

# Sustainable Community Development Through Accessible Road Infrastructure

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## ABSTRACT

This study examines the critical role of accessible road infrastructure in fostering sustainable community development within rural, agricultural settings. Focusing on Barangay Baras in San Miguel, Surigao del Sur, Philippines, the research investigates how poor road conditions and distant access undermine agricultural productivity, economic livelihoods, and social equity, while exacerbating vulnerability to seasonal flooding. The purpose was to diagnose these multidimensional impacts and generate a community-informed development planning framework that aligns local infrastructure projects with global sustainability goals (SDGs 2, 9, and 11).

Employing an explanatory sequential mixed-methods design, the study integrated quantitative survey data from 312 stratified respondents with qualitative insights from 18 purposively selected participants. Results conclusively establish that deficient road infrastructure acts as a systemic constraint, triggering severe economic leakage through high hauling costs and crop spoilage, deepening social exclusion by limiting access to education and healthcare, and amplifying climate risks through annual flood disruptions. These findings underscore the imperative for a paradigm shift in infrastructure planning. The study culminates in the proposed "Dalan sa Tinubdan" framework, a participatory and climate-resilient governance model designed to translate community-identified priorities into actionable, sustainable road development, thereby breaking the cycle of poverty and fostering inclusive, resilient growth.

**Keywords:** Road infrastructure, Sustainable community development, Participatory planning, Climate resilience, Agricultural livelihoods.

## INTRODUCTION

### Background of the Study

Sustainable community development is fundamentally linked to the availability of accessible and resilient infrastructure that supports economic productivity, social inclusion, and environmental sustainability. In rural and agricultural communities, road infrastructure serves as a vital backbone that enables the efficient movement of agricultural goods, facilitates access to education and health services, and strengthens community connectivity. These functions are essential to sustaining local livelihoods and ensuring long-term development, particularly in farming areas where agriculture remains the primary source of income. When road accessibility is limited, farmers and residents face recurring challenges such as delayed market access, increased transportation costs, and restricted mobility, which collectively undermine economic stability and quality of life. Anchored on the research title Sustainable Community Development through Accessible Road Infrastructure, this study seeks to examine how road conditions influence agricultural productivity and community well-being, emphasizing the need to integrate accessibility as a core component of local development planning.

Studies indicate that improved rural roads significantly reduce transportation costs, minimize post-harvest losses, and enhance farmers' access to markets, thereby contributing to agricultural sustainability and food security aligned with SDG 2 (Zero Hunger) (Mogues et al., 2021; Shrestha & Acharya, 2022). Furthermore, investments

in climate-resilient and well-maintained road networks support SDG 9 (Industry, Innovation, and Infrastructure) by improving rural connectivity and strengthening local economies (World Bank, 2020). Improved accessibility also advances SDG 11 (Sustainable Cities and Communities) by reducing rural isolation and improving access to basic services such as health care and education (Asian Development Bank, 2023). However, some studies caution that infrastructure investments yield limited sustainability outcomes when road projects lack regular maintenance, disaster-risk considerations, and community participation. These findings collectively support the relevance of the present study while underscoring the importance of localized and sustainability-oriented infrastructure planning.

Despite the growing body of literature on rural road infrastructure and sustainable development, significant empirical gaps remain at the community level, particularly in documenting how poor road accessibility concretely affects agricultural livelihoods and food systems in rural barangays. Most existing studies rely on regional or national datasets that fail to capture the lived experiences of farmers who repeatedly face transportation barriers. In the Philippine context, government reports acknowledge that inadequate farm-to-market roads contribute to higher hauling costs, transport delays, and increased spoilage of agricultural products, especially during the rainy season when unpaved roads become muddy or impassable (Philippine News Agency, 2025). Similarly, local infrastructure reports note that prior to road concreting, rural access routes frequently became inaccessible during periods of heavy rainfall, limiting farmers' ability to transport harvested crops and increasing post-harvest losses (Philippine Information Agency, 2025). News coverage further documents how damaged and poorly maintained farm-to-market roads slow down the movement of produce, raise logistical costs, and result in crop damage, with economic consequences borne by farmers and consumers alike (Philstar.com, 2025). Despite these documented conditions, there remains a lack of community-level empirical studies that systematically examine the frequency, severity, and livelihood impacts of transportation delays, increased hauling costs, and spoilage. This absence of localized evidence, particularly in flood-prone rural barangays, constitutes a critical research gap that this study seeks to address.

The significance of this study lies in its aim to develop a proposed development planning framework for road infrastructure and community development that advances the localized implementation of SDG 2, SDG 9, and SDG 11. By examining the interconnections between road accessibility, agricultural productivity, and access to essential services in Barangay Baras, San Miguel, Surigao del Sur, Philippines, the study seeks to generate evidence-based inputs that can guide local government units and stakeholders in prioritizing inclusive, climate-resilient, and sustainable road infrastructure projects. The proposed framework is intended to bridge the gap between national infrastructure goals and on-the-ground realities by integrating community experiences into development planning. Moreover, the study contributes to the frontier of knowledge by offering a context-specific planning model that demonstrates how global sustainability goals can be operationalized at the barangay level, reinforcing the role of accessible road infrastructure as a catalyst for sustainable community development.

## Legal Bases

Sustainable community development is grounded in the principle that rural populations require reliable access to infrastructure, social services, and economic opportunities to enhance their livelihoods, ensure food security, and achieve long-term resilience. In agricultural communities, road infrastructure is a critical enabler of development, serving as a lifeline that facilitates the movement of goods, services, and people. Accessible farm-to-market roads reduce post-harvest losses, lower transportation costs, and enable farmers to sell their produce in a timely manner, which directly improves household income and strengthens local food systems. This functional relationship between road accessibility and sustainable development aligns with global priorities, including the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 11 (Sustainable Cities and Communities). Conceptually, sustainable road infrastructure in rural settings is not merely a technical consideration; it embodies a multidimensional approach that integrates economic efficiency, social inclusiveness, and environmental resilience, thereby serving as a foundational element for community-wide development.

The legal framework in the Philippines reinforces the conceptual importance of accessible road infrastructure in rural development. RA 8435 – Agriculture and Fisheries Modernization Act (1997) emphasizes the development

of farm-to-market roads as a strategic measure to reduce post-harvest losses and enhance farmers' access to markets, directly linking road accessibility with agricultural productivity and household food security. Complementing this, RA 7607 – Magna Carta for Small Farmers (1992) mandates that small farmers receive support in accessing infrastructure, resources, and markets, thereby ensuring that development interventions such as rural road construction are inclusive and responsive to the needs of vulnerable agricultural populations. These provisions collectively underscore the centrality of road infrastructure in sustaining agricultural livelihoods and addressing rural poverty, anchoring the conceptual premise of the study that improved accessibility drives economic and social development at the barangay level.

The role of local governance and regulatory standards is equally critical in translating these conceptual and policy directives into actionable community-level projects. RA 7160 – Local Government Code of 1991 empowers local government units (LGUs) to plan, implement, and maintain infrastructure projects, including barangay and municipal roads. This legal authority ensures that the development planning framework proposed in this study can be operationalized locally, enabling barangay officials and stakeholders to integrate accessibility needs into their development plans. Technical standards and guidelines provided by the Department of Public Works and Highways (DPWH) Rural Road Standards and Manuals complement the legal mandate of LGUs by ensuring that roads are safe, durable, and capable of withstanding environmental stressors, such as heavy rainfall and flooding, which are common in rural communities like Barangay Baras. Together, these legal provisions form an operational backbone for community-based road development that aligns with both national standards and local needs.

Sustainability and resilience are reinforced through legal instruments that address environmental and disaster risk considerations. RA 10121 – Philippine Disaster Risk Reduction and Management Act of 2010 mandates that infrastructure development incorporate disaster risk reduction measures, which is particularly relevant for flood-prone rural roads. Environmental safeguards under RA 9003 – Ecological Solid Waste Management Act of 2000 and Department of Environment and Natural Resources (DENR) Environmental Impact Assessment (EIA) regulations ensure that road construction projects minimize environmental degradation and promote sustainable land use. These provisions complement agricultural and governance-focused laws by embedding environmental and climate resilience into the planning, design, and implementation of rural roads, reinforcing the study's emphasis on sustainable and inclusive community development. Furthermore, the Philippine Development Plan (PDP) and National Infrastructure Program (NIP) provide a strategic framework aligning local road development initiatives with national priorities for inclusive growth, rural development, and achievement of the SDGs.

In sum, the conceptual and legal bases of this study are interrelated and mutually reinforcing. Conceptually, accessible road infrastructure drives agricultural productivity, community connectivity, and sustainable livelihoods, aligning with SDG 2, 9, and 11. Legally, the combination of agriculture-focused laws (RA 8435, RA 7607), governance and technical standards (RA 7160, DPWH manuals), disaster and environmental protection laws (RA 10121, RA 9003, DENR regulations), and national development policies (PDP, NIP) provides a comprehensive framework that supports the operationalization of the proposed development planning framework for road infrastructure and community development. By integrating these legal provisions, the study ensures that recommendations are not only conceptually sound but also compliant with Philippine law and aligned with both local and national development priorities, thereby promoting a sustainable, resilient, and inclusive approach to rural community development.

## **REVIEW OF RELATED LITERATURE AND STUDIES**

This review synthesizes contemporary readings on the nexus between road infrastructure and sustainable community development, organized thematically according to the key variables identified in the study's objectives. The discourse has evolved beyond viewing roads merely as physical assets, now framing them as critical enablers of socio-economic systems, particularly in agrarian settings. This section explored five interconnected themes: the nature of transportation challenges, economic and livelihood impacts, social and market connectivity, climate-related disruptions, and participatory planning frameworks.

## Transportation Challenges in Rural Settings

A primary barrier to rural development is the physical state of local road networks. Globally, research indicates that deficient road conditions—characterized by poor geometry, lack of paving, and inadequate drainage—directly constrain mobility and increase vehicle operating costs significantly. For instance, a World Bank (2023) report emphasized that in developing economies, rural travel times can be up to five times longer than urban ones for comparable distances, primarily due to deteriorated road surfaces. Similarly, foreign studies in agrarian contexts like East Africa detail how narrow, seasonally impassable tracks force farmers to use inefficient modes of transport, such as head-loading or animal carts, drastically limiting the volume and speed of goods movement (Mekonnen & Abebe, 2021).

In the Philippine context, these global findings are reflected and intensified by local geographic and governance challenges. Recent studies confirm that many farm-to-market roads (FMRs) remain unpaved, poorly maintained, and vulnerable to rapid deterioration (Llanto & Navarro, 2022). Furthermore, Philippine research highlights a critical local divergence: the challenge is not only road quality but also the sheer absence of connective infrastructure to upland or geographically isolated barangays (Briones, 2023). This point of divergence is crucial for the present study; while international literature often focuses on upgrading existing networks, the situation in Barangay Baras may involve a more fundamental lack of connectivity. Consequently, this study seeks to specifically identify and document the precise logistical bottlenecks—such as the 8-10 kilometer stretch of degraded track—that translate these generalized challenges into daily hardships for residents.

## Economic Impacts on Livelihoods and Agricultural Productivity

The economic repercussions of poor rural infrastructure are severe and well-documented in recent literature. A consistent finding across foreign studies is that high transportation costs erode farmer profitability and act as a de facto tax on agricultural production. Research from South Asia demonstrates that poor road access correlates strongly with lower farm-gate prices, as traders' factor in higher logistics costs and risks of spoilage (Sharma & Singh, 2022). Moreover, delayed market access leads directly to post-harvest losses, particularly for perishable goods, with studies estimating losses attributable to logistical failures at 20-30% in some regions (FAO, 2022). This body of work establishes a clear causal chain from road failure to income reduction.

Local Philippine studies corroborate these international perspectives while adding nuance regarding the local agricultural value chain. Research on FMR impact in Caraga and other regions confirms that inadequate roads force farmers to sell to intermediaries at the farm gate at significantly lower prices, forfeiting potential market premiums (Philippine Institute for Development Studies [PIDS], 2021). Furthermore, a study by Cordero and dela Cruz (2023) on Mindanao farming communities explicitly links poor road conditions to a reliance on costly, small-scale hauling services, which disproportionately consumes household income. This synthesis underscores the relevance of the present study's second objective. By determining the specific effects of delays, spoilage, and hauling costs in Barangay Baras, this research can provide empirical, localized validation of these broader economic principles and quantify the direct financial leakage experienced by the community's farmers.

## Social Connectivity and Access to Essential Services

Beyond economics, contemporary literature strongly emphasizes the social dimensions of road accessibility. Foreign scholarship increasingly frames transport infrastructure as a determinant of social equity and inclusion. Accessible roads are linked to improved educational attainment, as they reduce student absenteeism, and to better health outcomes by enabling timely medical care (Jones & Kumar, 2023). This perspective highlights how isolation perpetuates multidimensional poverty, limiting human capital development. Conversely, improved connectivity fosters social cohesion and integration into broader societal networks (Chen, 2024).

In the local setting, Philippine researchers have explored how *hiwalay sa daan* (separated by the road) translates into tangible social deficits. Recent studies document that residents of poorly connected barangays face greater difficulties accessing rural health units and are less likely to pursue secondary or tertiary education due to commuting hardships (Dulawan, 2023). There is a convergence with global findings on the broad impact, but a

local divergence often lies in the compounding effect of insurgency or security concerns in some remote areas, which is beyond this study's scope. For this research, the third objective—to examine impacts on connections to markets, schools, and health services—directly engages with this scholarly conversation. It investigates how poor road access in Barangay Baras not only stifles economic activity but also systematically restricts citizens' fulfillment of basic social rights and participation in communal life.

### **Climate Vulnerability and Infrastructure Resilience**

A rapidly growing area of literature addresses the intersection of climate change and infrastructure fragility. International research underscores that many rural roads are highly vulnerable to climate shocks, especially flooding, which damages assets and disrupts livelihoods with increasing frequency (IPCC, 2022). Engineering-focused studies advocate for climate-resilient construction techniques, such as improved drainage and robust embankments, as essential for sustainable infrastructure (World Bank, 2023). This represents a proactive, design-oriented perspective on mitigating environmental risks.

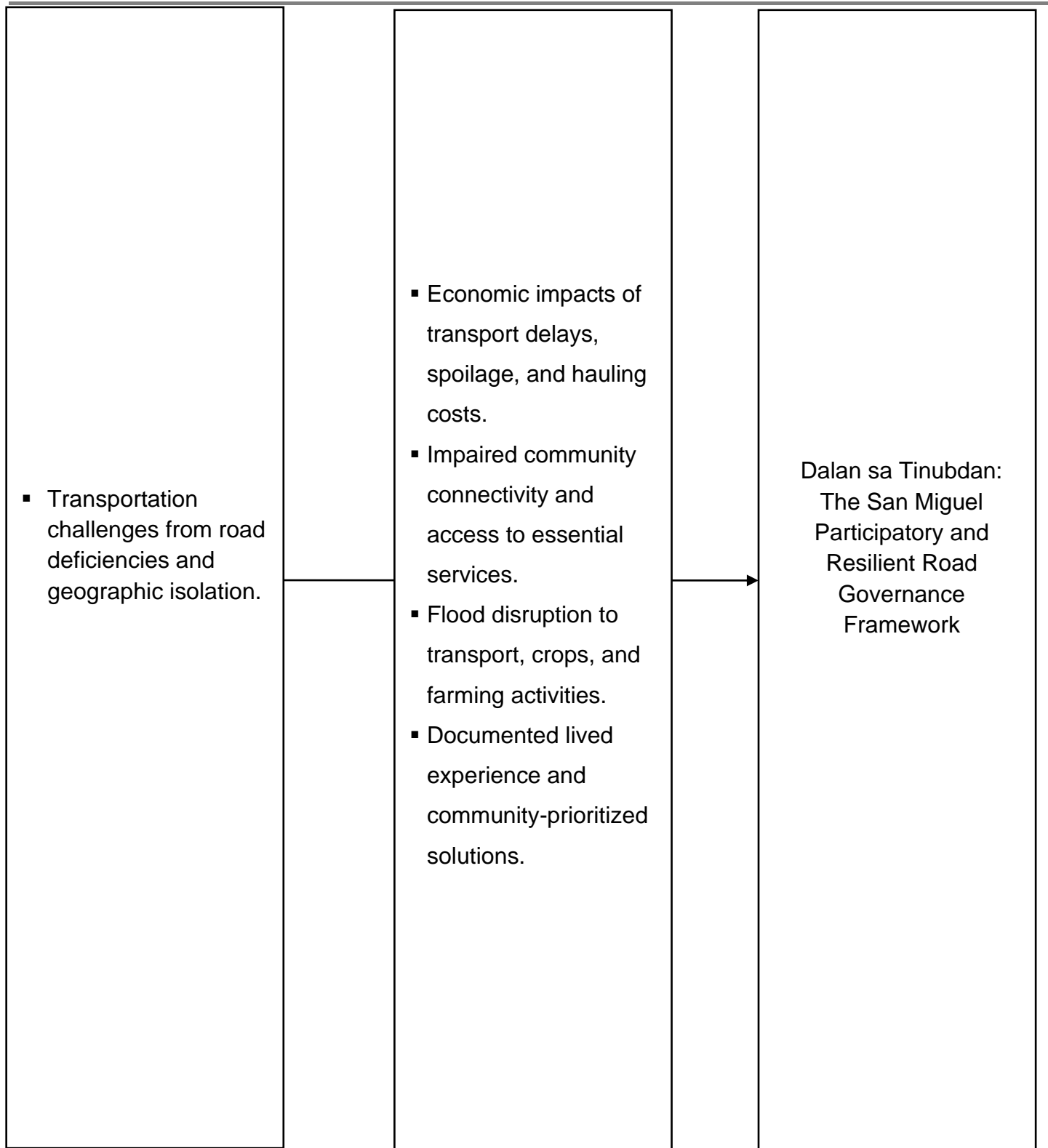
Philippine studies, while acknowledging the need for better engineering, often highlight the reactive and adaptive strategies communities are forced to adopt. Research on climate-disaster risks details how seasonal flooding not only damages roads but also destroys standing crops, creating a dual catastrophe for farmers (Lasco & Espaldon, 2020). This presents a critical local insight: the impact is integrated—damage to the road and damage to livelihoods occur simultaneously during a climate event. Therefore, the fourth objective of this study, which assesses the compound impact of flooding on both transportation and farming activities, is positioned to contribute to this discourse. It may provide a case study on how a specific community's vulnerability manifests, moving beyond generic climate risk assessments to document the lived reality of seasonal disruption and its demoralizing effect on agricultural continuity.

### **Participatory Frameworks for Sustainable Road Development**

Finally, contemporary scholarship strongly advocates for a paradigm shift in infrastructure planning. Foreign literature critiques top-down approaches and promotes participatory models that involve communities in the planning, implementation, and maintenance of road projects. Such frameworks are shown to enhance project suitability, foster local ownership, and improve long-term sustainability (Müller & Schick, 2024). This perspective positions communities not as passive beneficiaries but as essential partners in development.

Echoing this, recent Philippine policy research and NGO-led initiatives champion participatory asset-based community development (ABCD) for FMR projects. The Department of the Interior and Local Government (DILG, 2022) has guidelines promoting community mobilization for local infrastructure. However, a divergence exists between policy and widespread practice, with gaps in consistent implementation and capacity building at the barangay level (Alonzo, 2023). This gap directly informs the fifth and final objective of this study: to propose measures for improvement. The scholarly consensus on participation validates the intent to create a proposed development planning framework for road infrastructure and community development. This study aims to synthesize the global principles of participatory planning with the specific contextual realities of San Miguel, thereby contributing a practical, localized model that bridges the identified implementation gap and turns community insight into the cornerstone of sustainable road development.

Contemporary scholarly literature firmly establishes that accessible and resilient road infrastructure is a fundamental catalyst for sustainable rural development, with deficient conditions triggering a cascade of detrimental effects. Poor road quality directly imposes severe economic burdens—increased transportation costs, significant post-harvest losses, and depressed farm-gate prices—that erode household incomes and livelihoods. Furthermore, inadequate connectivity exacerbates social inequity by restricting reliable access to essential services like healthcare and education, reinforcing cycles of multidimensional poverty. This vulnerability is intensified by climate-related disruptions, as seasonal flooding damages both infrastructure and crops, creating a compound crisis that undermines agricultural continuity and community resilience. In response, a strong scholarly consensus advocates for a paradigm shift toward integrated, participatory planning frameworks, positioning community engagement as central to developing context-sensitive, equitable, and sustainable solutions.



**Figure 1. Schematic Diagram of the Study**

The schematic diagram originates with the study's central problem: the deficient state of road infrastructure and distant access, identified as the core independent variable. This foundational condition is not a static feature but an active catalyst, directly generating a cascade of specific socio-economic burdens that form the dependent variables of the research. These include the severe economic effects on farmers' livelihoods—such as income loss from crop spoilage and prohibitive hauling costs—and the broad social costs manifested in the community's severed connections to essential markets, educational institutions, and healthcare services. Furthermore, the diagram highlights how flooding during the rainy season acts as a critical aggravating factor, intensifying the degradation of the roads and multiplying the severity of the resulting economic and social disruptions, thereby creating a cyclical crisis for the community.

To move from observing effects to understanding their human dimension, the diagram illustrates the critical investigative phase. This involves gathering primary data on the lived experiences and perspectives of the community members in Barangay Baras. This qualitative input provides the empirical depth, detailing the daily realities behind the identified challenges. Subsequently, these ground-level insights enter a central process of synthesis and analysis. Here, the community's narratives are systematically integrated with the theoretical and empirical evidence from the scholarly citations. This analytical stage is where raw data is transformed into validated knowledge, diagnosing root causes, confirming variable relationships, and establishing the evidence-based foundation necessary for credible intervention planning.

The culmination of the entire research process is presented as the study's definitive output: the Proposed Development Planning Framework for Road Infrastructure and Community Development. This framework is not an abstract recommendation but a direct and practical product synthesized from the prior analysis of causes, effects, and community-identified priorities. It represents the translation of diagnostic research into an actionable, participatory plan. The diagram positions this framework as the strategic instrument designed to systematically address the initial infrastructure failure, mitigate its cascading impacts, and ultimately foster sustainable development by enhancing mobility, accessibility, and socio-economic growth in San Miguel.

### **Objectives of the Study**

This study diagnoses the multidimensional impacts of inadequate road infrastructure on Barangay Baras—including economic, social, and climate-related effects—through a community-informed lens in order to produce an actionable development framework for sustainable growth. Specifically, this study seeks to address the following objectives:

1. To identify the transportation challenges faced by residents of Barangay Baras due to poor road conditions and distant access to the main concrete road.
2. To determine the effects of delayed transport, crop spoilage, and high hauling costs on the income and livelihood of farmers.
3. To examine how poor road access affects the community's connection to markets, schools, health services, and nearby areas.
4. To assess the impact of flooding during the rainy season on transportation, crop damage, and farming activities.
5. To explore the lived experience of how road conditions and flooding impact livelihood and access, and to identify community-prioritized infrastructure solutions.
6. To propose possible measures and recommendations for improving road infrastructure to support community development.

### **Scope and Limitations of the Study**

This study aims to develop a community-informed framework for improving road infrastructure and accessibility in Barangay Baras, San Miguel, Surigao del Sur. The subject matter includes the condition of local roads, transportation challenges, and the resulting socio-economic impacts on residents, with particular focus on agricultural livelihood, access to essential services, and seasonal vulnerability to flooding. The locale is strictly confined to Purok Barangay Baras. The population consists of residents and farmers from the barangay, from whom qualitative and observational data gathered. The period of data collection was conducted over a defined three-month period during June to August encompassing both dry and rainy conditions where feasible to capture seasonal variations.

Geographically, the study is limited solely to Barangay Baras and does not include comparative analysis with neighboring barangays. Methodologically, findings are based on the responses of purposively selected residents and on-site observations, which may reflect conditions specific to the study period. While the researcher's

expertise as a civil engineer in San Miguel allows for the integration of technical insights and the preparation of preliminary design concepts, the study does not extend to detailed budgeting, procurement, or implementation planning, which fall under institutional administrative processes. The proposed recommendations are therefore intended as a planning and advocacy tool rather than as finalized project specifications.

### Significance of the Study

This study is significant for the following key stakeholders:

**Residents of Barangay Baras.** The research can formally document and validate their lived experiences, providing a vital evidence base for community advocacy. It empowers residents by ensuring their specific challenges and preferred solutions are central to any future development planning.

**Local Government Units (LGUs).** The study provides the Barangay Council of Baras and the Municipal Planning and Development Office (MPDO) of San Miguel with critical, data-driven insights for policy formulation and infrastructure programming. The proposed framework offers a practical tool for prioritizing projects, enhancing budget justification, and planning interventions that directly address the most pressing community-identified needs.

**Engineering Practice.** The study highlights the imperative for civil engineers and planners to integrate deep community consultation with technical design. It demonstrates a model for developing context-sensitive, sustainable infrastructure solutions that are not only structurally sound but also socially supported and economically impactful.

**Future Researchers and Development Sector.** This research contributes a concrete case study to the literature on participatory rural development and climate-resilient infrastructure. It provides a replicable methodology for assessing the integrated socio-economic and physical dimensions of accessibility, valuable for researchers, NGOs, and practitioners working in similar isolated, agrarian contexts.

### Definition of Terms

The following terms are operationally defined as they are used within the context of this study and its specific objectives.

**Accessible Road Infrastructure.** Refers to the state of the road network within Barangay Baras that enables the safe, reliable, and efficient movement of people, goods, and services. In this study, it is the central variable being assessed, specifically focusing on its current deficiencies, including poor surface conditions, lack of drainage, and the physical distance from the main concrete road.

**Community's Connection to Markets, Schools, Health Services, and Nearby Areas.** Denotes the degree of ease, frequency, reliability, and safety with which residents of Barangay Baras can reach commercial centers, educational institutions, healthcare facilities, and neighboring communities. This study examines how poor road access actively restricts this connectivity.

**Community-Prioritized Infrastructure Solutions.** The specific improvements in road design, drainage, or slope protection that are identified and ranked as most critical by the residents of Barangay Baras during data collection, forming a core input for the proposed development framework.

**Crop Damage.** The physical destruction or quality degradation of agricultural harvests, which in this study is specifically examined as a direct consequence of transportation over poor roads and exposure to flooding during transit or in fields.

**Crop Spoilage.** The decay or ruin of harvested agricultural produce before it reaches the market. This study operationalizes it as a key economic loss for farmers, directly linked to delays and poor handling necessitated by difficult transportation conditions.

**Delayed Transport.** The lengthening of the typical time required to move harvested crops from the farm in Barangay Baras to intended markets or buyers, caused by the poor state of the road network.

**Distant Access.** The significant geographical separation between the residential and farming areas of Barangay Baras and the nearest all-weather, concrete road, creating a fundamental barrier to connectivity.

**Farming Activities.** The cycle of agricultural production undertaken by farmer-residents, including land preparation, planting, maintenance, harvesting, and post-harvest handling. This study assesses how flooding and poor roads disrupt this entire cycle.

**Flooding during the Rainy Season.** The periodic inundation of roads and farmland in Barangay Baras due to heavy rainfall, which is examined in this study as a recurring climatic event that exacerbates road damage, halts transportation, and destroys crops.

**High Hauling Costs.** The disproportionately large financial expenditure incurred by farmers in Barangay Baras to pay for the manual or vehicular transport of their goods across the poor road network to the main road.

**Income and Livelihood of Farmers.** The total earnings and economic means of survival for agricultural households in Barangay Baras. This study seeks to determine how this variable is negatively affected by transportation-related losses and costs.

**Lived Experience.** The personal, first-hand accounts and narratives of Barangay Baras residents regarding the daily realities, challenges, and impacts of poor road conditions and flooding on their household economy and daily life.

**Poor Road Access.** The constrained ability of residents to travel to and from Barangay Baras due to the physical limitations of the road network, such as narrow paths, muddiness, and erosion.

**Poor Road Conditions.** The physical state of the barangay's roads, characterized in this study by features such as unpaved surfaces, severe ruts, standing water, erosion, and a general lack of all-weather durability.

**Sustainable Community Development.** A multi-dimensional process of improvement in Barangay Baras that is economically viable, socially inclusive, and environmentally resilient. In this study, it is the ultimate goal, framed as being dependent on achieving accessible road infrastructure.

**Transportation Challenges.** The specific practical difficulties faced by residents of Barangay Baras in moving themselves and their goods, encompassing physical impediments, increased effort, time consumption, and higher costs directly caused by poor road conditions and distant access.

## RESEARCH METHODOLOGY

This section describes the methodology used to investigate the impact of road conditions on Barangay Baras. A community-engaged, mixed-methods approach was employed, combining qualitative data collection with technical analysis. This design captures both the lived experiences of residents and the physical state of infrastructure, providing a holistic evidence base for the proposed development framework.

### Research Design

This study employs an explanatory sequential mixed-methods design. This approach involves a two-phase process where quantitative data is collected and analyzed first, followed by a subsequent qualitative phase designed to explain, elaborate on, or contextualize the initial quantitative results (Creswell & Plano Clark, 2018; Shorten & Smith, 2021). This design is particularly powerful for studies seeking not only to identify patterns or

trends but also to explore the underlying reasons, mechanisms, and lived experiences behind them. It allows researcher to use qualitative evidence to interpret quantitative findings, providing a more nuanced and complete understanding of complex social phenomena.

The design is particularly applicable to this study for several reasons. First, it aligns with the dual need for both measurable impact data and deep narrative understanding. Phase 1 (Quantitative) involves a survey to systematically quantify the prevalence and severity of transportation challenges, their economic costs, and the frequency of flood-related disruptions across a wider sample of the community. This phase directly addresses objectives related to identifying and determining the scale of specific effects such as income loss and frequency of delays. Phase 2 (Qualitative) used semi-structured interviews and focus group discussions to explore the lived experiences behind the survey statistics. This phase is designed to explain how and why these challenges manifest as they do, providing rich context on daily life, community priorities, and the nuanced realities that numbers alone cannot capture. The sequential nature ensures that emerging questions or patterns from the survey can be probed in depth during the interviews. Ultimately, this design allows for the integration of broad trends with deep insight, culminating in a well-substantiated, context-rich foundation for the proposed development planning framework.

## Research Locale

This study is situated in Barangay Baras, San Miguel, Surigao del Sur, Philippines a locale selected for its salient relevance to the research focus on sustainable agriculture and rural infrastructure. San Miguel is recognized as the primary rice granary and agricultural producer of the province, with Barangay Baras itself being a significant contributor to this output. The area's economic identity is fundamentally agrarian, making the efficiency of its farm-to-market road network a critical determinant of community livelihood, food security, and local development.

The specific choice of Barangay Baras as the research site is driven by a clear, observed disparity between its agricultural productivity and its infrastructural support systems. Despite its resource richness, the barangay experiences pronounced accessibility constraints due to underdeveloped, seasonally impassable roads. This creates a compelling case where the hypothesized negative impacts of poor road conditions, on crop spoilage, transportation costs, market access, and resilience to flooding, are actively observable and acutely felt by the community, thereby providing an ideal context to investigate the study's core problem.

Scientifically, this locale constitutes a purposively selected, critical case. The conditions present allow for an in-depth examination of the direct relationships between infrastructure quality, agricultural productivity, and socio-economic well-being within a real-world, high-stakes setting. The persistent and documented nature of the infrastructure challenges in Barangay Baras provides a clear, observable context for investigation, solidifying its appropriateness as a research site. The recurring, seasonal cycle of inaccessibility offers a longitudinal dimension to the study, allowing for the examination of cause and effect over time. Consequently, an in-depth analysis of this specific barangay serves as a critical case study, producing findings with high transferability to other geographically isolated, agriculturally dependent communities experiencing comparable infrastructural constraints.

## Research Respondents/ Participants

Respondents were selected based on the following criteria to ensure they represented the key stakeholder groups directly impacted by road infrastructure in Barangay Baras: (1) must be a permanent resident of Barangay Baras; (2) must be 18 years of age or older; (3) must primarily belong to one of five predefined categories based on their livelihood and dependency on local roads: Farmers (individuals whose primary income comes from agriculture), Students (individuals regularly commuting for education), Barangay Officials/Staff (elected or appointed local government personnel), Transport Drivers (individuals whose livelihood involves operating vehicles on barangay roads), and Other Residents (general community members not falling into the previous categories, who use roads for daily activities).

To ensure a representative sample that captures the distinct experiences of each stakeholder group, a stratified random sampling technique was employed. This method involves dividing the target population into homogeneous subgroups, or strata, before drawing random samples from each one (Taherdoost, 2022). This technique is particularly applicable to this study as it allows for the precise investigation of how road conditions uniquely affect different sectors of the community—such as farmers versus students—while also ensuring that the collective sample accurately mirrors the population structure of Barangay Baras (Taherdoost, 2022).

The total estimated adult population (N=1,395) was stratified into the five categories. Using the standard formula for calculating sample size from a finite population with a 95% confidence level and a 5% margin of error, a minimum sample size of 312 was determined. This total sample was then allocated to each stratum using proportional allocation, meaning the sample size for each group corresponds to its proportion in the total population. This guarantees that larger stakeholder groups are adequately represented in the data. The distribution is detailed in Table 1.

**Table 1. Distribution of Respondents/ Participants**

Category	Estimated Population	Samples	Participants
Farmers	420	94	4
Students	350	78	5
Barangay Officials/ Staff	35	8	1
Transport Drivers	70	16	2
Other Residents	520	116	6
<b>Total</b>	<b>1,395</b>	<b>312</b>	<b>18</b>

From within each stratified sample, a subset of participants was then purposively selected for in-depth qualitative methods such as interviews and focus groups to gather rich, detailed narratives. The final qualitative participants (n=18) were chosen to ensure at least one voice from each stratum was included, with greater representation from larger groups to maintain proportionality of perspective. This purposive approach is standard in qualitative research to identify information-rich cases that can provide deep, nuanced insights into complex, context-specific phenomena, such as the lived experience of transportation challenges, the economic impact on livelihoods, and the social dimensions of access within an agricultural community (Campbell et al., 2020; Bouncken et al., 2025).

**Research Instrument**

This study employed a researcher-developed structured survey questionnaire as its primary data collection instrument to ensure methodological rigor. The questionnaire was meticulously designed to align with the research objectives and to operationalize the key variables under investigation. Facilitating an explanatory sequential mixed-methods approach, the instrument integrated quantitative Likert-scale items with qualitative open-ended questions. To ensure clarity and cultural appropriateness, all items were presented in both English and the local Cebuano dialect.

The questionnaire was organized into four distinct sections, each corresponding to a key research variable. Part I, “Transportation Challenges,” contained eight items designed to identify specific difficulties related to road conditions and distant access (Objective 1). Part II, “Effects of Delays, Spoilage, and Hauling Costs,” used eight items to determine economic impacts on farmers' livelihoods (Objective 2). Part III, “Access to Services and Connectivity,” comprised eight items examining social consequences and restricted access to essential services (Objective 3). Part IV, “Flooding and Seasonal Impact,” included eight items to assess the compounding effects of rainy-season flooding on transportation and agriculture (Objective 4). To explore the lived experience of how road conditions and flooding impact livelihood and access, and to identify community-prioritized infrastructure solutions, open-ended questions were included (Objective 5).

To establish the instrument's validity, it underwent a rigorous face and content validation process by a panel of experts. The panel included two civil engineers from the Municipal Engineering Office of San Miguel: an Engineer II with eight years of field experience in rural infrastructure and an Engineer I with four years of experience. They evaluated the tool for clarity, relevance, comprehensiveness, and alignment with study objectives using a standard validation rubric. Their suggestions, such as simplifying technical terms in the Cebuano translation and adjusting the sequence of questions for better flow, were incorporated into the revised draft.

Following validation, a pilot test was conducted and the data from the pilot were analyzed for reliability using Cronbach's Alpha to test internal consistency which yielded  $\alpha = .89$ . This coefficient confirmed the instrument's excellent internal consistency. Feedback from pilot respondents regarding ambiguous phrasing on two items was also noted. All comments and statistical results from the pilot test were incorporated, finalizing a robust, valid, and reliable instrument for full-scale deployment. This iterative process of validation, statistical testing, and practical refinement ensured the tool was both psychometrically sound and contextually appropriate for field deployment in the main study.

### **Data Gathering Procedure**

The data gathering procedure was conducted systematically through a multi-stage process that integrated both quantitative and qualitative methods, ensuring comprehensive data collection aligned with the study's objectives. The process was structured into three main phases: preparation and planning, field implementation and administration, and data consolidation and preliminary analysis.

The preparation and planning phase began with securing official approvals from the Municipal Mayor's Office and the Barangay Council of Baras. A detailed logistical plan and timeline were established, coinciding with a period that captured the transition from dry to rainy seasons to observe varying road conditions. Prior to full deployment, the refined instruments underwent a final pilot in a neighboring barangay to ensure procedural clarity.

The implementation and administration phase involved the structured rollout of data collection. For the quantitative survey, the stratified random sampling frame was used. Researcher systematically approached households within each identified stratum. After obtaining informed consent, the survey was administered through a combination of guided self-administration for literate respondents and researcher-assisted interviews for others, ensuring a high completion rate. Simultaneously, qualitative data was gathered through scheduled semi-structured interviews and in-depth interviews (IDIs) with the purposively selected participants from each stratum. These sessions, held in barangay facilities, were audio-recorded with permission and designed to probe deeper into experiences hinted at in the surveys. Throughout this phase, supporting observational data was also systematically documented by the researcher, including photographic evidence of road defects, drainage failures, and flood levels, as well as field notes on travel times and vehicle types unable to traverse certain sections.

The final data consolidation and preliminary analysis phase ensured robustness and prepared for the final output. Completed surveys were checked daily for completeness before data encoding. Interview and audio recordings were transcribed verbatim and translated where necessary, with transcripts subsequently cleaned and prepared for thematic analysis. This integrated data collection process, encompassing structured surveys, in-depth narratives, and direct observation, was explicitly designed to generate the layered evidence base required. The analysis and synthesis of this triangulated data—quantifying challenges, qualifying lived experiences, and documenting physical conditions—directly fed into the formulation of the study's core output: the evidence-based, community-grounded proposed development planning framework for road infrastructure and community development.

### **Ethical Considerations**

This study adhered to the foundational ethical principles for human subject research as outlined in the Belmont Report: Respect for Persons, Beneficence, and Justice. These principles formed the operative framework for all

procedures, ensuring the protection, dignity, and equitable treatment of every participant throughout the research process.

The principle of Respect for Persons was upheld by rigorously safeguarding participant autonomy through informed consent and confidentiality. Prior to participation, individuals received a complete explanation of the study's purpose, procedures, and their rights in both English and Cebuano. They were assured of their voluntary participation, their right to decline any question or withdraw at any time without penalty, and the measures taken to protect their identity. All data were de-identified, and audio recordings from interviews and focus groups were secured and handled in strict compliance with the Data Privacy Act of 2012 (R.A. 10173).

The principle of Beneficence was applied through a deliberate design to minimize potential harm and maximize benefit. The research aimed to avoid psychological or social distress by employing sensitive interview techniques and ensuring a supportive environment for sharing experiences. The significant potential benefit of the study was its commitment to translating findings into a tangible development framework, thereby contributing to long-term improvements in community infrastructure, livelihood security, and access to essential services for Barangay Baras.

Finally, the principle of Justice was honored through the fair selection of participants and the equitable distribution of the study's potential benefits. The use of stratified random sampling ensured that all major community sectors – farmers, students, transport drivers, etc. – were equitably represented, justly distributing the burden of participation. The study was consciously situated in Barangay Baras precisely because its residents bear the acute burden of infrastructural deficit; consequently, the primary output of the research—a community-informed development plan—is designed to directly benefit the participating community, ensuring that those who contribute to the knowledge also stand to gain from its application.

## Data Analysis

The core qualitative data from open-ended survey responses and interviews (Part V) had been analyzed using Braun and Clarke's (2006, 2022) six-phase framework for thematic analysis. This method is particularly suited to the study as it provides a systematic yet flexible process for identifying, analyzing, and reporting patterns (themes) within rich, experiential data, allowing for a deep, inductive understanding of the community's lived realities.

The analysis adheres to the following phases: (1) Familiarization: Immersive reading and re-reading of all qualitative transcripts alongside listening to audio recordings to gain deep familiarity with the data. (2) Generating Initial Codes: Significant features of the data relevant to the research objectives can be systematically labeled with concise codes (e.g., “walking as last resort,” “flood-induced crop loss,” “middleman dependency,” “isolation from healthcare”). This initial coding can be performed manually to maintain closeness to the data. (3) Searching for Themes: The coded data can be collated and organized into potential overarching themes that capture broader patterns of meaning. For instance, codes related to increased travel time, vehicle damage, and accident risk may cluster under a candidate theme like “The Multi-faceted Burden of Poor Mobility.” (4) Reviewing Themes: This phase involves a rigorous check where candidate themes are reviewed against both the coded extracts and the entire dataset. Themes can be refined, split, combined, or discarded to ensure they form a coherent pattern that accurately represents the data. (5) Defining and Naming Themes: Clear definitions and names will be developed for each final theme, articulating the essence of what each theme captures and how it contributes to understanding the central research problem. (6) Producing the Report: The final analysis can weave together the vivid, anonymized extracts from participants with the researcher's analytic narrative, linking the themes back to the study's objectives and the scholarly literature to produce a compelling account of the findings.

Through this structured coding and thematic generation process, the analysis can move beyond simple description to develop insightful, data-grounded themes that directly address the study's nature. These themes can elucidate the complex interrelationships between road infrastructure, economic vulnerability, social exclusion, and climate resilience in Barangay Baras, thereby providing the empirical depth necessary to inform the proposed development planning framework.

## Statistical Treatment

**Weighted Mean.** The quantitative data from the survey had been analyzed using descriptive statistics, primarily employing the weighted mean to determine the average level of agreement or perceived severity for all Likert-scale items. This approach directly serves the first four objectives: the mean scores on the identifying most critical transportation challenges; for quantifying the economic impact on livelihoods; for measuring the perceived restriction in access to services and connectivity; and for assessing the severity of flooding impacts on transport and farming, thereby creating a foundational quantitative profile of the community's experiences.

## Limitations of the Study

While the explanatory sequential mixed-methods design provides a robust and context-rich evidence base, several limitations should be acknowledged.

**Scope and Generalizability.** The study is confined to a single barangay, Barangay Baras in San Miguel, Surigao del Sur. Although this purposive selection enables in-depth examination of a critical case, the findings—particularly the quantitative prevalence rates and specific economic impacts—may not be directly generalizable to other communities with different geographical, socio-economic, or infrastructural contexts. However, the rich qualitative data and the structured framework offer transferable insights for rural, agriculturally dependent areas facing similar infrastructure constraints.

**Sampling Limitations.** Stratified random sampling was employed for the quantitative survey to ensure proportional representation across stakeholder groups. Despite efforts to achieve the calculated sample size ( $n=312$ ), logistical constraints in reaching remote sitios during the rainy season may have introduced minor non-response bias, as some households were inaccessible or declined participation. The qualitative phase purposively selected 18 participants to capture diverse perspectives; while this number is appropriate for thematic analysis, it does not claim statistical representativeness and may not fully capture the full spectrum of community experiences.

**Methodological Constraints.** The study relied primarily on self-reported data from surveys and interviews, which are subject to recall bias and social desirability bias. Respondents may have over- or under-reported the frequency of transport disruptions, income losses, or other sensitive issues. The cross-sectional nature of the quantitative data collection captures a single point in time, limiting the ability to establish long-term trends or causal relationships. Although the timing of data collection spanned both dry and wet seasons to observe seasonal variability, the study did not employ continuous longitudinal monitoring.

**Technical Measurement.** Road condition assessment was based on participatory mapping and qualitative observation rather than standardized engineering metrics (e.g., International Roughness Index) applied consistently across all segments. While this approach aligns with the study's community-engaged aim, it limits technical comparability with formal infrastructure audits.

**Researcher Positionality.** The researcher's role as an external observer may have influenced participant responses during interviews and focus groups, despite efforts to build rapport and maintain neutrality. Reflexive practices—such as maintaining field notes and peer debriefing—were employed to mitigate potential bias.

These limitations do not undermine the validity of the study's conclusions but should be considered when interpreting the findings and when applying the proposed framework in other contexts. Future research could expand the geographic scope, incorporate longitudinal monitoring, and integrate objective engineering assessments to complement community-reported data.

## RESULTS AND DISCUSSIONS

This section presents and examines the empirical findings of the study, structured to systematically address each research objective. It begins by detailing the quantitative results from the community survey, which profile the prevalence and severity of transportation challenges, economic impacts, access restrictions, and flooding effects. These statistical findings are then integrated with the rich qualitative themes derived from community narratives,

providing depth and context to the measured data. The subsequent discussion interprets this combined evidence, analyzing the patterns and relationships within the data and situating the local realities of Barangay Baras within the broader context of existing literature on rural infrastructure and sustainable development, thereby constructing a coherent argument that leads directly to the formulation of the proposed development framework.

### Transportation Challenges Due to Poor Road Conditions

**Table 2. Transportation challenges due to poor road conditions and distant access to the main concrete road**

Indicators	Farmers		Students		Brgy. Officials		Drivers		Residents	
	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating
1. The road from our purok to the main concrete road is difficult to pass.	4.13	Very Challenging	3.90	Very Challenging	3.88	Very Challenging	4.25	Extremely Challenging	3.84	Very Challenging
2. Vehicles (motorcycle, tricycle, truck) often cannot reach our farms because of poor road conditions.	4.13	Very Challenging	3.77	Very Challenging	3.75	Very Challenging	4.06	Very Challenging	3.79	Very Challenging
3. Travel time from our area to the market is longer because of the poor road.	4.12	Very Challenging	3.87	Very Challenging	3.75	Very Challenging	4.19	Very Challenging	3.84	Very Challenging
4. Poor Road conditions increase the risk of accidents for drivers and passengers.	4.14	Very Challenging	3.87	Very Challenging	3.63	Very Challenging	4.25	Extremely Challenging	3.88	Very Challenging
5. I often need to walk long distances because vehicles cannot pass through our road.	4.15	Very Challenging	3.88	Very Challenging	3.88	Very Challenging	4.19	Very Challenging	3.86	Very Challenging
6. Poor roads make it difficult to transport farm inputs (seeds, fertilizer, equipment).	4.16	Very Challenging	3.90	Very Challenging	3.88	Very Challenging	4.25	Extremely Challenging	3.87	Very Challenging
7. Transport operators avoid our area because of bad road conditions.	4.14	Very Challenging	3.88	Very Challenging	3.75	Very Challenging	4.19	Very Challenging	3.84	Very Challenging
8. Bad Road conditions increase my travel expenses like fare.	4.15	Very Challenging	3.87	Very Challenging	3.88	Very Challenging	4.25	Extremely Challenging	3.86	Very Challenging
<b>Overall Mean</b>	<b>4.14</b>	<b>Very Challenging</b>	<b>3.87</b>	<b>Very Challenging</b>	<b>3.80</b>	<b>Very Challenging</b>	<b>4.20</b>	<b>Very Challenging</b>	<b>3.85</b>	<b>Very Challenging</b>

Table 2 presents the quantitative assessment of the transportation challenges faced by residents of Barangay Baras, providing empirical evidence of the severity of issues related to poor road conditions and distant access. The data, drawn from a stratified sample representing the key stakeholder groups—Farmers, Students, Barangay Officials, Drivers, and Other Residents—reveals a consistently high level of perceived difficulty across all eight indicators. Overall mean scores for every group fall within the "Very Challenging" range (3.80 to 4.20), demonstrating that infrastructural deficiency is a pervasive, cross-sectoral barrier affecting the entire community.

The analysis of the highest and lowest results offers critical insight into the differential impact of these challenges. Transport Drivers reported the highest overall mean (4.20), with four specific indicators; road passability, accident risk, difficulty transporting farm inputs, and increased travel expenses; rated as "Extremely Challenging" (mean = 4.25). This aligns with the findings of Cordero and dela Cruz (2023), whose research in Mindanao linked poor road conditions directly to a reliance on costly, small-scale hauling services that disproportionately burden households. The drivers' acute concern over accident risk further underscores a severe safety crisis that transcends mere economic inconvenience. Conversely, while still within the "Very Challenging" band, Barangay Officials reported the lowest overall mean (3.80). This slight but consistent attenuation across several indicators, most notably on the risk of accidents (Mean=3.63), may reflect a different daily travel experience or an administrative perspective. This divergence resonates with Briones's (2023) observation of a potential disconnect between localized, lived hardship and broader governance awareness, particularly in geographically isolated barangays where the challenge involves a fundamental lack of connectivity rather than just poor quality. This highlights the critical importance of integrating multiple community perspectives in diagnostic planning.

An in-depth discussion of these findings substantiates and expands upon the scholarly themes established in the literature. The universal rating of challenges as "Very" to "Extremely" Challenging offers robust, localized validation of global research identifying deficient road conditions as a primary barrier to rural development (World Bank, 2023). Specifically, the top-rated challenges; difficulty in passing roads, increased travel time, and the prohibitive cost of transport; directly mirror the "precise logistical bottlenecks" and extended rural travel times documented in both international and Philippine studies (Mekonnen & Abebe, 2021; Llanto & Navarro, 2022).

Furthermore, the economic implications embedded in this data are profound. The high scores on indicators like increased travel expenses and the extreme difficulty in transporting farm inputs (a top concern for Farmers and Drivers) provide the empirical link to the economic impacts detailed in the literature. These challenges directly operationalize the "de facto tax on agricultural production" described by Sharma & Singh (2022), as they represent the upstream causes of the high transportation costs and post-harvest losses that erode farmer income (FAO, 2022; PIDS, 2021). This established causal chain from physical access barriers to economic vulnerability underscores the critical necessity of integrating infrastructure solutions with livelihood support in any development framework, thereby directly informing the study's ultimate goal of creating a participatory and sustainable planning model for San Miguel.

### Effects of Delayed Transport, Crop Spoilage, and High Hauling Costs

Table 3. Effects of delayed transport, crop spoilage, and high hauling costs on the income and livelihood of farmers

Indicators	Farmers		Students		Brgy. Officials		Drivers		Residents	
	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating
1. I have lost income because my crops were delayed and spoiled before reaching the market.	4.29	Extremely Impactful	3.90	Severely Impactful	3.75	Severely Impactful	4.25	Extremely Impactful	3.88	Severely Impactful
2. Hauling costs are high because of poor road conditions.	4.23	Extremely Impactful	3.79	Severely Impactful	3.88	Severely Impactful	4.31	Extremely Impactful	3.81	Severely Impactful
3. I sometimes sell my products at lower prices or to local buyers because of poor transport.	4.26	Extremely Impactful	3.88	Severely Impactful	4.00	Severely Impactful	4.31	Extremely Impactful	3.86	Severely Impactful
4. Spoiled or delayed crops reduce my bargaining motivation in the market.	4.23	Extremely Impactful	3.86	Severely Impactful	3.88	Severely Impactful	4.25	Extremely Impactful	3.88	Severely Impactful
5. Poor roads force me to depend more on middlemen to sell my products.	4.24	Extremely Impactful	3.85	Severely Impactful	3.75	Severely Impactful	4.31	Extremely Impactful	3.89	Severely Impactful
6. Delays in transportation make it harder to meet buyers' demands	4.26	Extremely Impactful	3.88	Severely Impactful	3.88	Severely Impactful	4.25	Extremely Impactful	3.84	Severely Impactful
7. High hauling costs reduce my profit margin.	4.23	Extremely Impactful	3.85	Severely Impactful	4.00	Severely Impactful	4.44	Extremely Impactful	3.88	Severely Impactful
8. Some of my harvest is wasted because transport is unavailable on time.	4.24	Extremely Impactful	3.92	Severely Impactful	3.88	Severely Impactful	4.25	Extremely Impactful	3.89	Severely Impactful
<b>Overall Mean</b>	<b>4.25</b>	<b>Extremely Impactful</b>	<b>3.87</b>	<b>Severely Impactful</b>	<b>3.88</b>	<b>Severely Impactful</b>	<b>4.30</b>	<b>Extremely Impactful</b>	<b>3.87</b>	<b>Severely Impactful</b>

Table 3 quantifies the perceived economic impacts on farmers' income and livelihood stemming from delayed transport, crop spoilage, and high hauling costs in Barangay Baras. The data reveals a critical economic crisis sharply delineated by stakeholder role. The results bifurcate into two distinct tiers of severity: Farmers and Drivers, whose livelihoods are directly tied to the physical movement of goods, report impacts categorized as "Extremely Impactful," with overall means of 4.25 and 4.30, respectively. In contrast, Students, Barangay Officials, and Other Residents, who experience the economic consequences secondarily, report impacts classified as "Severely Impactful," with overall means clustered around 3.87-3.88. This stratification, quantified by both mean scores and sample representation, highlights that the economic burden of poor roads is disproportionately borne by the agricultural production and transport sectors.

The highest results, particularly from Farmers and Drivers, offer empirical validation for established scholarly concerns. Drivers identified high hauling costs reducing profit margins as the single most severe impact (Mean=4.44), directly

substantiating Cordero and dela Cruz's (2023) finding that poor road conditions create a reliance on prohibitively expensive, small-scale hauling services. Farmers rated income loss from delayed and spoiled crops and the consequent need to sell at lower prices as extremely impactful (Means=4.29 & 4.26). This powerfully confirms the "de facto tax on agricultural production" described by Sharma & Singh (2022) and the pattern of forfeited market premiums due to selling to local intermediaries noted by PIDS (2021). The slightly lower, though still severe, ratings from non-farming groups imply that while the entire community feels the economic strain, the direct, transactional impact on agricultural commerce is uniquely devastating for producers and transporters.

An in-depth analysis of these findings demonstrates a precise operationalization of the "clear causal chain from road failure to income reduction" outlined in the literature. Each indicator in the table maps directly onto a link in this chain. The high costs of transport (Indicator 2) erode profitability from the outset. Delays and spoilage (Indicators 1, 4, 6, 8) lead to direct physical and economic losses, a dynamic well-documented by the FAO (2022). The resulting compromised market position forces farmers into unfavorable terms of trade, including lower prices and increased dependence on middlemen (Indicators 3 & 5), thereby completing a cycle of diminished returns. This empirical evidence from Barangay Baras negates any notion that such impacts are merely theoretical or sporadic; instead, it confirms they are severe, systematic, and deeply embedded in the daily reality of the community's primary economic sector. The data underscores that improving road infrastructure is not just a logistical issue but a fundamental prerequisite for breaking this cycle of economic vulnerability and enabling sustainable agricultural livelihoods.

Furthermore, the climatic vulnerability evident in these results intensifies the community's economic precarity. The high reported disruption from flooding, particularly regarding crop damage and impassable roads, provides a concrete, local case study of the integrated climate-infrastructure-livelihood risks discussed in broader research. This pattern of seasonal crisis directly corresponds with the observations of Lasco & Espaldon (2020) on the dual catastrophe of damaged roads and destroyed crops, while illustrating the "compound crisis" that erodes agricultural resilience, as noted in synthesis of contemporary literature. This established pattern of recurring disruption underscores the non-negotiable need for climate-adaptive engineering in any infrastructure solution, thereby shaping the core principles of the proposed framework to prioritize resilience and year-round accessibility for San Miguel.

### **Access to Service and Connectivity**

Table 4 presents the perceived level of restriction on the community's access to essential services and social connectivity due to poor road infrastructure in Barangay Baras. The data reveals a profound and pervasive social deficit, with mean ratings consistently in the high range across all eight indicators. The results stratify into two levels of severity, mirroring the pattern observed in economic impacts. Farmers and Drivers, whose daily mobility is essential for both livelihood and household welfare, report impacts categorized as "Extremely Restrictive," with overall means of 4.22 and 4.33, respectively. Conversely, Students, Barangay Officials, and Other Residents report restrictions classified as "Severely Restrictive," with overall means ranging from 3.84 to 3.91. This demonstrates that while the entire community faces significant barriers, the consequences for access are most acutely felt by those for whom roads are a critical lifeline for both economic and social needs.

**Table 4. How poor road access affects the community’s connection to markets, schools, health services, and nearby areas**

Indicators	Farmers		Students		Brgy. Officials		Drivers		Residents	
	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating
1. Poor roads make it difficult for children to attend school regularly.	4.23	Extremely Restrictive	3.85	Severely Restrictive	4.00	Severely Restrictive	4.38	Extremely Restrictive	3.93	Severely Restrictive
2. Getting health services is harder because of the poor road.	4.23	Extremely Restrictive	3.85	Severely Restrictive	3.75	Severely Restrictive	4.31	Extremely Restrictive	3.90	Severely Restrictive
3. Poor Road access limits our ability to connect with other barangays and markets.	4.22	Extremely Restrictive	3.86	Severely Restrictive	3.88	Severely Restrictive	4.25	Extremely Restrictive	3.91	Severely Restrictive
4. Poor roads make it difficult for teachers to reach schools in our barangay.	4.21	Extremely Restrictive	3.85	Severely Restrictive	3.75	Severely Restrictive	4.44	Extremely Restrictive	3.93	Severely Restrictive
5. Patients sometimes fail to get urgent medical help because of road problems.	4.22	Extremely Restrictive	3.88	Severely Restrictive	3.88	Severely Restrictive	4.25	Extremely Restrictive	3.90	Severely Restrictive
6. Poor Road conditions discourage relatives and visitors from coming to our place.	4.21	Extremely Restrictive	3.90	Severely Restrictive	3.75	Severely Restrictive	4.31	Extremely Restrictive	3.91	Severely Restrictive
7. Road inaccessibility prevents us from fully participating in barangay and municipal activities.	4.20	Severely Restrictive	3.88	Severely Restrictive	3.88	Severely Restrictive	4.38	Extremely Restrictive	3.90	Severely Restrictive
8. Poor Road access limits opportunities for small businesses to grow.	4.21	Extremely Restrictive	3.92	Severely Restrictive	3.88	Severely Restrictive	4.31	Extremely Restrictive	3.87	Severely Restrictive
<b>Overall Mean</b>	<b>4.22</b>	<b>Extremely Restrictive</b>	<b>3.87</b>	<b>Severely Restrictive</b>	<b>3.84</b>	<b>Severely Restrictive</b>	<b>4.33</b>	<b>Extremely Restrictive</b>	<b>3.91</b>	<b>Severely Restrictive</b>

The highest results offer compelling empirical evidence for the social equity concerns raised in the literature. Drivers identified the difficulty for teachers to reach schools as the single most severe restriction (Mean=4.44), highlighting a critical barrier to educational service delivery that compounds student access problems. Farmers and Drivers both rated restricted access to health services and connection to other barangays and markets as extremely restrictive (Means  $\geq 4.22$ ). These findings provide quantitative validation for Jones and Kumar’s (2023) assertion that transport infrastructure is a key determinant of social inclusion, directly linking poor roads to impediments in education and healthcare access. Additionally, they resonate strongly with Dulawan’s (2023) documentation of how *hiwalay sa daan* (separation by the road) translates into tangible deficits in accessing rural health units and fostering communal ties in the Philippine context. The slightly lower, though still severe, ratings from other groups suggest a gradient of impact, where direct, daily users of the road for livelihood purposes experience the sharpest edge of social exclusion.

An in-depth analysis of these findings illustrates the mechanism by which poor roads systematically erode social capital and perpetuate multidimensional poverty, as framed in contemporary literature. Each indicator maps onto a specific dimension of this deprivation. Restrictions on children’s school attendance and teacher access (Indicators 1 & 4) directly threaten human capital development, a core concern in studies linking connectivity to educational attainment. Barriers to timely healthcare (Indicators 2 & 5) create acute risks and exemplify how

infrastructure failure compromises basic welfare. The limitation on connecting with markets, other communities, and participating in civic activities (Indicators 3, 7) stifles social cohesion, economic networks, and political participation, counteracting the integrative benefits of improved connectivity noted by Chen (2024). This data powerfully negates any view of road access as merely a convenience; instead, it confirms it as a foundational prerequisite for fulfilling social rights and fostering an inclusive, engaged community. The cumulative effect is a state of enforced isolation that reinforces poverty cycles, making the improvement of accessibility a central pillar of any genuine social development strategy for Barangay Baras.

Furthermore, this interconnected reality—where physical barriers simultaneously stifle economic activity, educational advancement, and health outcomes—demonstrates that infrastructure investment must be evaluated not merely by reduced travel time, but by its capacity to restore social equity and disrupt this cycle of disadvantage. Consequently, this analysis critically informs the participatory planning model by demanding that solutions be co-designed with communities to target not only logistical bottlenecks but also these deeply rooted social deficits. This approach ensures the resulting development framework is holistic, inclusive, and sustainable.

### Flooding and Rainy Seasons’ Impact on the Farming Activities

Table 5 quantifies the perceived severity of disruption caused by seasonal flooding on multiple facets of life in Barangay Baras. The data reveals that flooding is not merely an inconvenience but an "Extremely Disruptive" annual crisis for key livelihood groups, with Farmers and Drivers reporting overall means of 4.35 and 4.31, respectively. Students, Barangay Officials, and Residents (20%) also report severe impacts, with overall means ranging from 3.87 to 3.97. This indicates that while the entire community is significantly affected, the production and transport sectors, the backbone of the local economy, bear the most catastrophic brunt of this recurring climate shock.

**Table 5. Impact of flooding during the rainy season on transportation, crop damage, and farming activities**

Indicators	Farmers		Students		Brgy. Officials		Drivers		Residents	
	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating	Mean	Adjectival Rating
1. Roads in our area become impassable during the rainy season.	4.36	Extremely Disruptive	3.82	Severely Disruptive	4.00	Severely Disruptive	4.38	Extremely Disruptive	3.93	Severely Disruptive
2. Flooding often damages harvested crops waiting for transport.	4.34	Extremely Disruptive	3.82	Severely Disruptive	3.88	Severely Disruptive	4.25	Extremely Disruptive	3.90	Severely Disruptive
3. Flooding lowers our willingness to plant or invest in crops.	4.36	Extremely Disruptive	3.88	Severely Disruptive	4.00	Severely Disruptive	4.31	Extremely Disruptive	3.91	Severely Disruptive
4. Flooding makes it difficult for children to go to school.	4.34	Extremely Disruptive	3.87	Severely Disruptive	3.88	Severely Disruptive	4.25	Extremely Disruptive	3.93	Severely Disruptive
5. Farm animals are affected or lost during flooding.	4.34	Extremely Disruptive	3.87	Severely Disruptive	4.00	Severely Disruptive	4.44	Extremely Disruptive	3.90	Severely Disruptive
6. Flooding damages farm tools and equipment.	4.35	Extremely Disruptive	3.87	Severely Disruptive	4.00	Severely Disruptive	4.25	Extremely Disruptive	3.91	Severely Disruptive
7. Flooded roads delay the delivery of essential goods to our barangay	4.35	Extremely Disruptive	3.88	Severely Disruptive	3.88	Severely Disruptive	4.31	Extremely Disruptive	3.90	Severely Disruptive
8. Seasonal flooding increases our financial burden.	4.36	Extremely Disruptive	3.92	Severely Disruptive	4.00	Severely Disruptive	4.25	Extremely Disruptive	3.87	Severely Disruptive
<b>Overall Mean</b>	<b>4.35</b>	<b>Extremely Disruptive</b>	<b>3.87</b>	<b>Severely Disruptive</b>	<b>3.96</b>	<b>Severely Disruptive</b>	<b>4.31</b>	<b>Extremely Disruptive</b>	<b>3.97</b>	<b>Severely Disruptive</b>

The highest results starkly illustrate the integrated nature of this climate risk. For Drivers, the loss of farm animals registered as the single most severe impact (Mean=4.44), highlighting an often-overlooked asset depletion that compounds livelihood loss. Farmers identified increased financial burden, lowered willingness to plant, and impassable roads as equally extreme disruptions (Means=4.36). This pattern provides vivid empirical validation for Lasco and Espaldon's (2020) observation of the "dual catastrophe" in Philippine contexts, where

flooding simultaneously destroys infrastructure (roads) and productive assets (crops, livestock). The demoralizing effect on farmers' willingness to invest in future planting is particularly critical, as it points to a psychological dimension of climate vulnerability that threatens agricultural continuity beyond immediate physical damage.

An in-depth analysis of these findings demonstrates how flooding acts as a powerful multiplier of the chronic challenges already documented. The data shows that flooding does not create new, isolated problems but intensifies every pre-existing vulnerability. It exacerbates transportation challenges by making roads utterly impassable (Indicator 1), cripples' economic resilience by destroying harvested crops and capital assets like tools and animals (Indicators 2, 5, 6), and deepens social exclusion by cutting off access to schools and essential goods (Indicators 4, 7). This cascade of effects confirms the IPCC's (2022) assessment of rural infrastructure's high vulnerability to climate shocks. The results move beyond generic risk models to document the lived reality where, as the literature synthesis notes, a "compound crisis" undermines both agricultural continuity and community resilience. This negates any approach that treats drainage or slope protection as secondary engineering concerns; instead, it establishes climate resilience as the non-negotiable core of any sustainable infrastructure solution for San Miguel, directly aligning with the World Bank's (2023) advocacy for climate-resilient construction techniques.

Furthermore, the stratification of impacts between livelihood groups and the recurrent nature of this disruption provides crucial insight for intervention design. The data confirms that standardized infrastructure solutions are insufficient; the extreme disruption reported by farmers and drivers demands targeted, priority investments in the specific farm-to-market corridors and drainage systems that protect agricultural assets. This empirical grounding in local experience validates the participatory planning models advocated by Müller and Schick (2024), demonstrating that only through community co-design can interventions accurately address which roads, fields, and assets are most critical to protect. Consequently, the findings compel a planning framework that moves beyond reactive repair, instead embedding seasonal climate adaptation into the core of San Miguel's development strategy to build systemic resilience.

**Lived Experience Due to Poor Road Conditions and Flooding Impact Livelihood and Access, and to Identify Community-Prioritized Infrastructure Solutions**

Qualitative data from surveys, interviews, and focus groups were analyzed using Braun and Clarke's (2006, 2022) six-phase reflexive thematic analysis framework. This approach enabled systematic identification of patterns of shared meaning across stakeholder groups: farmers, students, transport drivers, residents, and local officials—while remaining grounded in the community's lived experience. The analysis moved inductively from explicit challenges to latent interpretations of systemic and psychosocial realities.

**Table 6. Thematic Analysis of Stakeholder Lived Experience**

Category	Theme	Sub-theme
Logistical and Economic Barriers	The Embodied Cost of Inaccessibility: Physical Barriers as Economic Strain	Severe road deterioration and lack of access; High hauling costs and reduced market prices
Multidimensional Community Impact	Cascading Effects: From Constrained Mobility to Social and Economic Disenfranchisement	Livelihood instability and farming disincentive; Restricted access to essential services and social isolation
Climate Vulnerability and Resilience	The Annual Reset: Climate Shocks as a Systemic Wipe of Assets and Morale	Recurrent flooding and road damage; Loss of hope and cyclical poverty
Technical and Governance Priorities	Foundational Interventions for Stability: Engineering Meets Community-Based Stewardship	All-weather paving and slope stabilization; Community monitoring and participatory planning
Participatory and Actionable Advocacy	From Voice to Action: Community-Identified Urgency in Transparent, Resilient Planning	Site-specific prioritization; Demand for co-decision-making and accountability

## Category 1: Logistical and Economic Barriers

Physical inaccessibility functions not merely as inconvenience but as a direct economic strain, reshaping market dynamics and household financial stability.

### Theme: The Embodied Cost of Inaccessibility—Physical Barriers as Economic Strain

Poor road conditions emerged as an active agent in market failure, creating what participants described as “infrastructure-mediated economic leakage.” Farmers reported that traders exploited their immobility, offering low prices while transport costs consumed most of their earnings. A farmer explained:

*“The road to the market is rugged and muddy. We have to rent a large truck, but the fare is very expensive. That’s why the price of our product is very low—the traders take advantage of us.”* (Farmer 3)

Transport drivers echoed this, citing high maintenance costs and safety risks. A barangay official noted that logistics costs constitute the largest expense for farmers, diverting resources from family needs or farm improvements. The road functions as a de facto tax on agriculture, institutionalizing economic disadvantage through captive market dynamics. Addressing this requires not only road repair but also interventions that correct market asymmetries solidified by decades of poor access.

## Category 2: Multidimensional Community Impact

Constrained mobility extends beyond economics into social, psychological, and civic domains, creating systemic disenfranchisement.

### Theme: Cascading Effects—From Constrained Mobility to Social and Economic Disenfranchisement

Participants described how road conditions disrupt access to health care, education, and community life. A resident shared:

*“When it rains heavily, the doctor can’t come in. The children walk for several hours to school. I feel like I’m trapped here.”* (Resident 5)

Students reported frequent absences during the rainy season, while health workers noted delays in vaccination and prenatal care. The sense of isolation was expressed not only geographically but as a loss of agency and belonging. Immobility constitutes a form of eroded citizenship. Infrastructure development must be evaluated not merely by reduced travel time but by its capacity to restore a sense of possibility and civic inclusion.

## Category 3: Climate Vulnerability and Resilience

The community experiences climate shocks as cyclical disruptions that erase both material assets and the psychological will to persevere.

### Theme: The Annual Reset—Climate Shocks as a Systemic Wipe of Assets and Morale

Flooding and typhoons repeatedly damage roads and crops, forcing residents to restart from zero each year. An elderly farmer stated:

*“Every year, it floods. The road is destroyed, the crops are destroyed. It’s like the hardship just repeats. We’re losing hope.”* (Farmer 4)

Drivers lose income during the rainy season, and leaders described the compounded loss of both harvest and motivation. The phrase “reset button” captured the cyclical nature of disruption. Climate vulnerability operates cumulatively across economic, social, and psychological dimensions. Resilience-building must integrate

psychological and social infrastructure, such as support systems that address both asset protection and community morale, alongside physical repairs.

#### **Category 4: Technical and Governance Priorities**

The community articulates a clear demand for integrated solutions that combine sound engineering with local stewardship.

#### **Theme: Foundational Interventions for Stability—Engineering Meets Community-Based Stewardship**

Residents demonstrated sophisticated understanding of infrastructure needs, emphasizing cemented roads, proper drainage, and community involvement in planning. A community leader noted:

*“The road should be cemented and have proper drainage. But we must be included in planning—we know where it floods.”* (Resident 8)

Drivers and students highlighted safety risks near schools, while officials acknowledged the gap between municipal plans and local conditions, calling for community-based monitoring. An epistemological disconnect exists between formal planning systems and local knowledge. Participation must be reconceptualized as knowledge integration, through mechanisms such as community technical liaisons or participatory mapping, rather than procedural consultation.

#### **Category 5: Participatory and Actionable Advocacy**

The community demands genuine co-decision-making, moving beyond token consultation to transparent, priority-driven action.

#### **Theme: From Voice to Action—Community-Identified Urgency in Transparent, Resilient Planning**

Participants rejected consultations as mere formalities and insisted on inclusion in decision-making. A youth leader stated:

*“We shouldn’t just be consulted—we should be part of the decision. We know the solution: prioritize the road to the center first, then the one going to the mountain.”* (Youth 1)

Drivers asked to be involved in design, and students called for intergenerational inclusion in planning. Officials echoed the need for structured systems to incorporate sitio-level priorities into master plans. The demand for co-decision-making reflects a sophisticated local governance consciousness. A proposed development framework must institutionalize meaningful power-sharing mechanisms, functioning as a hybrid governance tool that integrates community-driven prioritization with technical and regulatory standards.

#### **Synthesis and Implications**

Through reflexive thematic analysis, this study moves beyond descriptive reporting to surface the complex interrelationships between road infrastructure, economic vulnerability, social exclusion, and climate resilience. The findings reveal that poor road conditions create intersecting vulnerabilities across sectors and generations, affecting not only livelihoods but also access to education, health, civic participation, and psychological well-being.

By incorporating the often-overlooked perspectives of students and transport drivers alongside farmers, residents, and officials, the analysis highlights how infrastructure inequality is experienced as systemic, cyclical, and deeply disenfranchising. These themes provide the empirical depth necessary to inform a development planning framework that is responsive not only to technical and economic needs but also to the psychosocial, educational, and governance realities of the community.

## Proposed Development Planning Framework for Road Infrastructure and Community Development Dalan sa Tinubdan: The San Miguel Participatory and Resilient Road Governance Framework

### Rationale

The *Dalan sa Tinubdan* Framework directly responds to the systemic infrastructure challenges documented in Barangay Baras. It translates the study’s key findings, economic strain on farmers, social isolation, safety concerns, and recurring climate shocks, into an actionable, community-centered roadmap. By embedding participatory governance through a multi-sectoral council and institutionalizing feedback mechanisms, the framework ensures that infrastructure planning, design, and monitoring are shaped by the lived experiences of farmers, drivers, youth, and other stakeholders. Its seven-phase structure moves beyond isolated construction to foster a sustainable ecosystem where improved mobility catalyzes socio-economic growth, reduces vulnerability, and rebuilds community morale.

### Core Components of the Framework

Component	Key Elements
<b>1. Situational Analysis and Needs Assessment</b>	Systematic diagnosis of road conditions and socio-economic impacts using participatory mapping, road audits, and sector-specific focus group discussions. Outputs include a digital road asset inventory, accessibility vulnerability maps, and a quantified data report.
<b>2. Stakeholder Engagement and Participatory Governance</b>	Institutionalization of co-governance through a multi-sectoral Local Infrastructure Development Council (SM-LIDC) and establishment of citizen feedback channels (suggestion boxes, SMS hotline, community liaison officers) supported by quarterly public accountability forums.
<b>3. Strategic Infrastructure Planning and Design</b>	Development of a participatory prioritization matrix (scoring projects by accessibility impact, economic value, equity, climate urgency, and feasibility) and adoption of climate-resilient design standards (e.g., all-weather paving, drainage for 25-year rainfall) validated through community workshops.
<b>4. Resource Mobilization and Funding</b>	Identification of multi-source funding (LGU, national agencies, climate finance, public-private partnerships) combined with transparent financial management, including participatory budgeting and public posting of procurement documents.
<b>5. Implementation and Institutional Capacity Building</b>	Clear roles via tripartite agreements, local labor requirements ( $\geq 30\%$ unskilled labor from the community), and targeted training for barangay officials, SM-LIDC members, and community “ <i>Bantay Daan</i> ” volunteers in project monitoring and basic maintenance.
<b>6. Monitoring, Evaluation, and Feedback</b>	A multi-tiered monitoring system (community volunteers, barangay committee, SM-LIDC) using a unified reporting tool, with key performance indicators tracking output (km of road), outcome (travel time reduction, school attendance), and process (consultations, feedback use).
<b>7. Sustainability and Policy Integration</b>	Enactment of a municipal ordinance mandating the participatory governance structure and planning processes, and mainstreaming of priority road networks into the Comprehensive Land Use Plan (CLUP), Local Development Investment Program (LDIP), and Local Climate Change Action Plan (LCCAP).

## Implementation Overview

The framework is designed for a 24-month horizon, beginning with situational analysis and governance setup, followed by strategic planning, resource mobilization, and phased implementation. Capacity building and continuous monitoring run alongside construction, culminating in policy integration to ensure long-term sustainability. Detailed operational procedures—including the SM-LIDC terms of reference, the complete scoring matrix, monitoring tools, and a phased Gantt chart—are provided in Appendix [X].

By systematically addressing the root causes of infrastructure inequality identified in the thematic analysis, this framework offers a replicable model for community-led, climate-resilient road development that strengthens both physical connectivity and local governance capacity.

## CONCLUSIONS AND RECOMMENDATIONS

This section presents the study's conclusions and recommendations, synthesizing empirical findings to inform evidence-based reforms that enhance the sustainable, equitable, and resilient community development within LGU San Miguel.

### Conclusions

This study establishes that inadequate road infrastructure in Barangay Baras is not a mere physical inconvenience but a fundamental systemic constraint on sustainable development. Through an explanatory sequential mixed-methods design, the findings reveal how poor road conditions perpetuate a self-reinforcing cycle of economic vulnerability, social exclusion, and climate-induced disruption. In doing so, the study makes three interconnected contributions: advancing theoretical understanding of infrastructure inequality, providing actionable policy insights, and offering a transferable governance framework for rural development.

### Theoretical Contributions

The analysis extends current scholarship by reconceptualizing road infrastructure not merely as a physical asset but as an active agent in shaping economic relations, social inclusion, and temporal development trajectories.

First, the study introduces the concept of infrastructure-mediated market failure, demonstrating that poor roads function as a *de facto* tax on agriculture by creating captive markets where traders exploit producer immobility. This finding moves beyond conventional transportation cost analyses to reveal how infrastructure conditions actively structure power asymmetries in rural economies. The “embodied cost of inaccessibility” reframes logistical bottlenecks as fundamentally economic and relational, not merely physical.

Second, the research contributes to social exclusion literature by demonstrating that immobility constitutes a form of eroded citizenship. The psychological dimension of “feeling trapped” reveals how infrastructure inequality internalizes disenfranchisement, shaping not only present capabilities but also future aspirations. This finding challenges narrow evaluations of infrastructure success based solely on travel time reduction, instead arguing for metrics that capture restored civic belonging and expanded life horizons.

Third, the study advances climate vulnerability scholarship by conceptualizing the “annual reset” as a cyclical temporality of development disruption. Flooding and typhoons systematically erase both material assets and community morale, creating a psychological landscape where long-term planning feels futile. This insight underscores the need for resilience frameworks that integrate psychological and social infrastructure alongside physical repairs.

Fourth, the research identifies an epistemological disconnect between formal planning systems and local knowledge regimes. The community's sophisticated understanding of drainage patterns and flood risks constitutes untapped expertise, challenging top-down governance models. This finding supports participatory stewardship paradigms while specifying mechanisms—such as community technical liaisons and participatory mapping—for translating lived experience into actionable engineering parameters.

## Policy Contributions

The study's empirical findings directly inform a set of actionable policy contributions, operationalized through the proposed *Dalan sa Tinubdan* Framework.

**Addressing Economic Leakage.** Quantifying the disproportionate burden of hauling costs on farm incomes, the study demonstrates that infrastructure interventions must be paired with market governance reforms. The framework's participatory prioritization matrix explicitly weights projects by economic value—prioritizing roads that connect high-producing agricultural areas to markets—while its community employment provisions ensure that economic benefits are retained locally.

**Reducing Social Exclusion.** The documented impacts on education, health access, and civic participation demand that infrastructure planning incorporate social equity criteria. The framework mandates representation from marginalized groups—including women, youth, and persons with disabilities—within the Local Infrastructure Development Council and establishes feedback mechanisms designed to capture the needs of those most vulnerable to isolation.

**Building Climate Resilience.** The recurrent pattern of climate-induced disruption requires moving beyond reactive repairs to proactive, resilient design. The framework adopts “Build Back Better” standards, mandating drainage systems sized for 25-year rainfall projections and all-weather paving for priority routes. By embedding climate resilience into design standards and linking projects to the Local Climate Change Action Plan, the framework institutionalizes adaptation as a core principle rather than an add-on.

**Institutionalizing Participatory Governance.** The community's demand for genuine co-decision-making—captured in the theme “From Voice to Action”—informs the framework's central innovation: the transformation of participation from token consultation to structured power-sharing. The proposed ordinance legally mandates the multi-sectoral council, citizen feedback channels, and quarterly public accountability forums, ensuring that participatory governance outlasts any single project cycle.

## Significance of the Study

By integrating quantitative trends with qualitative narratives, this study provides a holistic evidence base for understanding infrastructure inequality as a multidimensional phenomenon. The findings confirm that road inaccessibility functions as a systemic barrier that intertwines economic leakage, social exclusion, and climate vulnerability into a self-reinforcing cycle of poverty. Breaking this cycle requires a fundamental shift from top-down infrastructure delivery to a co-designed, community-embedded, and resilience-focused planning framework.

The *Dalan sa Tinubdan* Framework offers a replicable model for rural development that aligns with scholarly advocacy for participatory, integrated approaches. Its seven-phase structure—spanning situational analysis, participatory governance, resilient design, resource mobilization, capacity building, monitoring, and policy integration—provides a roadmap that other geographically isolated, agriculturally dependent communities can adapt to their local contexts. In doing so, the study contributes not only to the academic literature on infrastructure and development but also to the practical pursuit of sustainable, equitable, and inclusive growth in underserved rural communities.

## Recommendations

To translate these conclusions into transformative action, it is imperative that the Municipal Government of San Miguel and the Barangay Council of Baras formally adopt and operationalize the Proposed Development Planning Framework for Road Infrastructure and Community Development. This framework provides the essential roadmap to transition from diagnosis to sustainable implementation. Its immediate utilization should focus on the participatory prioritization and upgrading of the most critical road segments, with engineering practice delivering climate-resilient designs for all-weather passability, robust drainage, and slope stabilization to directly break the cycle of flood-induced crises.

Specifically, the framework may be deployed to catalyze economic transformation. Local Government Units (LGUs) can utilize its structured planning matrix to prioritize interventions that generate the highest return on investment by plugging the identified economic leaks. This requires conducting transparent cost-benefit analyses that quantify the projected reduction in hauling costs and post-harvest losses, thereby securing funding and guiding engineering practice towards high-impact projects. Concurrently, the development sector can leverage this analysis to design and fund complementary livelihood programs, such as shared cold storage or cooperative transport services, providing immediate economic relief to residents of Barangay Baras while infrastructure is being built.

The framework may also be explicitly applied to dismantle barriers to social equity. LGUs, in partnership with civil society and sectoral agencies, can use its stakeholder engagement mechanisms to ensure road planning actively re-integrates the community. Infrastructure must be designed not solely for freight, but as multi-service corridors guaranteeing reliable access for school transport and emergency health vehicles. By applying the framework's social connectivity metrics, planners can ensure that the restored road network actively rebuilds the social fabric and human capital of Barangay Baras.

Furthermore, the entire planning and execution process can be an exercise in applied climate adaptation. Engineering practice is tasked with employing the framework's resilience standards to design roads that withstand seasonal shocks, using historical flood data provided by residents. Simultaneously, LGUs may implement the framework's protocols for integrating early warning systems and community-based disaster risk management, ensuring the infrastructure serves as a backbone for year-round resilience, safeguarding both assets and community morale.

Finally, to ensure legacy and continuous improvement, the adoption of this participatory framework can be institutionalized. Future researchers are recommended to utilize the framework as a baseline for longitudinal studies on its impact on poverty reduction, social inclusion, and climate resilience. The development sector is urged to support the capacity-building components of the framework, empowering local stakeholders in monitoring and maintenance. This collective, sustained commitment can transform community voice into effective governance, ensuring the road to development in Barangay Baras is paved with sustainability, equity, and resilience for generations to come, as detailed in the accompanying Gantt chart for implementation.

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