

THE IMPACT OF BATU JOMBA ROAD DETERIORATION ON COMMUNITY ECONOMIC ACTIVITIES IN LUAT LOMBANG VILLAGE SIPIROK DISTRICT SOUTH TAPANULI REGENCY

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Abstract

Batu Jomba Road is a strategic route that serves as a primary interprovincial connection; however, in recent years it has frequently suffered severe deterioration. This condition is attributed to geographical factors, high traffic volume, and inadequate infrastructure maintenance. Road damage has generated significant impacts on local economic activities, including increased transportation costs, declining household income, and disruptions in the distribution of agricultural products and commercial goods. This study focuses on the Batu Jomba Road segment located in Luat Lombang Village, Sipirok District, South Tapanuli Regency. The objective of the research is to analyze the impact of road damage on the economic activities of the local community. A quantitative research approach was employed, with data collected through questionnaires and field observations. The research sample consisted of 40 households residing in Luat Lombang Village. Data were analyzed using the Product Moment correlation technique. The results of hypothesis testing indicate that the calculated t-value was 21.462, while the critical t-value at a 5% significance level was 2.024. Since the calculated t-value exceeds the critical value, the research hypothesis is accepted. These findings demonstrate that damage to Batu Jomba Road has a statistically significant effect on the economic activities of the community in Luat Lombang Village, particularly on household income and the sustainability of local businesses.

Key words: Road Damage; Economic Activities; Batu Jomba Road; Luat Lombang Village

INTRODUCTION

Road infrastructure is a fundamental component of land transportation systems and plays a strategic role in supporting social and economic activities by facilitating the mobility of people and the distribution of goods. The availability of well-maintained roads is essential for ensuring the smooth functioning of education, trade, and employment activities, and it contributes directly to regional economic growth. This importance is emphasized in Law No. 38 of 2004 on Roads, which states that roads play a crucial role in economic development, socio-cultural activities, environmental sustainability, and national defense and security.

Along with economic growth and the increasing movement of goods and people, the demand for high-quality road infrastructure has become increasingly urgent. Properly functioning roads can accelerate the distribution of goods, reduce transportation costs, and improve the efficiency of community economic activities (Siahay dkk; 2023). However, in practice, road deterioration remains a complex problem in many regions, causing significant losses to road users, including longer travel times, traffic congestion, increased accident risks, and disruptions to economic activities (Danza dkk; 2025).

Road damage is generally caused by various factors, such as the exceedance of the road's design life, inadequate drainage systems, water ponding, vehicle loads exceeding capacity, extreme weather conditions, as well as insufficient maintenance and technical supervision (Shohibul, Q. A.; 2024). Poor road conditions also lead to reduced driving speeds, higher transportation costs, and decreased comfort and safety for road users (Sholihin, C., & Kausarian, H; 2024).

A clear example of this issue can be found on Batu Jomba Road in Luat Lombang Village, Sipirok District, South Tapanuli Regency. Batu Jomba Road is a national road and a primary arterial road that forms part of the Central Sumatra Transversal Corridor, connecting North Sumatra Province and West Sumatra Province. As a national road, it is managed under the authority of the Ministry of Public Works and Housing (PUPR) and plays a vital role in supporting interregional mobility and trade activities.

Nevertheless, the geographical conditions of Batu Jomba Road, which lies within an active fault zone, make it highly vulnerable to ground movement, landslides, and surface subsidence. Consequently, despite repeated repair efforts, road deterioration continues to occur and disrupt transportation flow. This condition has a direct impact on the residents of Luat Lombang Village, most of whom depend on agriculture, plantations, and trade for their livelihoods. Limited access to markets results in delays in the distribution of agricultural products, increased transportation costs, declining product quality, and reduced household income.

Based on these conditions, the deterioration of Batu Jomba Road represents not only a technical infrastructure problem but also a socioeconomic issue that affects the welfare of the local community. Therefore, this study is essential to empirically analyze the impact of Batu Jomba Road deterioration on the economic activities of the community in Luat Lombang Village, Sipirok District, South Tapanuli Regency.

METODE

This study employs a quantitative approach, which relies on numerical data analyzed using statistical techniques. This approach aims to generate objective and scientifically measurable findings based on data collected from respondents (Puansah & Ritonga, 2021)(Nurhamijah & Puansah, 2025; Pane et al., 2025; Siregar et al., 2025).

RESULTS AND DISCUSSION

Road Infrastructure and Road Deterioration

Road infrastructure plays a strategic role in supporting social and economic activities by providing accessibility and mobility for both people and goods. Roads are defined as land transportation infrastructure along with their supporting structures intended for public traffic, whether located on, above, or below the ground surface, excluding specialized transportation facilities such as railways. Based on their function and administrative status, national roads serve as primary interregional connectors and play a crucial role within the national transportation network.

Road deterioration is generally caused by a combination of technical and environmental factors, including traffic loads that exceed design capacity, unstable subgrade conditions, inadequate drainage systems, material aging, extreme weather conditions, and insufficient maintenance practices (Amrulloh, I. F., Salim, A., & Nasrullah, N; 2025). Road damage can be classified into structural deterioration, which reduces the pavement's ability to withstand traffic loads, and functional deterioration, which decreases user comfort and safety even when the road structure remains intact (Kaliky, H. B., Walsen, S., & Jakob, J. C; 2024). If not properly addressed, both types of deterioration can significantly reduce road performance and limit regional accessibility.

The Impact of Road Deterioration on Economic Activities

From an economic perspective, road conditions are closely associated with transportation efficiency and market accessibility. Road deterioration increases travel time and transportation costs, thereby reducing the efficiency of goods and service distribution and weakening the competitiveness of local economic actors (Oktavia, dkk; 2025). Several studies have shown that inadequate road infrastructure has a negative impact on household income and the sustainability of small businesses, particularly in rural areas that rely heavily on agricultural and trading activities (Lestari, dkk; 2025).

Conversely, investment in road infrastructure has been proven to positively affect regional economic growth by improving accessibility and facilitating smoother flows of goods and services (Apriliyaningsih, dkk; 2025). Damaged roads can also hinder the distribution of agricultural products, reduce product quality due to delivery delays, and increase local commodity prices, which ultimately undermines community welfare.

Economic Activities

Economic activities refer to a series of human actions aimed at fulfilling living needs through the utilization of limited resources. These activities encompass the processes of production, distribution, and consumption of goods and services (Habibi, M; 2022). Production is related to the creation or enhancement of the utility and value of goods and services, distribution focuses on the transfer of goods from producers to consumers, while consumption involves the use of goods and services to meet the needs of individuals or groups (Azizah, dkk; 2024). The smooth functioning of economic activities is highly dependent on the availability of supporting infrastructure, particularly road transportation networks.

Community and Socioeconomic Context

Communities constitute social systems composed of individuals who live together within a defined territory, interact continuously, and share norms, values, and collective identities (Jamaludin, A. N; 2015)(Puansah et al., 2023, 2025; Puansya et al., 2025). Community perceptions and responses to infrastructure conditions are influenced by individual characteristics, the physical condition of infrastructure, and the surrounding social and environmental context (Suhendra, dkk; 2015). Road infrastructure deterioration affects not only economic aspects but also community access to public services such as education and healthcare, which in turn influences overall quality of life (Lyrra, L., & Kurniati, E; 2025).

Conceptual Linkage

Based on the theoretical framework discussed above, road deterioration leads to a decline in road functionality and accessibility, resulting in higher transportation costs, longer travel times, and limited access to markets. These conditions subsequently affect community production, distribution, and consumption activities, ultimately leading to reduced household income and weakened sustainability of local businesses. Therefore, the quality of road infrastructure is a key determinant of economic activity levels and community welfare, particularly in rural areas.

Research Findings and Results

Respondent Characteristics

The study involved 40 respondents from Luat Lombang Village. Female respondents constituted the majority (62.5%), while male respondents accounted for 37.5%. In terms of age distribution, the largest group was aged 46 years and above (50%), followed by those aged 36–45 years (30%) and 25–35 years (20%). Regarding educational background, most respondents had completed senior high school (55%), followed by junior high school (25%) and elementary school (20%). Overall, the respondents exhibited relatively diverse characteristics, with a predominance of middle-aged to older adults and a moderate level of educational attainment.

Findings of the Independent Variable (X): Batu Jomba Road Deterioration

The questionnaire results indicate that the majority of respondents perceive road deterioration as a tangible and disruptive problem. This perception is reflected in observations of potholes and damaged road surfaces, frequent vehicle damage, increasingly difficult access during the rainy season due to muddy conditions, longer travel times, limited road facilities such as traffic signs, inadequate nighttime lighting, and frequent waterlogging caused by poor drainage. Based on the total score recap ($\sum X = 1,443$; highest score = 45; lowest score = 23), the interval distribution places road deterioration in the “high” category. This finding suggests that the community perceives the condition of Batu Jomba Road as a serious and pressing issue.

Findings of the Dependent Variable (Y): Community Economic Activities

Regarding economic activities, the majority of respondents stated that road deterioration increases transportation costs, makes it difficult to transport agricultural products to markets, reduces household income, causes goods to be more easily damaged during transit, hinders the fulfillment of basic needs, leads to shipment cancellations, results in distribution delays, and reduces the intensity of trading activities, particularly visits from outside the village. The tabulation results show a total score of $\sum Y = 1,393$ (highest score = 44; lowest score = 22). The interval distribution places community economic activities in the “**moderate**” category, indicating that economic activities are still ongoing but are experiencing pressure or decline due to disruptions in accessibility and distribution.

Hypothesis Testing

Correlation (Product Moment) and Validity

The correlation analysis yielded an r value of 0.961, which falls into the category of a very strong relationship. The validity test, conducted by comparing the calculated correlation coefficient ($r = 0.961$) with the critical value ($r_{\text{table}} = 0.312$) at a 5% significance level ($n = 40$), indicates that the tested relationship is statistically valid.

Significance Test (t-test)

The t -test produced a calculated t value of 21.462, while the critical t value was 2.024 at $df = 38$ and $\alpha = 0.05$. Since the calculated t value exceeds the critical value, the alternative hypothesis (H_a) is accepted and the null hypothesis (H_0) is rejected. This result indicates a statistically significant effect of Batu Jomba Road deterioration on the economic activities of the community in Luat Lombang Village.

Coefficient of Determination

The coefficient of determination indicates a value of 92.35%, meaning that 92.35% of the variation in community economic activities is explained by road deterioration in the

research model. In conclusion, the more severe the road deterioration, the greater the decline in economic activities.

Overall, the research findings confirm that the deterioration of Batu Jomba Road has wide-ranging impacts on community life. The most prominent effects include increased accident risks, reduced driving comfort, and disruptions in the distribution of goods and services. Road deterioration leads to higher transportation costs, including increased vehicle operating and maintenance expenses, delivery delays, and a greater risk of damage to traded goods. These conditions ultimately reduce the productivity of economic actors such as farmers, traders, and small business owners. The situation becomes more severe during the rainy season, when road conditions further deteriorate and become increasingly difficult to traverse, thereby constraining economic activities and access to sub-district and district economic centers. Thus, the findings demonstrate a strong relationship between road infrastructure quality and community economic dynamics: deteriorated roads reduce mobility, weaken productivity, and impose higher economic burdens on local residents.

CONCLUSION

This study demonstrates that the deterioration of Batu Jomba Road has a significant effect on the economic activities of the community in Luar Lombang Village. The relationship between the two variables is classified as very strong, indicating that the more severe the road deterioration, the greater the resulting economic constraints. The main impacts experienced by the community include increased transportation costs, difficulties in transporting agricultural products to markets, distribution delays, and declining household income, which ultimately reduce purchasing power and overall community welfare. Furthermore, the coefficient of determination of 92.35% confirms that road deterioration is the dominant factor explaining variations in community economic activities, while the remaining variation is influenced by other factors beyond the scope of this study. The results of the *t*-test further confirm that this relationship is statistically significant, leading to the acceptance of the research hypothesis.

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