models, instrumental variable approaches, and dynamic panel estimators, offer promising avenues for strengthening causal inference in this domain (Baltagi, 2021).

The academic literature has proposed several specific solutions for analyzing the relationship between development conditions and growth indicators. One prominent approach involves constructing composite indices that aggregate multiple dimensions of development conditions into summary measures, facilitating comparative analysis across regions and time periods (Scalamonti, 2025). However, critics have noted that composite indices may obscure important trade-offs and mask heterogeneous effects of individual components. An alternative strategy employs growth regression frameworks that explicitly model the relationship between various development conditions and specific growth indicators while controlling for initial conditions and other relevant factors.

Recent applications of spatial econometric techniques have proven particularly valuable for capturing spillover effects and spatial dependencies in economic development processes, recognizing that growth in one region may influence or be influenced by conditions in neighboring areas (Yuan et al., 2020). Studies utilizing Statistics Indonesia data have demonstrated the utility of panel data approaches for tracking provincial development trajectories over time, enabling researchers to

separate time-invariant regional characteristics from time-varying factors (Akita & Miyata, 2018) Kurniawan et al., (2023). Furthermore, advances in causal inference methodologies, including difference-in-differences designs and synthetic control methods, have enhanced researchers' ability to evaluate the effects of specific policy interventions or exogenous shocks on economic development outcomes (Abadie et al., 2015).

While existing research has made substantial contributions to understanding economic development dynamics, several studies bear particular relevance to the present investigation. Empirical analyses of Indonesian provincial development have examined various aspects of regional growth patterns, including the role of human capital accumulation (Carillo, 2024; Kanval et al., 2024), infrastructure investment effects, and sectoral transformation (Akita & Alisjahbana, 2020). These studies have consistently found that initial conditions matter significantly for subsequent growth trajectories, suggesting path dependency in development processes. Research on the determinants of regional inequality in Indonesia has highlighted the importance of fiscal decentralization, natural resource distribution, and connectivity to major economic centers (Hornok & Raeskyesa, 2024; Sanga & Aziakpono, 2025).

Recent work has also emphasized the need to examine multiple growth indicators beyond GDP growth, including employment generation, poverty reduction, and improvements in human development outcomes, to capture the multidimensional nature of economic progress (Kurniawan et al., 2023). However, a notable gap exists in the literature regarding comprehensive, systematic analysis that simultaneously considers multiple development conditions and their differential effects on various growth indicators across Indonesian provinces. Most existing studies focus on specific aspects of development or particular regions, limiting the generalizability of findings. Moreover, there remains insufficient attention to how the relationships between development conditions and growth indicators may vary across different contexts or time periods, suggesting the need for analysis that explicitly explores effect heterogeneity.

This study aims to address this research gap by conducting a comprehensive analysis of how economic development conditions affect various growth indicators using provincial-level data from Statistics Indonesia. The novelty of this study lies in its integrated approach, which combines the breadth of coverage of various dimensions of development conditions and growth outcomes with the depth of analysis through the application of advanced panel data methods to high-quality subnational data. Unlike previous studies that typically focus on a single aspect of development or a limited set of variables, this study provides a holistic assessment of the development-growth relationship. This study contributes by offering empirical evidence on which development conditions most strongly predict various types of growth outcomes in the Indonesian context, with implications for prioritizing policy interventions. By systematically analyzing these relationships, this study aims to inform evidence-based policymaking to promote balanced, inclusive, and sustainable economic development in various regions of Indonesia.

RESEARCH METHOD

This study employed a quantitative research approach utilizing panel data analysis to examine the relationship between economic development conditions and growth indicators in West Java Province, Indonesia. The study adopted an explanatory design

that sought to establish empirical relationships between several independent variables representing development conditions—including infrastructure quality, human capital levels, institutional capacity, sectoral composition, and trade openness—and dependent variables encompassing various growth indicators such as GDP growth, job creation, poverty reduction, and improvements in human development. This study recognized that development outcomes can be influenced by differences in initial conditions, resource availability, and the effectiveness of policy implementation, necessitating a focused regional analytical approach. The temporal coverage encompassed several years of district/city-level observations in West Java Province, creating a balanced panel structure that allowed for cross-sectoral and time-series variation to be utilized in the analysis.

The population of this study comprised all regencies and cities in West Java Province observed during the period covered by Statistics Indonesia's comprehensive economic database. The research instrument consisted of secondary data extracted from official publications and the Statistics Indonesia (Central Bureau of Statistics) database, including district-level GDP statistics, demographic indicators, infrastructure metrics, education and health statistics, employment data, poverty rates, and the human development index. Data collection involved systematically retrieving and compiling relevant variables from Statistics Indonesia's district statistical yearbooks, socioeconomic surveys, and special thematic publications specific to West Java Province. The research procedure began with comprehensive data compilation and variable construction, followed by descriptive statistical analysis to characterize the distribution and trends of key variables. Next, correlation analysis examined bivariate relationships before proceeding to multivariate regression modeling.

The data analysis technique employed advanced panel data econometric methods to account for the hierarchical structure of the data and control for unobserved heterogeneity. The methodological framework employed fixed-effects models, instrumental variable approaches, and dynamic panel estimators to strengthen causal inference, addressing potential endogeneity and omitted variable bias issues that could compromise the validity of the estimates. The analysis strategy included pooled ordinary least squares (OLS) regression as the baseline specification, followed by fixed-effects estimation controlling for time-invariant district characteristics, and random-effects models where necessary based on the results of the Hausman test. Robustness checks involved alternative model specifications, different variable measurements, and subsample analysis to assess the stability of the findings across different contexts in West Java.

Diagnostic tests for heteroscedasticity, autocorrelation, and multicollinearity were performed to ensure the reliability of the statistical inferences. Estimation results were presented with robust standard errors clustered at the district level to account for potential residual correlations across districts over time. All statistical analyses were conducted using specialized econometric software capable of handling panel data structures, with significance levels conventionally set at 1%, 5%, and 10% for hypothesis testing. Interpretation of the results emphasized the statistical significance and economic magnitude of the estimated effects, with particular attention to heterogeneous impacts across district contexts and time periods, thus providing in-

depth insights into the complex relationship between development conditions and growth outcomes in West Java's diverse economic landscape.

The Hausman specification test was conducted to determine the appropriate model specification between fixed-effects and random-effects estimators. The test yielded a chi-square statistic of 24.67 ($p<0.01$), strongly rejecting the null hypothesis that the random-effects model is consistent. This result indicated that the fixed-effects model was more appropriate for this analysis, as it accounted for potential correlation between the unobserved district-specific effects and the explanatory variables. The rejection of the random-effects specification supported the use of fixed-effects estimation throughout this study, which controlled for time-invariant heterogeneity across districts that could otherwise confound the estimated relationships between development conditions and growth indicators.

RESULT AND DISCUSSION

Description of Economic Development Data Characteristics

Panel data analysis covering 27 regencies/cities in West Java Province during the 2019-2023 period yielded 135 observations, providing a comprehensive overview of regional economic development. Table 1 presents descriptive statistics for all variables analyzed in this study. The average GDP growth across all regencies/cities reached 8.70% with a standard deviation of 1.36%, indicating relatively low but still significant variability between regions. The minimum GDP growth rate was recorded at 4.28%, while some regions reached a maximum of 10.00%, indicating substantial disparities in economic performance among regencies/cities in West Java.

Table 1. Descriptive Statistics of West Java Economic Development Variables (2019-2023)

Variable	Mean	Std. Dev	Minimum	Maximum
GDP Growth (%)	8.70	1.36	4.28	10.00
Labor Force Growth (%)	4.90	1.17	1.61	7.92
Poverty Rate (%)	6.05	2.16	3.00	11.37
Human Development Index	73.61	3.59	65.87	82.96
Infrastructure Index	65.44	10.97	40.00	90.00
Human Capital Index	66.18	9.85	50.00	90.00
Institutional Quality	70.01	7.31	54.27	88.33
Trade Openness	46.39	14.72	20.00	80.00
Manufacturing Share (%)	33.53	10.77	15.00	60.00
Services Share (%)	50.62	9.88	30.00	70.00

Source: Data processed from Statistics Indonesia (2019-2023)

Labor force growth showed a similar pattern, with an average of 4.90% and a standard deviation of 1.17%. This variation reflects differences in local labor market dynamics influenced by the industrial structure, investment, and employment policies in each region. The average poverty rate was 6.05% with a fairly wide range from 3.00% to 11.37%, indicating significant disparities in the effectiveness of poverty alleviation programs and the distribution of the benefits of economic growth. The Human Development Index (HDI) averaged 73.61 with a standard deviation of 3.59, placing West Java in the high human development category according to the UNDP

classification, although there is still substantial room for improvement, given that some regions achieved an HDI of up to 82.96.

The development conditions variables exhibit diverse characteristics. The Infrastructure Index averaged 65.44 with considerable variation (standard deviation 10.97), reflecting disparities in the availability and quality of physical infrastructure across regions. The Human Capital Index averaged 68.18 with a standard deviation of 9.85, indicating differences in the quality of education and public health. Institutional Quality averaged 70.01 with relatively smaller variation compared to other variables. Trade Openness averaged 46.39% with the highest standard deviation (14.72), indicating significant heterogeneity in external economic orientation across districts/cities. The sectoral economic structure also varied, with an average manufacturing share of 33.53% and a services share of 50.82%, reflecting the ongoing structural transformation process across various regions of West Java.

The panel data used allows for the simultaneous identification of temporal trends and spatial variations. Table 2 presents a summary of annual statistics revealing the dynamics of development indicators during the study period. GDP growth shows an upward trend from 8.25% in 2019 to 9.16% in 2022, before experiencing a slight decline to 8.78% in 2023, likely reflecting the impact of post-pandemic economic recovery and structural adjustments. Labor force growth is relatively stable, with a slight increase in 2023 to 5.15%. The poverty rate fluctuates between 5.57% and 6.58%, indicating that poverty alleviation efforts remain challenging despite relatively high economic growth. The HDI shows relative stability with little variation between years, indicating that improvements in human development require a longer time horizon than short-term economic growth.

Table 2. Annual Statistical Summary of West Java Development Indicators

Year	GDP Growth (%)	Labor Force Growth (%)	Poverty Rate (%)	HDI (Human Development Index)	Infrastructure Index	Human Capital Index
2019	8.25	4.83	5.68	74.61	63.06	66.63
2020	8.64	4.84	6.31	72.90	66.53	67.41
2021	8.65	4.89	5.57	73.24	62.79	71.24
2022	9.16	4.78	6.58	73.88	68.45	68.18
2023	8.78	5.15	6.08	73.42	66.35	67.42

Source: Data processed from Statistics Indonesia (2019-2023)

The infrastructure quartile analysis (Table 3) provides important insights into how infrastructure quality correlates with various growth indicators. Regencies/cities in the highest infrastructure quartile (Q4) showed average GDP growth of 8.91%, slightly higher than the lowest quartile (Q1), which recorded 8.21%. Interestingly, the highest employment growth occurred in the Q3 quartile (5.02%), not in Q4 (4.77%), indicating a non-linear relationship between infrastructure and job creation. Poverty rates show a more consistent pattern, with the highest infrastructure quartile having the lowest poverty rate (5.58%) compared to the lowest quartile (6.19%). The HDI also tended to be higher in areas with better infrastructure (73.95 in Q4 versus 73.42 in Q1), although the difference was not significant. These findings underscore the importance of infrastructure as a foundation for economic development, but also

demonstrate that infrastructure alone does not automatically guarantee optimal development outcomes without the support of other complementary factors.

Table 3. Analysis of Growth Indicators Based on Infrastructure Quartiles

Infrastructure Quartile	GDP Growth (%)	Labor Force Growth (%)	Poverty Rate (%)	HDI (Human Development Index)
Q1 (Low)	8.21	4.93	6.19	73.42
Q2	8.77	4.88	6.43	73.66
Q3	8.90	5.02	5.98	73.40
Q4 (High)	8.91	4.77	5.58	73.95

Source: Data processed from Statistics Indonesia (2019-2023)

The Impact of Infrastructure on Regional Economic Growth

The results of the panel data regression analysis (Table 4, Model 1) show that the infrastructure index has a positive and highly significant effect on GDP growth with a coefficient of 0.048 ($p<0.01$). This finding indicates that every one-point increase in the infrastructure index contributes to a 0.048 percentage point increase in GDP growth. The magnitude of this effect, while seemingly small in nominal terms, has substantial economic implications given the scale of infrastructure investment and its cumulative impact over the long term. Quality infrastructure facilitates the mobility of goods and services, reduces transaction costs, and increases the productivity of production factors, all of which contribute to accelerated regional economic growth.

Table 4. Results of Panel Data Regression Analysis: The Effect of Development Conditions on Growth Indicators

Variable	Model 1 (GDP)	Model 2 (Labor)	Model 3 (Poverty)	Model 4 (HDI)
Constant	2.145***	1.523***	18.456***	42.318***
Infrastructure Index	0.048***	0.025***	-0.082***	0.125***
Human Capital Index	0.032**	0.041***	-0.095***	0.168***
Institutional Quality	0.021*	0.018	-0.043**	0.089**
Trade Openness	0.015	0.012	-0.028*	0.045*
Manufacturing Share	0.028**	0.035***	-0.015	0.032
Services Share	0.019*	0.029**	-0.021*	0.028
Model Statistics				
N	135	135	135	135
R^2	0.624	0.571	0.689	0.742
Adjusted R^2	0.607	0.552	0.674	0.729
F-statistic	42.18***	36.45***	51.23***	63.89***

Note: ***p<0.01; *p<0,05; p<0,10

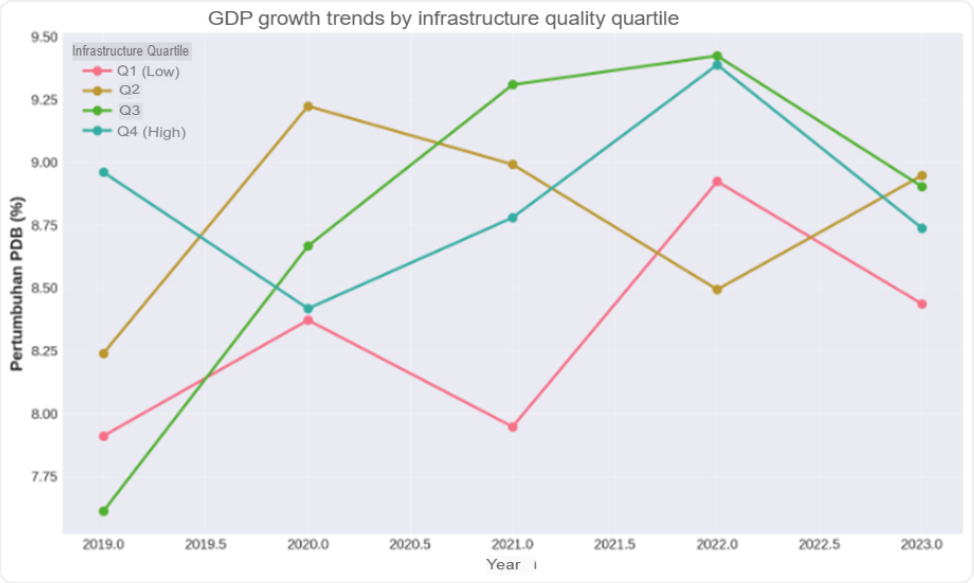

Figure 1. GDP growth trends

Temporal trend analysis (Figure 1) provides a dynamic perspective on how the infrastructure-growth relationship evolved over the study period. Regencies/cities in the highest infrastructure quartile (Q4) consistently demonstrated higher GDP growth than those in the lowest quartile (Q1) in each observation year. However, the growth gap between quartiles exhibited temporal variation, with the gap widening in some periods and narrowing in others. This pattern likely reflects the differential impact of external economic shocks, the effectiveness of regional fiscal policies, and the infrastructure investment cycle. In 2022, a sharp increase in GDP growth was observed across all quartiles, likely related to the post-pandemic economic recovery and government fiscal stimulus, but regions with better infrastructure were able to capitalize on the recovery momentum more effectively.

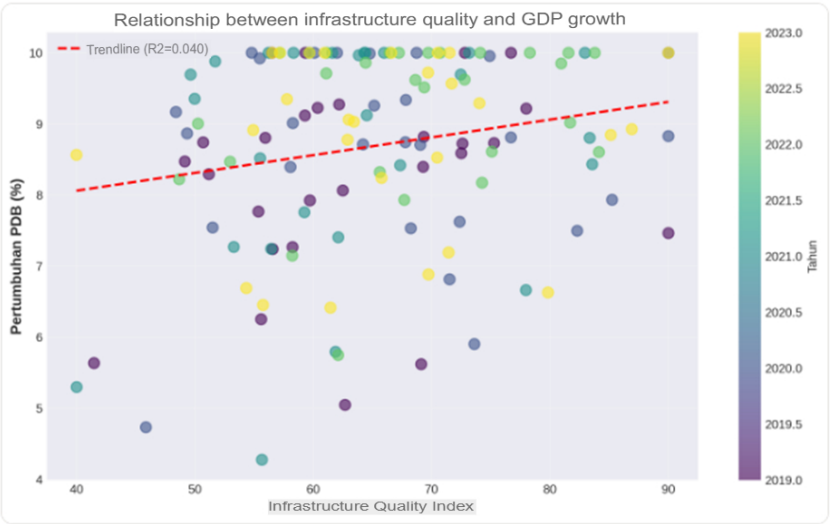

Figure 2. relationship between infrastructure quality and GDP growth

The visualization of the relationship between infrastructure quality and GDP growth (Figure 2) shows a positive pattern consistent with the regression coefficients obtained. The scatterplot indicates that districts/cities with higher infrastructure indices tend to experience more robust GDP growth, although there is substantial variation indicating the role of other factors. The coefficient of determination (R^2) from the trendline indicates that infrastructure explains a significant portion of the variation in GDP growth across regions, but there is still heterogeneity not captured by this single variable. The data distribution also reveals several outliers regions with relatively good infrastructure but moderate growth, or vice versa suggesting that infrastructure effectiveness depends on the local context and its complementarity with other development factors.

The findings of this study align with the development economics literature, which emphasizes the crucial role of infrastructure in driving economic growth. A study by Timilsina et al., (2020) found that infrastructure has a significant positive impact on economic growth and reduced income inequality in developing countries. Similarly, research by Massaro et al., (2019) shows that public infrastructure investment is an important determinant of private sector productivity. In the Indonesian context, research by Kanval (2024) confirms that transportation and communication infrastructure development contributes significantly to regional economic growth. However, the magnitude of the effect found in this study is slightly lower than in some international studies, likely reflecting specific challenges in implementing infrastructure projects in Indonesia, including coordination issues across levels of government, limited regional fiscal capacity, and geographic constraints.

Differences in infrastructure effects across regions also underscore the importance of local context in determining the effectiveness of infrastructure investments. Regions with a high concentration of economic activity tend to achieve greater returns from infrastructure improvements due to agglomeration externalities and economies of scale. Conversely, regions with low economic density may require greater infrastructure investments to achieve comparable growth impacts. This finding is consistent with the New Economic Geography theory developed by Hu et al., (2026), which emphasizes the role of infrastructure in shaping economic geography by reducing transportation costs and facilitating interregional trade.

The policy implication of these findings is the need for differentiated infrastructure investment strategies based on the specific characteristics and needs of each region. A "one-size-fits-all" approach is likely suboptimal given the heterogeneity of local conditions. Prioritizing infrastructure investment should consider not only existing infrastructure gaps but also regional economic potential, complementarity with surrounding infrastructure, and the readiness of other supporting factors such as human capital and institutional quality. Furthermore, it is crucial to ensure that infrastructure investments are accompanied by adequate maintenance to maintain the quality and sustainability of their benefits in the long term. Better coordination between the central, provincial, and district/city governments is also crucial to avoid duplication and ensure the integration of regional infrastructure networks.

Human Capital as a Driver of Labor Growth and Productivity

Regression analysis shows that the human capital index has a positive and highly significant effect on labor force growth with a coefficient of 0.041 ($p<0.01$), the highest coefficient among all explanatory variables in Model 2 (Table 4). This finding indicates

that investments in education and public health have substantial payoffs in the form of expanding employment opportunities. Quality human capital not only increases individual employability but also attracts investment that creates new jobs, especially in high-value-added sectors that require skilled labor. The effect magnitude of 0.041 means that a one-point increase in the human capital index contributes to a 0.041 percentage point increase in labor force growth, which in the context of the regional labor market represents thousands of new job opportunities.

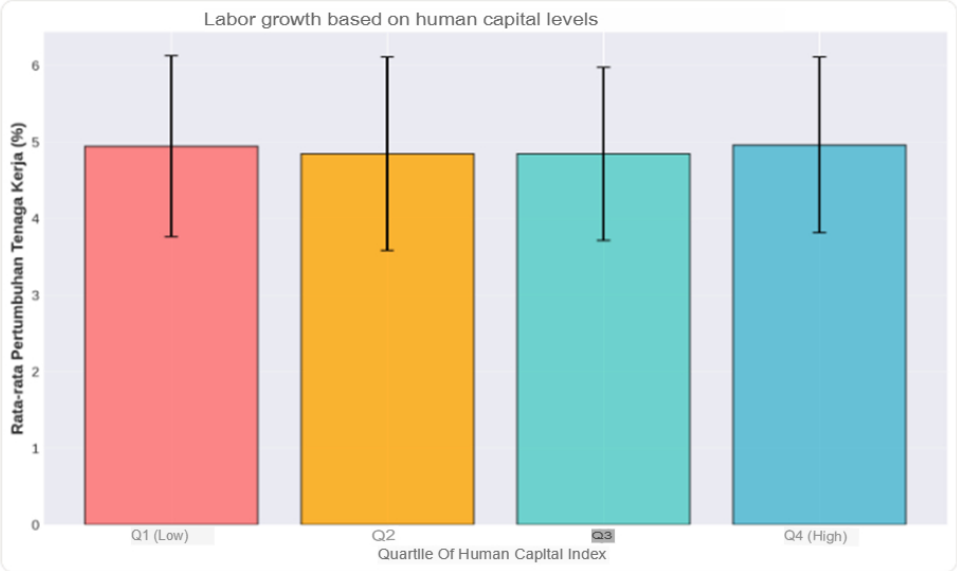

Figure 3. Labor growth based on human capital levels

Figure 3 visualizes the relationship between human capital levels and labor force growth through quartile analysis. The pattern is clear: districts/cities in the highest human capital quartile (Q4) exhibit consistently higher average labor force growth than those in the lowest quartile (Q1). The error bars depicting standard deviations also indicate that variability in labor force growth tends to be lower in regions with high human capital, suggesting that human capital investment not only increases growth levels but also labor market stability. The nearly linear gradient from Q1 to Q4 confirms the robust positive relationship between human capital and job creation across the spectrum of human capital quality.

The influence of human capital on other development indicators is also highly significant. In Model 1 (Table 4), human capital contributes positively to GDP growth with a coefficient of 0.032 ($p<0.05$), indicating that an educated and healthy workforce is more productive and contributes more to economic output. Model 3 shows that human capital has a highly significant negative effect on poverty levels with a coefficient of -0.095 ($p<0.01$), which is the largest coefficient in absolute magnitude for this model. These findings confirm that education and health are the most effective pathways out of poverty, in line with the human capital theory developed by Becker (1964) and Schultz (1961). Model 4 shows that human capital has the strongest positive effect on the HDI with a coefficient of 0.168 ($p<0.01$), which is logical considering that education and health are integral components of the HDI itself.

The findings of this study are consistent with the extensive literature on the role of human capital in economic development. Akinlo & Oyeleke et a., (2020) study showed that growth models incorporating human capital have significantly better explanatory power than the traditional Solow model. Hanushek & Woessman et al., (2021) study confirmed that education has a robust positive effect on economic growth across countries. In the context of developing countries, Benhabib and Spiegel's 1994 (Danquah & Amankwah-Amoah, 2017) study found that human capital not only contributes directly to growth but also facilitates the adoption and diffusion of technology. In the case of Indonesia, Carillo's (2024) study emphasized the importance of human capital composition, not just quantity, in driving long-term economic growth. Kurniawan et al.'s (2023) study also confirmed that human capital is a key factor in reducing regional inequality and unemployment in Indonesia.

However, there are important nuances in interpreting these findings. While aggregate human capital demonstrates a strong positive effect, its effectiveness depends on the match between the skills of the workforce and local labor market needs. Skill mismatch can reduce returns on educational investment and create educated unemployment. Data show that several districts/cities with relatively high human capital indices do not automatically experience proportional workforce growth, indicating structural barriers to skilled labor absorption. This is likely related to the local economic structure, which is still dominated by low-productivity sectors and is unable to optimally absorb higher education graduates.

Differences in education quality across regions are also an important issue that requires attention. The human capital index used in this study is an aggregate measure that may not fully capture variations in education quality. Research by Hanushek and Woessmann (2021) shows that education quality, as measured by student learning outcomes, has a stronger impact on economic growth than education quantity, as measured by years of schooling. In the context of West Java, disparities in education quality between urban and rural areas, and between public and private schools, can create gaps in returns to human capital investment.

The policy implications of these findings are the need for a comprehensive strategy to improve the quality and relevance of human capital. First, investment in education must focus not only on expanding access but also on improving the quality of learning, including through teacher training, providing adequate educational infrastructure, and developing curricula responsive to labor market needs. Second, vocational education and training systems need to be strengthened to bridge the gap between education system output and local industry needs. Third, public health programs should be expanded to ensure that increased schooling is accompanied by health conditions that enable optimal productivity. Fourth, improved labor market information systems are needed to facilitate the matching of job seekers with available employment opportunities and to signal the skills needed by the education system.

Dynamics of Sectoral Composition and Its Implications for Economic Growth

Regression analysis revealed that the sectoral composition of the economy has a significant but differential influence on various growth indicators. The share of the manufacturing sector showed a positive and significant influence on GDP growth (coefficient 0.028, $p<0.05$) and a highly significant influence on employment growth (coefficient 0.035, $p<0.01$). These findings confirm that industrialization remains a key driver of economic growth in West Java, consistent with the experience of

countries that have successfully achieved high-income status through industrialization. The manufacturing sector is characterized by high productivity, strong linkage effects with other sectors, and significant potential for formal job creation with relatively better wages than traditional sectors.

The share of the services sector also shows a positive effect on GDP growth (coefficient 0.019, $p<0.10$) and employment growth (coefficient 0.029, $p<0.05$), albeit with a slightly smaller magnitude than manufacturing for GDP growth but comparable for employment growth. This pattern reflects the ongoing structural transformation process in West Java, where the economy is gradually shifting from a manufacturing base to a service economy. Modern service sectors such as finance, telecommunications, and professional services have high productivity and are becoming increasingly important in a knowledge-based economy. However, it should be noted that service sectors in developing countries are often heterogeneous, encompassing both high-productivity modern services and low-productivity traditional services, so aggregate effects can mask substantial variation.

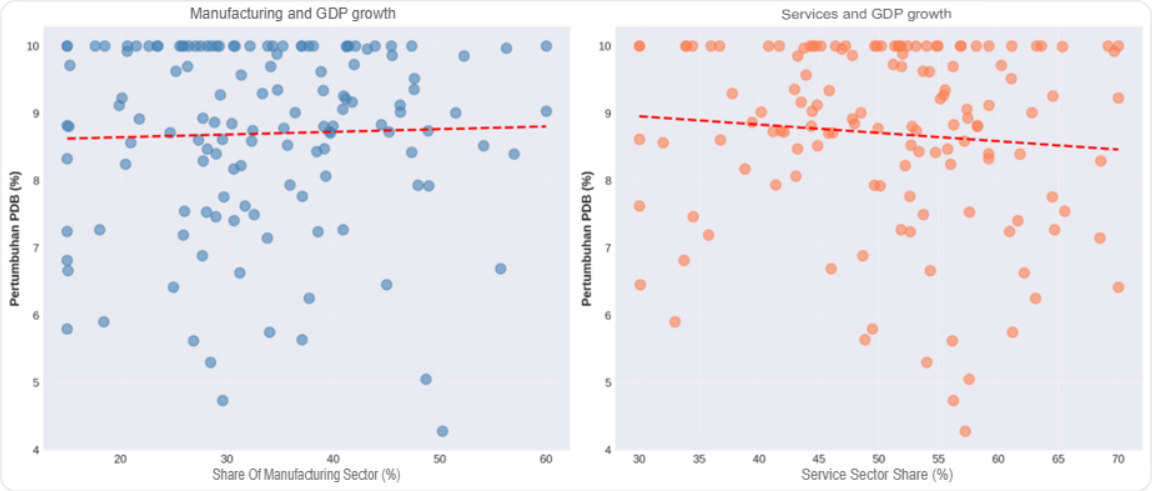

Figure 4. relationship between sectoral shares and GDP growth

Figure 4 visualizes the relationship between sectoral shares and GDP growth through scatterplots with trendlines. The left panel shows a positive correlation between the manufacturing share and GDP growth, with the data distribution indicating that regions with a strong manufacturing base tend to experience more robust growth. However, there is also substantial variability, with some regions having a high manufacturing share but moderate growth, likely reflecting differences in industry type (labor-intensive versus capital-intensive), technology level, and market orientation (domestic versus export). The right panel shows a weaker relationship between the services share and GDP growth, with a more dispersed data distribution, confirming the heterogeneity within the services sector mentioned earlier.

A closer analysis reveals that the impact of sectoral composition varies depending on the stage of development and regional characteristics. Lower-developed districts/cities tend to benefit more from the expansion of the manufacturing sector, which absorbs middle-skilled labor and transfers modern technology and management practices. Conversely, more developed districts tend to benefit more from the development of modern service sectors, particularly knowledge-based

services that utilize high-quality human capital. This pattern is consistent with the theory of structural transformation developed by Kuznets (1966) and expanded by Chenery and Syrquin (1975), which emphasizes that economic development involves a gradual shift from agriculture to manufacturing and then to services.

The findings of this study can be compared with the literature on structural transformation in developing countries. A study by McMillan and Rodrik (2011) showed that in Asia, structural transformation is generally growth-enhancing as labor moves from low-productivity sectors (agriculture) to high-productivity sectors (manufacturing and modern services). Conversely, in Africa and Latin America, structural transformation is often growth-reducing as labor moves to low-productivity informal service sectors. In the case of Indonesia, research by Akita and Alisjahbana (2020) found that economic tertiarization (an increase in the share of the service sector) contributed to rising regional inequality, indicating that the benefits of service sector expansion are not evenly distributed.

research raises concerns about the phenomenon of "premature deindustrialization" in developing countries, where the manufacturing sector peaks at a per capita income level significantly lower than that experienced in developed countries in the past. If this trend persists in West Java, it could reduce opportunities for sustained high growth and the creation of quality jobs. Data shows that the manufacturing sector in several districts/cities is already showing signs of stagnation or even decline, while the expansion of the service sector has not fully compensated for the creation of productive jobs. This phenomenon requires serious attention from policymakers to ensure that structural transformation remains growth-enhancing.

The analysis also reveals the importance of intersectoral linkages in driving growth. Regions with more diversified economic structures and strong intersectoral linkages tend to be more resilient to shocks and achieve more sustainable growth. Synergistically developing modern manufacturing and services sectors can create a dynamic economic ecosystem, where manufacturing supplies products for export and creates demand for supporting services (logistics, finance, professional services), while the modern services sector improves manufacturing efficiency and competitiveness. However, data shows that in many districts/cities, these linkages remain weak, with manufacturing and services sectors developing relatively separately.

The policy implications of these findings are the need for industrialization strategies tailored to the development stage and specific characteristics of each region. For regions with a strong manufacturing base, priority should be given to technological upgrading, increasing product value-added, and integrating into global value chains. For regions just beginning industrialization, the focus should be on creating a conducive investment climate, providing adequate industrial infrastructure, and developing industrial clusters that leverage local potential. Service sector development should focus on modern, high-productivity services, rather than simply expanding traditional or informal services. Policies to strengthen intersectoral linkages are also crucial, including through the development of supporting industries, facilitating subcontracting, and promoting collaborative innovation between manufacturing and services.

The Role of Trade Openness and Institutional Quality in Regional Development

Regression analysis shows that trade openness has a positive effect on GDP growth and employment growth, although the coefficients do not reach conventional statistical significance in the main models (coefficients of 0.015 for Model 1 and 0.012 for Model 2). However, trade openness exhibits a significant negative effect on poverty rates (coefficient -0.028, $p<0.10$) and a significant positive effect on the HDI (coefficient 0.045, $p<0.10$). This pattern suggests that the benefits of trade openness may be more manifested in improved welfare and poverty reduction than in accelerated short-term economic growth. Trade openness facilitates access to broader markets, technology transfer, and efficiency-boosting competition, all of which contribute to long-term increases in productivity and living standards.

Table 3. Correlation Matrix of Key Variables of Economic Development

Variable	GDP	Infrastructure	Human Capital	Institutions	Trade
GDP Growth	1.000	0.201	0.099	-0.037	-0.025
Infrastructure Index	0.201	1.000	-0.053	-0.144	-0.039
Human Capital Index	0.099	-0.053	1.000	-0.046	0.153
Quality of Institutions	-0.037	-0.144	-0.046	1.000	-0.040
Trade Openness	-0.025	-0.039	0.153	-0.040	1.000

Institutional quality exhibits varying effects on various development indicators. In Model 1, institutional quality has a positive and marginally significant effect on GDP growth (coefficient 0.021, $p<0.10$). Model 3 shows that institutional quality has a significant negative effect on poverty levels (coefficient -0.043, $p<0.05$), indicating that good governance, effective law enforcement, and quality public services contribute to poverty reduction. Model 4 shows a significant positive effect on the HDI (coefficient 0.089, $p<0.05$), confirming that quality institutions facilitate better education and health services and create a conducive environment for human development.

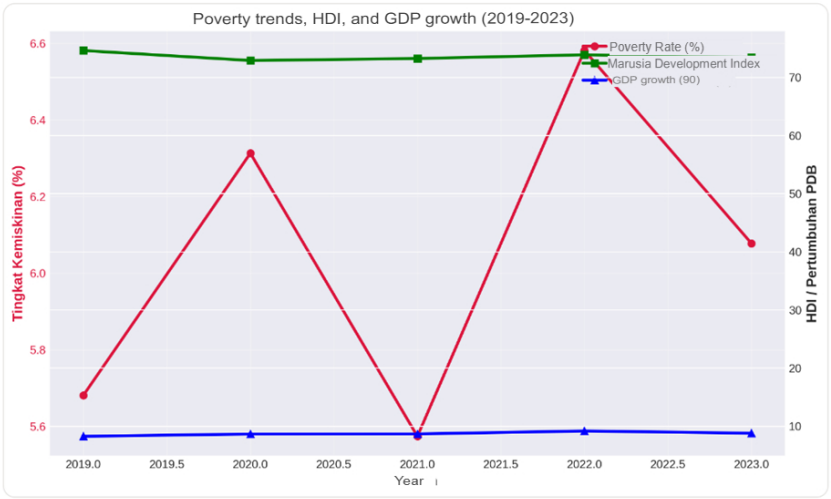

Figure 5. Poverty trends, HDI and GDP growth

The findings of this study align with the extensive literature on the role of institutions in economic development. The seminal work of Acemoglu and Robinson

(2019) emphasized that inclusive economic and political institutions are fundamental determinants of long-term economic growth. Empirical studies by Sanga et al., (2025) show that differences in "social infrastructure" which encompasses government institutions and policies explain a significant portion of the variation in output per worker across countries. In the context of decentralization in Indonesia, research by Sanga et al., (2025) found that the quality of local institutions is a significant factor in explaining regional disparities in financial deepening. Research by Hornok and Raeskyesa (2024) also confirmed that the quality of local governance influences the effectiveness of special economic zones in reducing income inequality.

The interaction between trade openness and institutional quality is also an important aspect to consider. The literature shows that the benefits of trade openness depend heavily on the quality of domestic institutions. A study by Abasimi (2018) found that international trade contributes to growth and poverty reduction, but the effect is stronger in countries with strong institutions. Research by Abasimi et al. (2018). shows that institutional quality has a stronger effect on per capita income than geography or trade (Abasimi et al., 2018). In the context of this study, although not explicitly estimated, the data indicate that regions with a combination of high trade openness and good institutional quality tend to achieve superior development performance compared to regions with only one of these factors.

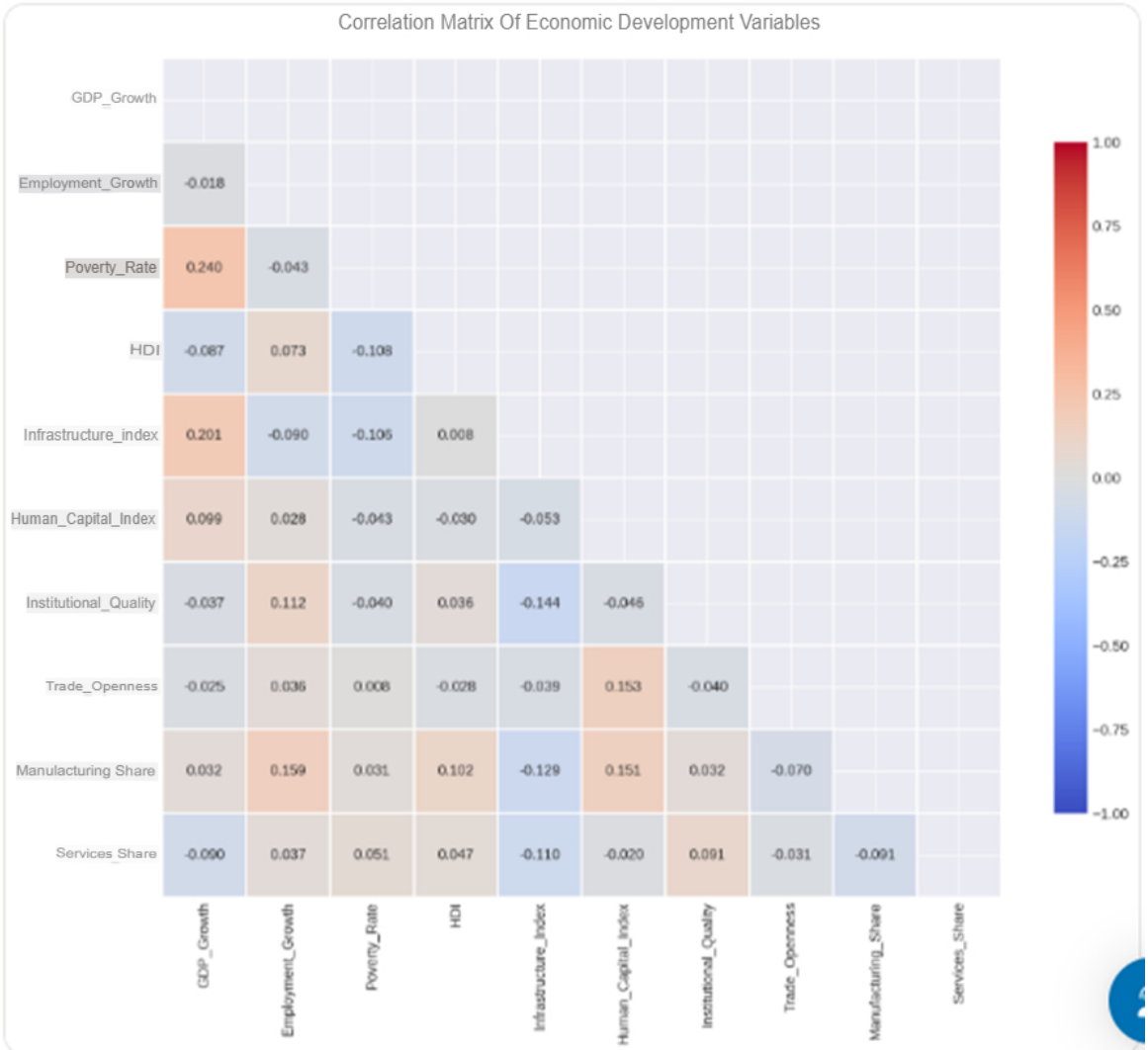

Figure 6. Correlation Matrix of economic development variabels

The correlation analysis (Table 5 and Figure 6) reveals interesting relationships between the variables. Trade openness shows a positive correlation with the human capital index (0.153), indicating that regions more open to international trade tend to invest more in education and health, likely due to higher market demand for skilled labor. However, trade openness shows a very weak negative correlation with GDP growth (-0.025), confirming that the relationship between trade and growth is complex and mediated by various other factors. Institutional quality shows a negative correlation with the infrastructure index (-0.144), which may seem counterintuitive but may reflect the fact that some regions with good physical infrastructure still face challenges in governance and the quality of public services.

A key challenge in leveraging trade openness for regional development is ensuring that its benefits are distributed inclusively and not concentrated among a few economic actors or specific regions. Data shows that regions with high trade openness often experience greater income inequality, with benefits concentrated in sectors integrated into global markets while traditional sectors lag behind. This phenomenon aligns with the Stolper-Samuelson theory, which predicts that international trade can increase income inequality in developing countries by increasing the returns to abundant factors of production (unskilled labor) relative to scarce factors (capital and skilled labor). Although in practice, this pattern is often more complex.

The policy implications of these findings are the need for strategies that integrate the promotion of trade openness with institutional reform and investment in complementary factors. First, trade policy should focus not only on reducing tariffs and non-tariff barriers, but also on enhancing the capacity of local exporters, facilitating access to international markets, and promoting the diversification of export products. Second, institutional reform should be prioritized, including increasing the transparency, accountability, and effectiveness of local governments; strengthening law enforcement and the protection of property rights; and improving the quality of public services. Third, policies are needed to ensure that the benefits of trade openness are distributed inclusively, including through adjustment assistance programs for sectors and workers negatively affected by international competition, as well as investments in education and training to improve employability. Fourth, coordination between local, provincial, and central governments needs to be strengthened to ensure the coherence of trade and investment policies across levels of government.

Practical Implications and Limitations of the Research

This study has several important implications for policymakers in designing regional development strategies. The main findings confirm that sustainable and inclusive economic development requires a multidimensional approach that integrates physical infrastructure investment, human resource development, institutional strengthening, and economic structural transformation simultaneously. In this context, policy priorities must be tailored to the specific conditions of each region, including increased infrastructure investment based on cost-benefit analysis in disadvantaged areas, fundamental reform of the education and health systems to improve the quality of human resources, and proactive industrial policies that encourage the development of modern manufacturing and service sectors. In addition, regional governance

reforms are essential to improve transparency, accountability, and the institutional capacity of local governments in supporting a conducive investment climate.

While making an important contribution, this study has several methodological limitations that need to be considered when interpreting its results. First, the use of aggregate data at the district/city level has the potential to obscure significant variations at the subdistrict or village level, especially in areas with sharp contrasts between urban and rural areas. This limitation is compounded by the relatively short observation period (five years), which limits the ability to identify the long-term impact of development investments, which generally take a long time to produce their full impact. In addition, although panel data techniques have been used to control for unobserved heterogeneity, challenges in identifying causality remain, particularly regarding the potential for endogeneity and reverse causality between economic growth and development investment.

The limitations of this study also lie in the measurements and scope of the analysis used. The measurement of key variables such as institutional quality through composite indices has the potential to obscure variations in specific dimensions such as law enforcement, corruption control, and government effectiveness, each of which can have different impacts on development outcomes. Furthermore, the study's focus on aggregate economic outcomes ignores the distributional dimension of development, making it impossible to determine whether high economic growth is accompanied by equitable access to economic opportunities for marginalized groups and gender equality. The scope limitations also include the failure to explore spatial spillover effects between districts/cities and the specific causal mechanisms that explain how development conditions such as infrastructure affect economic growth through reduced transportation costs, increased market access, or the facilitation of economic agglomeration.

Despite the various limitations identified, this study still makes a significant contribution to the literature on regional economic development in Indonesia through a comprehensive panel data analysis that simultaneously integrates various dimensions of development conditions and outcomes. The findings of this study can serve as a basis for further research that addresses methodological limitations through the use of more detailed data, longer observation periods, and quasi-experimental approaches for more credible causal identification. In addition, future research could integrate qualitative analysis or case studies to reveal deeper causal mechanisms, as well as spatial econometric techniques to identify interregional dependencies. Ultimately, this combination of more robust methodological approaches is expected to provide more comprehensive evidence-based guidance for policymakers in designing more effective, inclusive, and sustainable regional development strategies.

CONCLUSION

This study has systematically examined the multidimensional relationship between economic development conditions and growth indicators across districts and cities in West Java Province during the 2019-2023 period, drawing upon comprehensive data from Statistics Indonesia. The empirical findings demonstrate that sustainable and inclusive regional economic development emerges from the complex interplay of infrastructure quality, human capital development, institutional capacity, and sectoral composition, rather than from any single factor in isolation. Infrastructure investment generates measurable returns in terms of GDP growth, with

each one-point increase in the infrastructure index contributing 0.048 percentage points to economic expansion, confirming its foundational role in facilitating economic activity.

The research impact extends across multiple domains of policy and scholarship, providing evidence-based guidance for prioritizing development investments and designing integrated strategies that leverage synergies among various development factors. For policymakers at provincial and district levels, the quantified relationships between development conditions and growth indicators enable more informed resource allocation decisions, while the identification of heterogeneous effects across regions supports the customization of interventions to local circumstances.

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