

The Impact of Micro, Small, and Medium Enterprises on Regional Economic Growth in the Border Area of West Kalimantan, Indonesia

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Abstract

This study examines the role of micro, small, and medium enterprises (MSMEs) as a transmission mechanism linking education, infrastructure, and labor to regional economic growth in the border area of West Kalimantan, Indonesia. Border regions frequently face structural disadvantages — including geographic isolation, fragmented markets, and limited institutional capacity — that constrain their ability to convert development inputs into sustainable economic output. Using a Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach with secondary panel data from five border districts (Sambas, Bengkayang, Sanggau, Sintang, and Kapuas Hulu) for the period 2018–2022, the study simultaneously tests direct and indirect causal relationships among these variables. Results indicate that education and infrastructure significantly influence economic growth, whereas labor does not demonstrate a significant direct effect. Education also significantly affects the number of MSMEs, but infrastructure does not. Crucially, the number of MSMEs neither significantly drives economic growth nor mediates the relationship between development factors and regional output — a phenomenon described here as growth transmission failure. This condition arises from the subsistence character of most MSMEs, their limited access to finance and technology, and weak integration into broader value chains. These findings challenge conventional assumptions about MSMEs as automatic engines of regional development and suggest that policy interventions must prioritize productivity enhancement, human capital quality, and value chain integration over mere business-unit expansion.

Keywords: economic growth, border regions, SEM-PLS, growth transmission failure, regional development.

1. Introduction

Regional economic growth is increasingly interpreted as more than the mere expansion of gross regional domestic product (GRDP). Contemporary regional economics emphasizes the ability of a region to develop productive economic structures, reduce spatial disparities, and strengthen the resilience of local economic systems (Papachrysou and Vasilakos, 2026) (Roura et al., 2025). This broader understanding of development becomes particularly important when analyzing border regions, where geographical, institutional, and market constraints frequently limit economic transformation.

Border areas often experience structural disadvantages compared with central economic regions. Geographic distance from national growth centers, inadequate infrastructure networks, and fragmented markets can reduce regional competitiveness and limit productive investment. These challenges are evident in the border region of West Kalimantan, Indonesia, which shares a direct boundary with Malaysia (Helma, 2023)(Javier et al., 2023). BPS data for 2022 reveal that per capita GRDP across the five border districts ranged from IDR 34.78 million in Bengkayang to IDR 48.37 million in Sanggau, compared to IDR 66.17 million in Pontianak City a gap exceeding 47 percent between the border periphery and the provincial urban center (BPS Kalimantan Barat, 2023). Despite, it's strategic geographic position and potential for cross-border trade, economic development across these districts remains uneven and structurally constrained.

In development economics, education, infrastructure, and labor are commonly recognized as fundamental drivers of economic growth. Education contributes to human capital formation and enhances entrepreneurial capabilities. Infrastructure improves connectivity and lowers transaction costs, enabling more efficient economic interaction across regions. Meanwhile, labor participation expands productive capacity and supports economic activity (Yin et al., 2024) However, However, empirical evidence indicates that the presence of these factors does not automatically translate into economic growth, particularly in peripheral regions characterized by structural constraints (Malesu and Syrovátka, 2025). The impact of development inputs often depends on the capacity of regional economic structures to convert them into productive output (Constantine, 2017).

In West Kalimantan's border economy, micro, small, and medium enterprises (MSMEs), represent a dominant component of local economic activity, particularly in absorbing labor and supporting household livelihoods (Malesu and Syrovátka, 2025). The total number of MSMEs in West Kalimantan grew from 196,656 units in 2022 to 225,713 units by July 2023, an increase of approximately 14.8 percent (Dinas Koperasi dan UMKM Kalimantan Barat, 2023). Nevertheless, the growth in the number of MSMEs does not necessarily indicate improvements in productivity or value creation (López, 2025), many MSMEs operate on a subsistence basis with limited access to financing, technology, and wider market networks, which constrains their contribution to regional economic output (Rodrigues and Carrilho, 2024). As a result, their contribution to per regional output may be weaker than theoretically expected (Telukdarie et al., 2024).

Given these conditions, the present study examines whether MSMEs function as an effective transmission mechanism linking development determinants namely education, infrastructure, and labor to economic growth in the border areas of West Kalimantan. Using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach, the study simultaneously evaluates both direct and indirect relationships among these variables (Hair and Alamer, 2022a). The findings aim to provide empirical insights for regional development policies in border areas, emphasizing not only the accumulation of production factors but also the strengthening of productivity and structural transformation within the MSME sector (Paul et al., 2025).

2. Literature Review

Recent developments in the literature on regional economic growth indicate a shift from traditional linear growth models toward approaches that emphasize contextual and spatial mechanisms of economic development Chang (Chang et al., 2024). In the neoclassical framework, economic growth is largely determined by the accumulation of capital, labor, and technological progress (Dykas et al., 2022). However, more recent studies highlight that the effectiveness of these factors is strongly influenced by institutional quality, regional structural capacity, and the degree of market integration (Eissa and Zaki, 2025a). This perspective becomes particularly relevant when analyzing border regions, which often experience what can be described as a “double periphery” condition. These regions are frequently marginalized from national economic centers while simultaneously facing competitive pressures from neighboring countries (Taubenböck et al., 2023).

Within this context, MSMEs are often conceptualized as engines of economic development due to their role in job creation, local value generation, and innovation diffusion (Saragih et al., 2025). Endogenous growth theory further emphasizes the role of entrepreneurship and innovation as central drivers of long-term economic productivity (Henrekson et al., 2024). Nevertheless, empirical evidence demonstrates considerable variation in the contribution of MSMEs to regional growth, particularly in areas characterized by spatial barriers and limited market connectivity (López, 2025). In many border regions, MSMEs tend to develop as necessity-driven enterprises rather than opportunity-driven businesses. These firms often operate with limited productivity, restricted access to finance, and weak integration into broader value chains (Makkonen and Leick, 2020). Under such circumstances, the expansion of MSMEs may fail to translate into measurable economic growth, resulting in what can be described as a growth transmission failure, where development inputs do not effectively convert into increased regional output (Malesu and Syrovátka, 2025).

Despite the growing recognition of this phenomenon, many empirical studies continue to treat MSMEs either as independent determinants or as outcomes of economic growth, rather than examining their role as mediating mechanisms within the regional economic system (Swami and Sharma, 2025). Consequently, research that simultaneously analyzes the mediating role of MSMEs in the relationship between development factors and economic growth remains relatively limited, particularly in the spatial context of border regions (Anggraeni et al., 2026).

The gap in the literature lies in the still dominance of a partial and linear approach that places MSMEs as an independent or dependent variable, not as a mediation mechanism (Swami and Sharma, 2025). Studies that simultaneously test the role of MSMEs as a conditional growth transmission mechanism in the spatial context of borders are still limited (Anggraeni et al., 2026). This research addresses this gap by adopting a structural modeling approach that captures both direct and indirect causal relationships among development variables. Such an approach allows for a more comprehensive understanding of economic growth dynamics in border regions, where structural and spatial constraints often shape development outcomes (Paul et al., 2026).

3. Methods

This study adopts a quantitative research design, employing Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine direct and indirect causal relationships among five constructs: education, infrastructure, labor, MSMEs, and regional economic growth (Hair and Alamer, 2022b). PLS-SEM was selected for its capacity to handle small samples, non-normal data distributions, and complex mediation structures simultaneously.

The study covers the five border districts of West Kalimantan Sambas, Bengkayang, Sanggau, Sintang, and Kapuas Hulu, using secondary panel data from the Indonesian Central Statistics Agency (BPS) for the period 2018–2022. Education is measured through indicators related to human capital formation, including school participation rates and average years of schooling (Ramos-Rodríguez et al., 2024). Infrastructure is proxied by road networks

(Varghese and Prakash, 2025) Labor is the workforce force participation rate. MSMEs are operationalized through the number of registered business units per district. Economic growth is represented by the GRDP growth rate (BPS Kalimantan Barat, 2023).

The analytical procedure follows four stages: descriptive statistics outer loading assessment for measurement model validity (AVE, cross-loadings) and reliability (Cronbach’s alpha, composite reliability), structural model evaluation (path coefficients, (R²), and bootstrapping for hypothesis testing, including MSME mediation effects (Hair and Alamer, 2022a).

4. Results

The empirical analysis reveals that economic growth dynamics in the border region of West Kalimantan are shaped by complex interactions among development factors, particularly education, infrastructure, labor, and the structure of MSMEs. The PLS-SEM approach enables simultaneous evaluation of causal relationships among latent constructs and provides insights into the transmission mechanisms that operate within the regional economic system.

4.1 Measurement Model Evaluation: Convergent Validity

The first stage of analysis involves evaluating the measurement model to ensure the validity and reliability of the indicators used to represent latent constructs. Outer loadings were assessed in two stages. Stage 1 results are presented in Table 4.1, which includes indicators with loading values below the accepted threshold of 0.70, thereby warranting removal in the subsequent stage.

Table 4.1. Outer Loading Results — Convergent Validity Test (Stage 1)

Indicator	Infrastructure	MSMEs	Education	Economic Growth	Labor	Note
Access_Electricity_PLN	-0.842					Invalid
Expected_Years_of_Schooling			0.879			Valid
HDI (Human Development Index)				0.925		Valid
Total_Employed_Population					0.461	Invalid
Number_of_Schools	0.814					Valid
Small_Enterprise		0.498				Invalid
Medium_Enterprise		-0.011				Invalid
Micro_Enterprise		0.819				Valid
GRDP (Gross Regional Domestic Product)				0.926		Valid
Road_Length	0.622					Valid
School_Participation_Rate			0.569			Valid
Average_Years_of_Schooling			0.693			Valid
Labor_Force_Participation_Rate					-0.905	Invalid
Poverty_Rate				-0.409		Invalid

Source: Data Processed with SmartPLS 4 (2025)

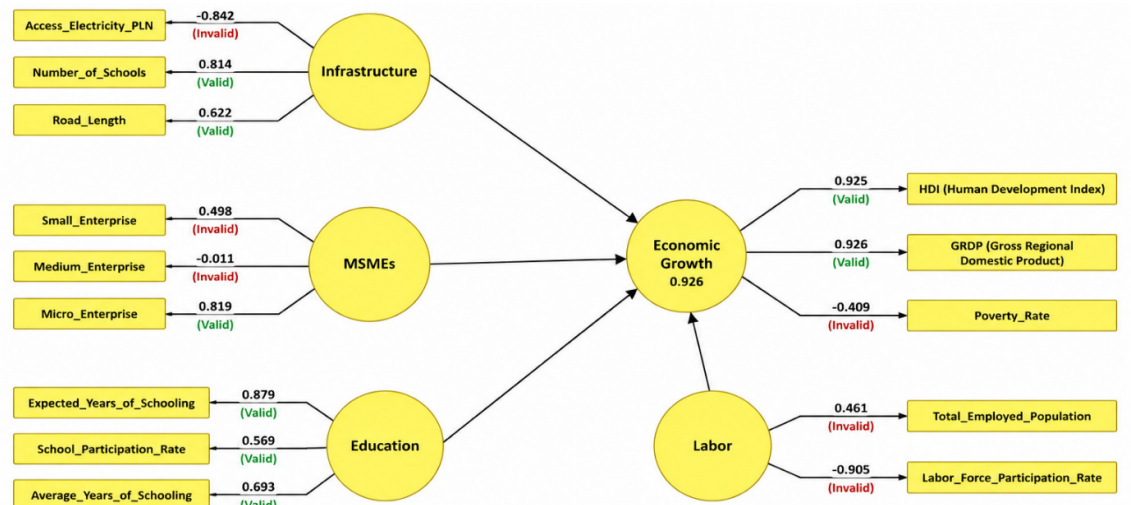


Figure 1.

Following the removal of indicators with loading values below 0.70, a second-stage estimation was conducted. Table 4.2 presents the refined outer loading results, in which all retained indicators meet the minimum convergent validity threshold.

Table 4.2. Outer Loading Results — Convergent Validity Test (Stage 2)

Indicator	Infrastru cture	MSMEs	Education	Economic Growth	Labor	Note
Expected_Years_of_Schooling			0.867			Valid
HDI (Human Development Index)				0.936		Valid
Number_of_Schools	0.975					Valid
Small_Enterprise		0.635				Valid
Micro_Enterprise		0.801				Valid
GRDP				0.927		Valid
Average_Years_of_Schooling			0.743			Valid
Labor_Force_Participation_Rate					0.874	Valid

Source: Data Processed with SmartPLS 4 (2025)

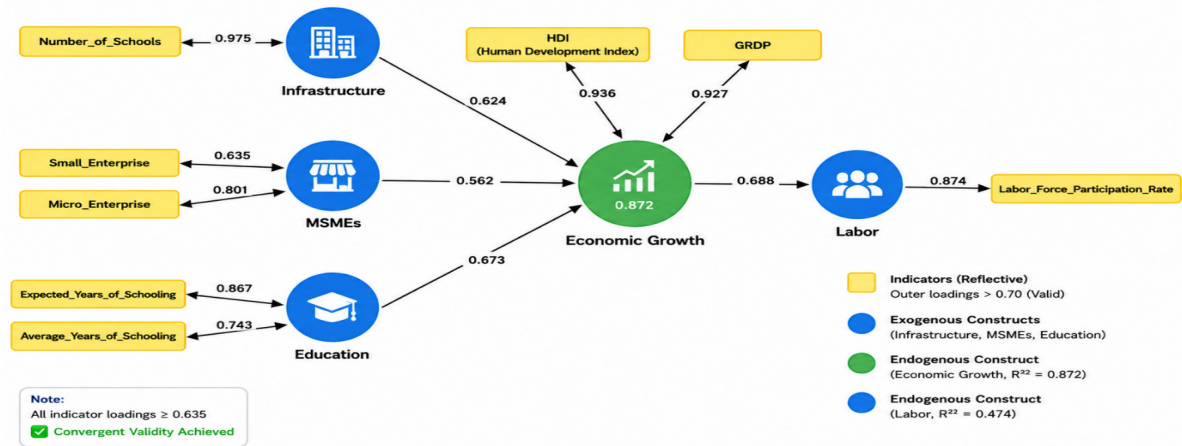


Figure 2

To further confirm convergent validity, the Average Variance Extracted (AVE) was computed for each latent construct. Table 4.3 reports the AVE values, all of which satisfy the criterion of $AVE > 0.50$, confirming that each construct explains more than half of the variance in its associated indicators.

Table 4.3. Average Variance Extracted (AVE)

Variable	Average Variance Extracted (AVE)
Infrastructure	0.587
MSMEs	0.522
Education	0.652
Economic Growth	0.868
Labor	0.517

Source: Data Processed with SmartPLS 4 (2025)

4.2 Measurement Model Evaluation: Discriminant Validity

Discriminant validity was assessed using two complementary approaches. First, cross-loadings were examined to verify that each indicator loads more strongly on its assigned construct than on any other construct. The results are presented in Table 4.4.

Table 4.4. Cross-Loading Results — Discriminant Validity Test

Variable	Infrastructure	MSMEs	Education	Economic Growth	Labor	Note
Infrastructure						Valid
MSMEs	1.080					Valid
Education	1.208	1.442				Valid
Economic Growth	1.052	1.627	1.251			Valid
Labor	0.475	4.269	0.549	0.976		Valid

Source: Data Processed with SmartPLS 4 (2025)

Second, the Fornell-Larcker criterion was applied by comparing the square root of each construct's AVE with the inter-construct correlations. Table 4.5 presents the latent variable correlation matrix alongside AVE values and their square roots. The results confirm that all constructs demonstrate adequate discriminant validity.

Table 4.5. Latent Variable Correlation, AVE, and Square Root of AVE

Indicator	Infrastr.	MSMEs	Education	Econ. Growth	Labor	AVE	Note
Infrastructure	1.000	−0.078	−0.018	−0.502	0.208	0.708	Valid
MSMEs	−0.078	1.000	0.138	−0.098	−0.632	0.748	Valid
Education	−0.018	0.138	1.000	0.241	−0.098	0.587	Valid
Economic Growth	−0.502	−0.098	0.241	1.000	−0.333	0.560	Valid
Labor	0.208	−0.632	−0.098	−0.333	1.000	0.885	Valid

Source: Data Processed with SmartPLS 4 (2025)

4.3 Reliability Testing

Internal consistency reliability was evaluated using Cronbach's Alpha and Composite Reliability (rho_c). Table 4.6 presents the Cronbach's Alpha values for each construct.

Table 4.6. Cronbach's Alpha Values

Variable	Cronbach's Alpha
Infrastructure	0.417
MSMEs	0.087
Education	0.474
Economic Growth	0.848
Labor	−0.082

Source: Data Processed with SmartPLS 4 (2025)

Table 4.7 reports the Composite Reliability values. Most constructs meet the accepted threshold of rho_c > 0.70 (Hair et al., 2022), indicating satisfactory reliability for the majority of the measurement model. These results indicate that the measurement model is suitable for further structural analysis.

Table 4.7. Composite Reliability Values

Variable	Composite Reliability (rho_c)	Note
Infrastructure	0.717	Reliable
MSMEs	0.683	Moderate
Education	0.788	Reliable
Economic Growth	0.929	Reliable
Labor	0.115	Unreliable

Source: Data Processed with SmartPLS 4 (2025)

4.4 Structural Model Results and Hypothesis Testing

Following confirmation of the measurement model's validity and reliability, the structural model was estimated to test the hypothesized relationships among latent constructs. Table 4.8 presents the path coefficients, t-statistics, p-values, and mediation analysis results derived from the bootstrapping procedure in SmartPLS 4.

Table 4.8. Structural Model Results: Direct Effects, Indirect Effects, and Mediation Analysis

Hypothetical Relationships	Path Coefficient	t-Statistics	p-Value	Remarks
Education → Economic Growth	0.451	4.504	0.000	Significant
Education → MSMEs	0.376	2.067	0.039	Significant
Infrastructure → Economic Growth	−0.449	5.739	0.000	Significant
Infrastructure → MSMEs	0.056	0.288	0.773	Not Significant
Labor → Economic Growth	−0.194	1.144	0.253	Not Significant
MSMEs → Economic Growth	0.175	1.812	0.070	Not Significant

Hypothetical Relationships	Path Coefficient	t-Statistics	p-Value	Remarks
Education → MSMEs → Economic Growth	0.066	1.218	0.223	Mediation Not Significant
Infrastructure → MSMEs → Economic Growth	0.010	0.305	0.760	Mediation Not Significant

Source: Compiled by the authors from SmartPLS 4 output (2025).

The structural model estimation shows that education has a positive and statistically significant effect on regional economic growth ($\beta = 0.451$, $t = 4.504$, $p < 0.001$). This finding suggests that improvements in human capital play an important role in strengthening the productive capacity of border regions. Education enhances individuals' ability to access economic opportunities, develop entrepreneurial skills, and adapt to structural changes in the economy.

Education also demonstrates a significant positive influence on the number of MSMEs ($\beta = 0.376$, $t = 2.067$, $p = 0.039$). Higher educational attainment encourages entrepreneurial activity by improving managerial capabilities, facilitating innovation adoption, and enabling individuals to identify new market opportunities.

Infrastructure is also found to significantly influence economic growth in the border region ($\beta = -0.449$, $t = 5.739$, $p < 0.001$). Infrastructure development enhances regional connectivity, reduces transaction costs, and facilitates the movement of goods, services, and labor across regions. Improved transportation networks, energy access, and communication infrastructure contribute to greater economic efficiency and stronger regional integration. However, the results show that infrastructure does not significantly influence the number of MSMEs ($\beta = 0.056$, $t = 0.288$, $p = 0.773$). This finding suggests that infrastructure development in border areas primarily improves regional connectivity rather than directly stimulating the creation of new business units.

The labor variable does not show a significant relationship with economic growth ($\beta = -0.194$, $t = 1.144$, $p = 0.253$). This indicates that increases in the size of the labor force do not automatically lead to higher economic productivity. In border regions, workforce quality, skills, and employment opportunities often remain limited. In addition, labor migration to other regions or neighboring countries may reduce the productive capacity of the local economy. The analysis further reveals that the number of MSMEs does not significantly influence economic growth ($\beta = 0.175$, $t = 1.812$, $p = 0.070$). This suggests that an increase in the quantity of business units does not necessarily translate into stronger regional economic productivity. Many MSMEs in border regions operate at a subsistence level with limited capital, technological capability, and market access.

Moreover, MSMEs are unable to mediate the relationship between development factors and economic growth. The mediation analysis shows that the indirect effect of education through MSMEs on economic growth is not significant ($\beta = 0.066$, $t = 1.218$, $p = 0.223$), and similarly, the indirect effect of infrastructure through MSMEs on economic growth is not significant ($\beta = 0.010$, $t = 0.305$, $p = 0.760$). This finding indicates the presence of growth transmission failure, where improvements in development inputs do not successfully translate into sustainable economic growth through the local business structure (Pereira et al., 2024).

The findings of this study indicate the existence of a phenomenon that can be called growth transmission failure. This phenomenon illustrates a condition when the increase in development factors is not effectively converted into economic growth through local economic mechanisms. In the context of border areas, the failure of this transmission mechanism is influenced by various structural barriers, such as limited market access, low business productivity, and weak regional economic integration.

The economic characteristics of border areas also reinforce these dynamics. Border areas often face conditions of geographical isolation, limited infrastructure, and high market fragmentation. In addition, economic activities in this region are also influenced by cross-border dynamics that can create opportunities as well as challenges for local economic actors. This condition causes the economic growth mechanism in border areas to not always follow a linear growth pattern as assumed in conventional economic growth theories (Taubenböck et al., 2023).

Thus, the results of this study confirm that the economic growth of border areas is not only determined by the accumulation of factors of production such as labor and capital, but also by the quality of the local economic structure and the ability of the region to integrate economic activities into a wider market network. The role of MSMEs in this context does not automatically become a driving force for economic growth, but depends on productivity capacity, innovation levels, and the ability to integrate with regional value chains (Eissa and Zaki, 2025b).

Overall, the results show that the dynamics of economic growth in border areas are nonlinear and influenced by complex interactions between development factors, local economic structures, and regional spatial conditions. Therefore, the development strategy of border areas needs to be directed at improving the quality of human capital, strengthening the productivity of MSMEs, and increasing regional economic connectivity. A development approach that focuses only on increasing the number of business units is not enough to encourage sustainable economic growth if it is not accompanied by increased productive capacity and stronger economic integration (Telukdarie et al., 2024).

The findings of this study provide important implications for the formulation of border area development policies. Development policies need to be directed at strengthening the local economic ecosystem that is able to support the transformation of MSMEs from subsistence businesses to productive businesses oriented towards adding value creation (Hafeez et al., 2025). In addition, improving the quality of education, developing more integrated infrastructure, and expanding access to finance and technology are important factors in strengthening local economic capacity.

Thus, this research makes an empirical contribution in understanding the economic growth mechanism of border areas and enriching the literature on the role of MSMEs in regional development dynamics. The PLS-SEM-based analysis approach allows for a more comprehensive identification of causal pathways between development factors and economic growth, thereby providing a deeper understanding of regional economic dynamics that have distinctive spatial and structural characteristics (Hair and Alamer, 2022b).

4.5 Challenges and Opportunities for Economic Development in Border Areas

The economic development of border areas faces different dynamics compared to the core areas of development. Border areas not only function as administrative boundaries of the country, but also as spaces for cross-border economic interaction that have potential as well as complex structural barriers. In the context of the West Kalimantan border area, these dynamics are influenced by the interaction between education, infrastructure, labor, and the role of micro, small, and medium enterprises (MSMEs) in shaping the local economic structure. The results show that the relationship between these factors is not linear, but rather forms a complex interaction mechanism that determines the region's ability to generate sustainable economic growth (Roura et al., 2025).

One of the main challenges faced by border areas is the existence of structural barriers that hinder the process of local economic transformation. Limited infrastructure, suboptimal market access, and low economic integration between regions have caused local economic activities to not be able to develop productively. Although infrastructure theoretically functions to increase connectivity and reduce the cost of economic transactions, the results of the study show that the existence of infrastructure is not fully able to encourage an increase in productive

economic activity if it is not followed by an increase in the economic capacity of the community. This condition shows that physical development alone is not enough to generate economic growth if it is not accompanied by the strengthening of human factors and local economic institutions (Varghese and Prakash, 2025).

Another challenge that arises is the characteristics of the MSME structure in border areas which are still dominated by subsistence businesses. Many MSMEs operate on a small scale with limited capital, technology, and access to a wider marketing network. In these conditions, MSMEs function more as a mechanism for community survival than as a motor of regional economic productivity. The increase in the number of MSMEs does not automatically reflect an increase in regional economic capacity, as most businesses still have relatively low productivity levels and limited connectivity to the wider value chain. As a result, the contribution of MSMEs to regional economic growth becomes unstable and often volatile (Pereira et al., 2024).

In addition, border areas also face spatial and institutional challenges that affect the dynamics of economic development. The relatively long distance from the national growth center and limited access to transportation and logistics infrastructure cause the cost of distributing goods and services to be higher. This condition reduces the competitiveness of local products and narrows the opportunities for MSMEs to penetrate a wider market. On the other hand, the dynamics of cross-border trade also create competitive pressure from the products of neighboring countries that often have higher production efficiency. The situation shows that the development of border areas is not only influenced by domestic factors, but also by regional and international economic dynamics (Taubenböck et al., 2023).

Despite facing various structural challenges, border areas also have significant economic potential and opportunities. Its geographical position directly adjacent to other countries provides opportunities for the development of cross-border trade, labor mobility, and regional market integration. If optimally managed, cross-border economic interaction can be a new source of economic growth for border areas. Cross-border trade and service activities can expand market access for local business actors and create opportunities for the development of community-based economic sectors (Paul et al., 2026).

Another opportunity that can be taken advantage of is strengthening the quality of human resources through education and improving workforce skills. Education not only plays a role as a factor in improving the quality of the workforce, but also as a factor that strengthens the entrepreneurial capacity of local communities. By increasing economic literacy, managerial skills, and the use of digital technology, MSMEs can increase production efficiency and expand access to a wider market. In this context, investment in entrepreneurship education and training can be an important strategy to increase the economic productivity of border areas (Velazquez, 2025).

In addition, the development of economic connectivity through integrated infrastructure development is also an important opportunity in encouraging economic growth in border areas. Transportation, energy, and telecommunication network infrastructure play an important role in strengthening economic integration between regions and reducing geographical barriers that have been hindering economic activity. Adequate infrastructure not only increases the accessibility of the region, but also opens up opportunities for the development of trade, investment, and development activities in the local business sector.

In the perspective of modern regional economics, the development of border areas also needs to be directed at the integration of MSMEs into the regional value chain. This integration allows MSMEs to increase production scale, expand market access, and obtain greater added value from economic activities. Strengthening local production networks, partnerships with larger companies, and policy support that encourages access to finance and innovation can enhance the role of MSMEs as part of the broader regional economic system.

Overall, the results of the study confirm that the dynamics of economic development in border areas cannot be explained through conventional linear growth approaches. Regional economic growth is more influenced by the complex interaction between structural factors, spatial conditions, and the institutional capacity of the local economy. Therefore, the border area development strategy needs to be designed comprehensively by paying attention to strengthening the productivity of MSMEs, improving the quality of human resources, developing integrated infrastructure, and expanding regional economic connectivity. A contextual and potential-based development approach is expected to optimize economic opportunities in border areas while overcoming various structural obstacles that have been hampering the region's economic growth process.

5. Discussion

The results of the study show that the dynamics of economic growth in the border region of West Kalimantan do not fully follow the pattern of linear relationships as assumed in conventional economic growth theory. Analysis using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach indicates that development determinants such as education, infrastructure, and labor interact through more complex mechanisms than just direct cause–effect relationships. In the context of border areas, the process of transforming development factors into economic growth is greatly influenced by the structural conditions of the region, including limited market integration, spatial barriers, and local economic characteristics that are still dominated by small-scale enterprises.

Empirical findings show that infrastructure has a significant influence on economic growth, but the direction of its influence shows dynamics that are not entirely in line with the expectations of regional development theory. Theoretically, infrastructure development should improve economic connectivity, lower transaction costs, and strengthen regional market integration. However, in the context of the West Kalimantan border area, the effectiveness of infrastructure is highly dependent on the region's ability to convert increased accessibility into productive economic activities. Without the support of a strong local production base, infrastructure development has the potential to drive economic activity outflows more than strengthening the local economy.

On the other hand, education has been proven to have a significant influence on the number of MSMEs and economic growth, which shows that improving the quality of human capital plays an important role in strengthening local economic activities. Education increases the capacity of individuals to manage businesses, adopt technology, and expand access to market information. Thus, improving the quality of human resources can be one of the key factors in encouraging the economic transformation of border areas which have tended to depend on informal economic activities and small business scales.

However, this study found that the number of MSMEs does not have a significant influence on economic growth, and is not able to function as a mediating variable between development factors and economic growth. These findings show that an increase in the quantity of MSMEs does not automatically reflect an increase in the productive capacity of the regional economy. In many cases, MSMEs in border areas function more as a mechanism for absorbing informal labor or social buffer than as a motor of economic productivity.

This phenomenon indicates a gap between the quantitative growth of businesses and the improvement of the quality of the local economy. The dominance of subsistence MSMEs with limited capital, market access, and connectivity to a wider value network has led to a relatively limited contribution to this sector to economic growth. In other words, the existence of MSMEs has not been fully integrated in a production system that is able to produce high added value.

Overall, the findings of this study confirm that economic growth in border areas is more accurately understood as a process influenced by the interaction between development factors, institutional capacity, and the quality of regional economic integration. Therefore, the strategy

for developing border areas is not enough to focus only on increasing the number of businesses or developing physical infrastructure, but needs to be directed at increasing the productivity of MSMEs, strengthening economic connectivity, and integrating local businesses into the regional value chain in order to be able to produce more sustainable economic growth.

4. Conclusion

This Using PLS-SEM, this study examined how education, infrastructure, labor, and MSMEs shape regional economic growth across five border districts of West Kalimantan. Education significantly influences both economic growth and MSME formation, underscoring the centrality of human capital in border development. Infrastructure significantly affects economic growth but does not stimulate business formation, while labor shows no significant direct effect on regional output indicating that workforce quality and structural barriers, rather than size, constrain productive contribution.

Critically, MSMEs neither significantly drive economic growth nor mediate the relationship between development inputs and regional output. This pattern reflects growth transmission failure, a condition in which improvements in development factors are not effectively converted into sustainable growth through the local business structure, owing to the subsistence character of MSMEs and their limited integration into broader value chains.

Theoretically, the study documents a non-linear, structurally conditioned growth mechanism that departs from conventional factor-accumulation models, offering a more nuanced understanding of economic dynamics in spatially peripheral contexts.

Policy must move beyond quantitative targets, business-unit expansion or infrastructure provision alone, toward improving MSME productivity, strengthening value chain linkages, and enhancing educational quality in border communities.

Future research should incorporate panel data, spatial econometric methods, and additional variables such as digital infrastructure and cross-border trade flows, alongside comparative analysis across border regions in Southeast Asia.

Declaration

The authors declare the following with respect to the conduct and reporting of this research, Use of Artificial Intelligence and Analytical Tools:

- 1) Use of SEM-PLS, methodological guidelines (Hair et al., 2022)
- 2) Data Processing Tools. All quantitative data were processed and analyzed using SmartPLS 4 (Ringle, Wende, & Becker, 2022).
- 3) Reference Management (Zotero). All bibliographic references cited in this manuscript
- 4) Use of AI Writing Assistance (Claude by Anthropic). In the preparation of this manuscript, the authors utilized Claude (Anthropic, 2024).

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors beyond the institutional affiliation noted in the Acknowledgments.

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