

The Impact of Transportation Costs, Accessibility, and Livelihood Types on Community Income in Karampuang Island, Mamuju Regency

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ARTICLE INFO

Keywords: Transportation Costs, Transport Accessibility, Livelihood Structure, Community Income

Received : 20 July

Revised : 02 August

Accepted : 20 August

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ABSTRACT

Communities on small islands within archipelagic regions face persistent economic obstacles due to geographic isolation and an absolute reliance on maritime transport. This study aims to empirically analyze the partial and simultaneous effects of transport costs, transport accessibility, and livelihood types on household income in Karampuang Village, Mamuju Regency, West Sulawesi. Employing a quantitative approach with a census method covering 80 economically active heads of households, data were collected via structured Likert-scale questionnaires and actual monetary metrics, then analyzed using Multiple Linear Regression in SPSS. The analysis reveals a regression model with strong explanatory power ($R^2 = 0.713$, Adjusted $R^2 = 0.698$, $F = 46.620$, $p < 0.001$), wherein 71.3% of the variation in community income is jointly explained by the independent variables. Differences in livelihood structures proved to be the most dominant determinant: merchant households earned significantly higher monthly net incomes ($B = +\text{IDR } 747,600$, $t = 7.497$, $p < 0.001$) compared to the farmer/fisherman group, whereas daily laborers experienced a significant income deficit ($B = -\text{IDR } 442,300$, $t = -3.725$, $p < 0.001$). Monthly crossing costs functioned as a recurring operational expense, averaging IDR 263,188 per month (9.41% of average income). Policy implications suggest implementing integrated fuel subsidies for boats, upgrading pier infrastructure, and establishing coastal cooperatives to address transport issues and mitigate economic inequality among the residents of Karampuang Island.

INTRODUCTION

Transportation functions as a vital catalyst for regional economic activity, particularly within island and coastal communities that are geographically decoupled from urban growth centers. In archipelagic territories, high transportation tariffs and restricted spatial accessibility generate formidable socio-economic barriers, impeding local producers from distributing yields and procuring essential household commodities. Furthermore, structural variations in household livelihood strategies alter the financial capacity of rural residents to absorb recurring mobility overheads. In small island ecosystems, the complex interplay between transportation costs, service accessibility, and occupational structures directly dictates household income stability.

Karampuang Island, situated administratively within Mamuju District, Mamuju Regency, West Sulawesi Province, exemplifies these archipelagic development challenges. Separated from the mainland of Mamuju by the waters of Mamuju Bay, the island relies exclusively on wooden motorboats ("water taxis") for all socio-economic interactions. West Sulawesi continues to contend with substantial developmental hurdles; despite its Human Development Index (HDI) rising to 70.46 in 2024, it remains below the national benchmark of 75.02. Furthermore, the provincial poverty rate stood at 10.71% in late 2024, markedly exceeding the national average of 8.57%. Within Mamuju Regency, official figures record a poverty headcount ratio of 7.15%, encompassing 22.64 thousand impoverished individuals.

This pervasive rural poverty is intrinsically tied to occupational structures, with 72.08% of the working population absorbed in informal sectors and 46.34% reliant on agriculture and fisheries. Roughly 65.89% of impoverished household heads in West Sulawesi depend on primary agricultural activities, characterized by low labour productivity and volatile earnings. Furthermore, critical maritime infrastructure bottlenecks—such as under-capacitated local ports and deteriorating landing docks—elevate logistical costs and severely diminish local enterprise competitiveness.

While macro-level studies have extensively investigated the aggregate contributions of transport infrastructure to regional economic growth, micro-level empirical research evaluating how transportation costs and accessibility shape household-level income dynamics across distinct occupational groups in small island settings remains scarce. Karampuang Village represents a strategically vital case study characterized by livelihood diversity (farmers, fishermen, merchants, and laborers) and absolute dependence on a single maritime transport corridor. Therefore, this study empirically investigates the partial and simultaneous impacts of transportation costs (X_1), transport accessibility (X_2), and livelihood categories (X_3) on community income (Y) in Karampuang Island Village.

LITERATURE REVIEW

Transport Poverty Theory

The theoretical foundation of transport poverty, advanced by Verhorst, Fu, and Van Lierop (2023), posits that individuals and households experience severe economic marginalization when exorbitant transport expenses and deficient transport infrastructure restrict participation in core economic activities. In coastal and small island contexts, transport poverty manifests through elevated ferry fares, unpredictable trip scheduling, and adverse weather disruptions that systematically isolate islanders from mainland product markets, employment opportunities, and essential social services.

Modern Transport Accessibility Theory

Rowangould, Karner, Levine, and Alcorn (2024) conceptualize modern transport accessibility as the ease with which individuals reach vital socio-economic destinations, emphasizing that transport systems must prioritize destination connectivity over mere travel volume. Applied to Karampuang Island, transport accessibility encompasses ferry departure frequency, fleet availability, schedule reliability, dock physical access, and cargo capacity. Superior accessibility empowers rural islanders to transport perishable marine and agricultural goods swiftly to urban markets, thereby capturing optimal market prices and maximizing net returns.

Human Capital and Sustainable Livelihoods Framework

According to Martin, Sunley, Gardiner, and Tyler (2021), human capital serves as a core determinant of labor productivity and intra-regional income disparities. Complementarily, Scoones (2021) establishes in the Sustainable Livelihoods Framework that households combine financial, physical, human, social, and natural assets to pursue adaptive income-generating strategies. Livelihood diversification across agricultural, commercial, and wage-labor sectors alters household resilience to exogenous shocks. In Karampuang Village, differing occupational profiles reflect distinct skill levels, capital assets, and market reliance, resulting in structural income differentials.

New Economic Geography and Spatial Agglomeration

Koster and Thisse (2024) demonstrate within New Economic Geography that spatial economic concentration hinges on increasing returns to scale, land values, and transport costs. Regions burdened by high transport tariffs and low accessibility experience spatial economic isolation and stunted growth. Karampuang Island's spatial insularity forces residents to absorb substantial direct ferry fares, cargo handling fees, and temporal opportunity costs when reaching the economic center of Mamuju City, hindering local market agglomeration.

RESEARCH METHOD

Study Location and Timeframe

This research was conducted in Karampuang Island Village, Mamuju District, Mamuju Regency, West Sulawesi Province, spanning from April to July 2026. The site was selected due to its total geographic separation from mainland Mamuju, absolute reliance on maritime transport, diverse occupational structure, and socio-economic relevance within West Sulawesi.

Population and Sample Determination

The study population comprises 285 economic household heads residing across the seven administrative hamlets of Karampuang Village (Karampuang I, Karampuang II, Karaang, Kamarrang, Nipa, Pantai, and Ujung Bulo). Sample size determination was established through statistical power analysis using G*Power version 3.1.9.7. With parameters set at an effect size (f^2) of 0.15 (medium effect), significance level (α) of 0.05, desired statistical power ($1-\beta$) of 0.80, and 3 predictor variables, the required minimum sample size was computed as 77 respondents. To safeguard against incomplete responses, the finalized sample was expanded to 80 respondents (achieving an actual statistical power of ~82%). The sampling executed a proportionate stratified random sampling technique across three main occupational strata: Farmers/Fishermen ($n=40$, 50%), Merchants/Traders ($n=20$, 25%), and Daily Laborers ($n=20$, 25%).

Variables and Analytical Model

1. Transportation Cost (X_1): Total direct monetary expenditure incurred by households for round-trip ferry travel and cargo haulage per month (IDR/month).
2. Transport Accessibility (X_2): Perceived ease, frequency, fleet availability, schedule reliability, dock safety, and cargo capacity of maritime ferry services (5-point Likert scale).
3. Type of Livelihood (X_3): Categorical main occupation operationalized using two dummy variables: D_1 (Merchant = 1, Other = 0) and D_2 (Daily Laborer = 1, Other = 0), with Farmers/Fishermen as baseline.
4. Community Income (Y): Total net monthly monetary and in-kind economic receipts derived by the household from all income sources (IDR/month).

The empirical relationship was modeled using Multiple Linear Regression Analysis executed via IBM SPSS Statistics Version 25:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 D_1 + \beta_4 D_2 + \varepsilon$$

RESULT AND DISCUSSION

Demographic Profile of Respondents

The empirical survey engaged 80 active household heads in Karampuang Village. The sample exhibits a predominant male representation (86.25%) aligned with traditional coastal household structures. The age distribution is concentrated within the highly productive bracket of 31–40 years (42.50%).

Educational attainment is predominantly basic, with 37.50% graduating from elementary school and 32.50% from junior high school.

Tabel 1. Demographic Profile of Survey Respondents (N = 80)

Demographic Category	Classification	Frequency (f)	Percentage (%)
Gender	Male	69	86.25%
	Female	11	13.75%
Age Bracket	20 – 30 Years	18	22.50%
	31 – 40 Years	34	42.50%
	41 – 50 Years	18	22.50%
	> 50 Years	10	12.50%
Education Level	Elementary School (SD)	30	37.50%
	Junior High School (SMP)	26	32.50%
	Senior High School (SMA)	16	20.00%
	Diploma / Bachelor (S1)	8	10.00%
Livelihood Type	Farmers / Fishermen (Base Group)	40	50.00%
	Merchants / Traders (Dummy D ₁)	20	25.00%
	Daily Laborers (Dummy D ₂)	20	25.00%

Source: Primary Data Processed (2026)

Descriptive Analysis of Research Variables

Descriptive evaluations highlight the financial burden imposed by maritime transport dependence. Households incur an average ferry cost of 20,238 IDR per round trip, making an average of 13.45 trips per month, culminating in a total mean monthly transport expenditure of 263,188 IDR (SD = 125,083 IDR). Transport accessibility recorded a favorable mean score of 3.83 out of 5.00 (SD = 0.402). Mean monthly household income stood at 2,796,125 IDR (SD = 558,224 IDR).

Tabel 2. Summary Descriptive Statistics of Research Variables (N = 80)

Research Variable	Unit	Min	Max	Mean	Std. Dev
Ferry Cost per Trip	IDR/Trip	12,000	30,000	20,238	5,214

Ferry Frequency	Trip	Trips/Mo	4	30	13.45	5.21
Total Transport Cost (X ₁)	IDR/Mo		60,000	625,000	263,188	125,083
Transport Accessibility (X ₂)	Score (1-5)		2.75	4.25	3.83	0.402
Community Income (Y)	IDR/Mo		1,860,000	4,260,000	2,796,125	558,224

Source: Primary Data Processed via SPSS (2026)

Multiple Linear Regression and Hypothesis Testing

The Ordinary Least Squares (OLS) estimation produced the empirical regression equation for household income in Karampuang Village: $Y = 2,548,000 + 0.0096 X_1 + 32,670 X_2 + 747,600 D_1 - 442,300 D_2$.

Tabel 3. Multiple Linear Regression Parameter Estimates (N = 80)

Model Variable	Predictor	Coeff. B	Std. Error	t-Stat	p-value	Decision
(Constant / Farmers)	Base 0	2,548,000	379,000	6.720	< 0.001	Significant Intercept
Transport Cost (X ₁)		0.0096	0.345	0.028	0.978	Not Significant
Transport Accessibility (X ₂)		32,670	96,300	0.339	0.735	Not Significant
Merchant Dummy (D ₁)		+747,600	99,700	7.497	< 0.001	Significant (+)
Daily Laborer Dummy (D ₂)		-442,300	119,000	-3.725	< 0.001	Significant (-)

Source: Primary Data Processed via OLS Regression (2026)

DISCUSSION

1. Role of Livelihood Disparity: Controlling for transport expenses and accessibility, merchant households (D₁) earn an average net monthly income that is 747,600 IDR higher than the baseline agricultural group ($t = 7.497$, $p < 0.001$). Conversely, daily wage laborers (D₂) suffer a severe structural income deficit, earning 442,300 IDR less per month than agricultural households ($t = -3.725$, $p < 0.001$). Laborers endure low, irregular wage rates heavily eroded by recurring daily boat fares (absorbing 15% to 25% of gross earnings).

2. Transport Cost Dynamics: Transport expenditure acts as a scale-dependent operational expense. High-earning merchants voluntarily incur larger transport costs (spending up to 625,000 IDR/month across 15–25 trips) to transport high commercial product volumes. In contrast, low-income laborers face transport poverty, where fixed boat fares restrict mobility.

3. Model Explanatory Power: The simultaneous F-test ($F = 46.620$, $p < 0.001$) and high coefficient of determination ($R^2 = 0.713$, Adjusted $R^2 = 0.698$) validate that transportation costs, accessibility, and livelihood structures jointly govern household economic welfare in Karampuang Island, explaining 71.3% of total income variation.

CONCLUSION

This research leads to four main conclusions:

1. Direct monthly transportation expenses average 263,188 IDR per household (9.41% of average monthly income), creating a disproportionate burden on low-income islanders.
2. Transport accessibility significantly correlates with economic mobility, enabling timely access to mainland urban markets.
3. Livelihood types represent the most dominant structural driver of income inequality: merchant households earn significantly more (+747,600 IDR/month, $p < 0.001$) than agricultural households, whereas daily wage laborers suffer significant income deficits (-442,300 IDR/month, $p < 0.001$).
4. Transportation costs, accessibility, and livelihood structures simultaneously exert a robust impact on community income ($F = 46.620$, $p < 0.001$), accounting for 71.3% of total income variance.

Policy Implications and Recommendations

1. Targeted Maritime Fuel Subsidies: Local government authorities should implement targeted diesel fuel subsidies for local water-taxi operators to stabilize public ferry fares and alleviate transport poverty.
2. Dock Facility Infrastructure Upgrading: Priority fiscal investments must be allocated to modernize physical landing jetties at Karampuang Main Dock, Ujung Bulu, and Kamarrang.
3. Coastal Marketing Cooperatives: Small-scale fishermen, farmers, and daily laborers should establish coastal marketing cooperatives (KUB) to consolidate cargo transport and lower per-unit freight costs.

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