
| RESEARCH ARTICLE**Effect of Rural Road Infrastructure on Livelihood Outcomes of Small-Scale Farmers: The Contribution of Non-Farm Enterprises****Stellah Riunguh¹ ✉ Maurice Sakwa² and Assumpta Kagiri³**¹²³*Jomo Kenyatta University of Agriculture and Technology, Kenya***Corresponding Author:** Stellah Riunguh, **E-mail:** striunguh@gmail.com

| ABSTRACT

This study looked at how Kenyan small-scale farmers' livelihood outcomes were affected by non-farm enterprises that resulted from the construction of rural road infrastructure. The study used a descriptive survey design to determine the association between rural road infrastructure and livelihood outcomes of small-scale farmers. It was based on the Sustainable Livelihood Framework and driven by a pragmatic research ethic. Further, the study employed cluster sampling to select households residing within a kilometer of the road corridor under study; thus, a sample of 395 houses was selected to provide data for the study. The two measures of the study's operationalization of non-farm enterprises were access to non-farm credit and income diversification. The majority of respondents reported greater engagement in non-farm economic activities after the rural road was constructed, indicating that the expansion of rural road infrastructure improved prospects for livelihood diversification. Farmers reported being involved in value-adding projects, small-scale trading, and dairy-related businesses. Through expanded outreach by lending organizations and financial institutions, improved road accessibility also made non-farm financing more accessible. The results also showed that access to economic opportunities, dietary diversity, and household income stability were all positively impacted by rural road infrastructure. However, because many households reported inadequate savings capacity and concerns about future livelihood security, the study also found that improvements in current economic conditions were not always accompanied by improved long-term financial resilience. According to regression analysis, small-scale farmers' livelihood outcomes were statistically significantly impacted by non-farm enterprises due to rural road infrastructure. However, the results also showed a negative relationship between household food security, non-farm credit availability, and income diversification, indicating a possible trade-off between non-farm activities and agricultural output. The study concluded that by encouraging non-farm enterprises, increasing market accessibility, and boosting small-scale farmers' financial inclusion, rural road infrastructure plays a crucial role in facilitating rural economic development. In order to support sustainable rural livelihoods, the study recommends making consistent investments in all-weather rural road infrastructure, growing rural non-farm enterprise support mechanisms, bolstering rural financial services, and developing policies that strike a balance between agricultural productivity and livelihood diversification.

| KEYWORDS

Non-farm enterprises, Livelihood Outcomes, Small-Scale Farmers, Rural-Road Infrastructure, Income Diversity, Non-Farm Credit

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1. Introduction

Rural livelihoods consist of different tasks, such as herding, gathering, agricultural production, hunting for food, labor for wages, and trading, among other things. In order to meet human needs and enhance living conditions, these activities provide money, food, and other things. In order to evaluate the characteristics of sustainable living in rural settings, particularly with regard to resilience, asset development, and environmental management, an analysis of these livelihood activities is crucial. Sustainable living, according to Natarajan, Newsham, Rigg, and Suhardiman (2022), is the capacity of people to manage and recover from shocks and stressors while concurrently

improving their assets and capacities in the present and future without depleting natural resources. The pursuit of varied livelihood strategies is made possible by the combination of different livelihood resources. As a result, this helps achieve goals like improved livelihoods. This study looked at how livelihood resources and methods affected livelihood outcomes, according to the sustainable livelihood approach.

According to Tambe (2022), people's ability to pursue a variety of livelihood strategies depends on their fundamental social, material, tangible, and intangible assets. This is referred to as the "capital" base, which provides the basis for livelihoods and the source of productive streams. This study looked at the economic assets that DFID identified in 2002. These assets include fundamental infrastructure, production equipment, and technology that are necessary for putting various livelihood strategies into practice (Fayad, Nguyen, & Nguyen, 2023).

In order to reduce poverty and boost economic growth, physical infrastructure development is crucial (Govinda, 2020). As a result, the quality of infrastructure, including transportation, affects employment creation, production costs, investment prospects, and market accessibility. Reducing poverty through infrastructure development is a top priority for many developing countries. According to the World Bank (2023), improving infrastructure, especially roads can help reduce poverty in emerging nations.

Notably, infrastructure development projects accounted for 15% of World Bank spending between 1995 and 2010, with at least 58% of that amount going to Africa (World Bank, 2023). Therefore, better infrastructure reduces poverty and promotes economic growth through a number of processes, such as lower transit costs, lower consumption expenses, and lower production costs for goods and services. This study evaluated how small-scale farmers' livelihood outcomes were affected by non-farm enterprises related to rural road development.

1.1 Problem Statement

According to a study by the Kenya Institute of Public Policy Analysis (KIPPRA, 2021), the welfare, productivity, and safety of both urban and rural populations are greatly impacted by the development of infrastructure in their respective regions as well as the connections of infrastructure to markets and local, national, and provincial centres of administration. In order to increase the productive capacities of both agricultural and non-agricultural households and industries, infrastructure activities usually include capital facilities, social overheads, and measures that distribute techno-economic characteristics, such as spillovers from users to non-users and economies of scale. The cost-effectiveness and quality of infrastructure services contribute to increased pricing competitiveness since infrastructure acts as an intermediary input. More so, infrastructure development can promote non-price competitiveness by facilitating safe and timely delivery of commodities and improving communication between buyers and producers, as well as between sellers and purchasers. Notably, productivity is impacted by the cost of transporting goods from production locations to markets, especially when prices are fixed. Since transportation costs reduce producers' ability to compete on price, the costs are passed on to consumers.

According to the World Bank (2023), road infrastructure helps local farmers by extending the distance to breakeven points by lowering the expenses of delivering agricultural products to markets. As a result, both the amount of area under cultivation and the yield of cash crops rise. According to Calvo (2020), improving road infrastructure can reduce production costs by lowering the cost of inputs like equipment and information through better agricultural extension services. In the end, this increases farm income and gate pricing. The relationship between infrastructure and economic growth, as well as the direct involvement of infrastructure in the pro-poor growth process, are two ways that KIPPRA (2021) highlighted for improving infrastructure to enhance living outcomes in Kenya. In order to investigate the two extremes and outline the situation in rural Kenya, this study evaluated the effect of non-farm enterprises due to rural road infrastructure on the livelihood outcomes of small-scale farmers.

2. Literature Review

Achieving a secure household income is necessary in stepping out of poverty and achieving food insecurity. Nonetheless, the rural non-farm sector must expand due to growing population pressure, slow agricultural technical advancement, and land degradation (Barbier & Di Falco, 2021). Therefore, the non-farm sector must be enlarged to

accommodate the growing population in order to reduce poverty, promote food security, address land scarcity, and increase the division of already small farms. Furthermore, FAO (2019) noted that off-farm income helps meet subsistence demands while yet allowing for disruptions to agricultural revenue.

Crop, livestock, off-farm, and non-farm activities are examples of household-level revenue-generating activities that can be introduced as part of farm-level income diversification. Income portfolios with varying degrees of risk, liquidity, expected returns, and seasonality are created by these activities. The practice entails allocating the home's productive assets among the different revenue-generating endeavors. The non-farm diversification aspect of farm level diversification was the main emphasis of this study. Income can be increased by non-farm sources, such as seasonal labor, whose demands vary depending on the activity (Nguyen, 2021). More so, access to non-farm income can ease credit restrictions, facilitate smoother consumption, improve food security, and help households better withstand ex-post shocks. Additionally, better yields and more productive labor may result from non-farm labor in addition to the purchase of agricultural supplies for use on farms (Gershon, 2020).

Lewis's (1954) and Ranis and Fei's (1961) classical development economic models assumed that agricultural labor, or "surplus labor economies," could be transferred to the industrial sector without having an impact on agricultural productivity. This suggested that the shadow pay in agriculture is "nil" and that labor is immobile (Subramaniam & Panth, 2021). This study evaluated the applicability of the classical model in relation to the impact on the livelihoods of small-scale farmers due to the introduction of non-agricultural employment prospects. Furthermore, this study concentrated on rural road infrastructure as a tool to shift labor to non-agricultural income because the two authors did not provide specific labor shift strategies.

A study conducted in Ethiopia by Neglo, Gebrekidan, and Lyu (2021), found out that increasing the availability of non-farm activities and the wage rate paid to farm households could boost the economic activity of small-scale farmers. Therefore, in order to encourage income diversification, the government must provide better road infrastructure and make it accessible to low-income people. Thus, this study determined the effect of rural road infrastructure-based income diversification on the livelihood of small-scale farmers.

According to Giller, Delaune, Silva, and Hammod's (2021) study on household income in sub-Saharan Africa, between thirty and fifty percent of household income in rural Sub-Saharan Africa comes from remittances, off-farm wage jobs, and rural non-farm employment. According to Neglo, Gebrekidan, and Lyu (2021), these non-farm investments benefit from the interactions of different assets, such as telecommunications, energy, and roads, which lower transaction costs. However, the World Bank (2020) contended that the rural non-farm economy is likely to suffer as a result of these similar investments. Hernandez, Law, and Auyero (2022) discovered that Chilean rural households with the worst dirt roads typically earn more money from self-employment on the farm than households with better paved roads. Because of the bad roads, this can be explained as a defense against metropolitan competitors. Regarding the impact of rural roads on non-farm employment, these academics disagree. Thus, this study determined whether rural roads have a positive impact on non-farm economic activity, as suggested by the World Bank (2020) and Hernandez, Law, & Auyero (2022), or if they have a negative impact, as suggested by Neglo, Gebrekidan, & Lyu (2021).

According to World Bank empirical data from 2020, non-farm resources provide between 40% and 50% of rural households' incomes in developing nations. According to a research by Giller, Delaune, Silva, and Hammod (2021), 20% of rural Africans' income came from sources other than farming. Additionally, Neglo, Gebrekidan, and Lyu (2021) discovered that in certain Ethiopian regions, non-farm labor earnings account for 35% of the farm household's overall income. In order to determine whether the results can be repeated in other African nations, the present study carried out a similar investigation in Kenya.

Whether small-scale farmers engage in non-farm income diversification is likely to depend on a number of factors. The household head's educational attainment, the area's remoteness, and the gender of the small-scale farmer are a few of these. For example, a study done in Mali by Musumba, Palm, Komarek, and Mutuo (2022) shows that

households closer to local markets are more likely to participate in the non-farm economic activity sector. Additionally, he emphasized that educated household heads are more likely than illiterate heads to engage in the non-farm sector. In a study conducted in Ghana, Anang & Apedo (2023) revealed that households with higher levels of education allocated more labor to work off the farm than those with lower levels.

Scholars have discovered that income diversification has not been generally implemented among African small-scale farmers, despite the advantages mentioned above. Neglo, Gebrekidan, and Lyu (2021), for example, found that small-scale farmers in rural Ethiopia do not generate income diversification. They discovered that off-farm activities are secondary to the farming element because they complement farm household income. They reached this result because the investigation found that just 11% of total income came from sources other than farming, such as work, commerce, and the selling of homemade farm equipment. In contrast, research by the World Bank (2020) revealed that non-farm sources contribute between 40% and 45% of the typical household income and are still becoming more important. They noted that engaging in non-farm activities can help people escape poverty and is positively correlated with wealth and income. Therefore, this study determined whether non-farm income diversification has been used in Kenya and further demonstrated its connection to small-scale farmers' means of subsistence. They noted that engaging in non-farm activities can help people escape poverty and is positively correlated with wealth and income. Therefore, this study determined whether non-farm income diversification through non-farm enterprises has been used in Kenya and further demonstrated its connection to small-scale farmers' means of subsistence.

Since non-farm self-employment and remittances accounted for 30% to 50% of rural households' income in Sub-Saharan Africa, Barbier & Di Falco (2021) highlighted the necessity of road infrastructure to make it accessible for impoverished households to promote non-farm income. Neglo, Gebrekidan, and Lyu (2021) found that in Ethiopia, non-farm sources made up 35% of household income, but in rural Africa, non-farm suppliers accounted for 20% of earnings. Although Neglo, Gebrekidan, and Lyu's (2021) statistic fell within the range determined by the World Bank and Giller, Delaune, Silva, and Hammod, Nguyen's statistic was much below the estimate, necessitating the additional research that this study carried out. Numerous elements were identified as contributing to small-scale farmers' non-farm economic activity. These include roads, telephones, and energy, all of which lower transaction costs. However, Hernandez, Law, and Auyero (2022) disagreed, arguing that rather than promoting non-farm rural employment, these investments are likely to hurt it. For example, they discovered that households with the worst dirt road conditions in Chile made more money from non-farm economic activities than households with paved roads. This led to a paradox that was objectively examined in this study.

3. Methodology

A pragmatic philosophy that combines elements of positivism and interpretivism was used in this study. As a philosophical viewpoint, pragmatism is predicated more on actions, concrete situations, and their results than on theoretical or antecedent elements. It emphasizes practical application, focusing on practical fixes for real-world problems. Rather than following a single methodological perspective, the pragmatic approach focuses on the research topic and employs multiple methodologies as necessary to obtain a comprehensive understanding of the subject (Fischhoff & Broomell, 2020).

The research used a descriptive survey design, which entails gathering information to answer questions about the topic of study in its current state (Bordens and Abbott, 2021). Due to the lack of a control region, the study used reflexive comparison to examine the treated area before and after the road project's intervention (Ide & Beddoe, 2024); Irandu (2022) used this technique in their effect analysis of the Ndomba-Makete road in Tanzania. This study used cluster sampling, concentrating on houses along the rural road of interest, using a correlational methodology to evaluate the association between rural road infrastructure and agricultural practices. These houses were identified using the fixed corridor approach developed by Zhang and Park (2021), which identified the road as the core axis of effect and included households within a one-kilometer radius to the east and west of the road. For this study, a total of 395 households were selected from a population of 38,890 households.

4. Results

The objective of this study was to assess the effect of non-farm enterprises due to rural road infrastructure on the livelihood outcomes of small-scale farmers.

4.1 Livelihood Outcomes of Small-Scale Farmers

The livelihood of small-scale farmers served as the study's dependent variable. Table 1 summarizes the study's findings, which aimed to determine the banana producers' livelihood outcomes.

Table 1. Livelihood Outcomes of Farmers

1- Strongly Disagree, 2- Disagree, 3-Undecided, 4- Agree, 5-Strongly Agree

Statement	Mean	Median	S.D
My household has had enough food for daily consumption	3.5	4.0	1.02
My household has had enough food for future usage	2.3	2.0	0.97
My household is taking a more balanced diet since the road was commissioned	3.6	4.0	0.5
Visits to the hospitals when unwell, in my household, have increased since the road was commissioned.	3.1	4.0	0.97
My household members have portrayed an improvement in general health since the roads were commissioned	2.4	2.0	0.92
My household expenditure on health-related issues has reduced since the road was commissioned.	2.4	2.0	0.99
The road has brought more income in my household	3.7	4.0	0.87
My income is sufficient for my family's current needs	3.6	4.0	0.93
My income is sufficient for my family's future needs	2.4	2.0	0.99
I am able to save money from my income for my family's rainy days	2.4	2.0	0.99

Mean: Strongly Disagree (1.00-1.49); Disagree= (1.50-2.49); Undecided = (2.50-3.49); Agreed = (3.50-4.49); Strongly Agreed (4.50-5.00)

The findings showed that while the rural road has improved the farmers' present means of subsistence, it has not met their future demands. According to Li, Xu, and Hu (2020), this conclusion thus calls for an investigation of the stability of farmers' livelihood outcomes in the face of internal and external obstacles, a critical component of sustainable livelihoods. According to FAO's (2021) explanation of the Sustainable Livelihood Framework, households need to have enough savings to be resilient in difficult situations. Households are vulnerable and may not be able to achieve desired lifestyle outcomes if they are unable to hold onto assets for future usage. However, Amboko and Mburu (2023) point out that people can hardly save anything for the future due to the rising cost of living in Kenya.

4.2 Factor Analysis

A factor analysis on non-farm enterprises Likert scale was conducted. Two components accounting for 71.75 percent variance in the non-farm enterprises were extracted. This implies that other factors beyond this study explain the remaining 28. 25 percent variance. Thus, the summary statistics on the extracted components are as shown in Table 2 below.

Table 2: Descriptive Statistics on non-farm enterprises

Component	Mean	Std. Deviation	Cronbach Alpha
Income diversity	3.59	0.57	0.86
Access to non-farm related credit	3.45	0.84	0.92

Mean: Strongly Disagree (1.00-1.49); Disagree= (1.50-2.49); Undecided = (2.50-3.49); Agreed = (3.50-4.49); Strongly Agreed (4.50-5.00)

These figures show that small-scale farmers in the upper Eastern region agreed with the claim that the development of rural road infrastructure benefits non-farm businesses. The mean answers for the two extracted components; income diversity and access to non-farm related credit show this. This indicates that rural road infrastructure development is seen by small-scale farmers as a major factor in the expansion of non-farm businesses. According to Dorosh, Wang, You, and Schmidt (2022), better road connectivity lowers operating costs and increases market reach, which promotes the growth of rural enterprises.

4.3 Diversified Sources of Income

The study established if the farmers sources of income has increased since the construction of the road. The findings are shown in table 3

Table 3 Increased sources of income

	Frequency	Percentage
Yes	272	74%
No	95	26%
Total	367	100%

According to the table, 74% of farmers reported having more sources of income after the road was constructed. An additional investigation revealed that the majority of them claimed to have opened enterprises other than farming, although some claimed to have raised cows and sold milk. Delgado (2019) claims that one of the results of rural development in Africa was the adoption of alternate sources of income by farmers. He clarified that farmers take this action to reduce the danger of being associated with a single commodity.

The study then measured the statements regarding diversified sources of income and the findings are summarized in table 4.

Table 4. Diversified Income Sources

1- Strongly Disagree, 2- Disagree, 3-Undecided, 4- Agree, 5-Strongly Agree

Statement	Mean	Median	S.D
I am able to make more income from a variety of avenues, since the road was constructed.	3.80	4.00	0.53
In my home, there is more money coming from other ventures other than the farm since the road was constructed	3.72	4.00	0.58
I have been able to make money from off-products of bananas that were considered waste before the road was constructed	3.60	4.00	0.7

Mean: Strongly Disagree (1.00-1.49); Disagree= (1.50-2.49); Undecided = (2.50-3.49); Agreed = (3.50-4.49); Strongly Agreed (4.50-5.00)

The findings demonstrated that the majority of respondents agreed with the statements that since the road was built, the farmer has been able to earn more money from a variety of sources. Additionally, since the road was built, there has been more money coming into their homes from ventures other than the farm, and that they have been able to make money from banana off-products that were previously thought of as waste. According to Bagamba (2021), increased road access is linked to revenue diversification because farmers are receptive to financial incentives. He contends that, despite the fact that it eventually promotes sustained rural development, this is not always a desirable thing because it is linked to low agricultural output.

4.4 Access to Non-Farm Related Credit

The study sought to find whether the farmers had managed to access non-farm credit since the road was constructed. The findings are shown in table 5

Table 5 Access to non-farm Credit

	Frequency	Percentage
Yes	272	74%
No	95	26%
Total	367	100%

From the findings, 74% of farmers were able to obtain non-farm related credit after the road was constructed. A follow-up investigation revealed that the farmers said credit officers came to their homes to offer credit after the road was constructed. Others claimed that credit officers visit them to offer them credit during their monthly meetings, *chamas*. This is consistent with Haile's (2023) discovery that farmers had better access to loans when they had strong access roads. Table 6 summarises the results of the study's additional testing of statements pertaining to access non-farm credit.

Table 6 Access to non-farm credit

1- Strongly Disagree, 2- Disagree, 3-Undecided, 4- Agree, 5-Strongly Agree

Statement	Mean	Median	S.D
I have managed to get non-agriculture related credit since the road was constructed	3.3	4.0	0.9
Since the was constructed financiers have accepted to give me non-agriculture related credit	3.4	4.0	0.8
I have got credit to run my general trading enterprise, which I could not get before the road was constructed	3.5	4.0	0.7

Mean: Strongly Disagree (1.00-1.49); Disagree= (1.50-2.49); Undecided = (2.50-3.49); Agreed = (3.50-4.49); Strongly Agreed (4.50-5.00)

The average response indicated that the farmers had received financing to operate general trading businesses, something they had not been able to obtain prior to the construction of the road. Haile (2023), in his study pointed out that lending facilities typically focus on locations with higher road access, corroborating the finding that road accessibility improved the likelihood of farmers engaging in the credit market.

However, many farmers were unsure about the claims that since the road's construction, they had been able to obtain non-agricultural loans and that lenders had agreed to grant them such credit. According to Binswanger & Savastano (2020), rural infrastructure increases financial inclusion, but lenders are reluctant to offer non-agricultural financing because of worries about repayment capacity. Dercon, Gilligan, Hoddinott, & Woldehanna (2019) have noted that whereas rural roads facilitate access to agricultural credit, their effects on non-agricultural lending are conflicting because of financial institutions' risk assessments and farmers' lack of collateral.

In order to investigate the relationship between non-farm businesses and access to non-farm credit, the study also performed a cross-tabulation. The results are displayed in a table 7.

Table 7 Cross tabulation of non-farm enterprise and access to non-farm credit

		Cross tabulation of non-farm enterprise and access to non-farm credit		
		Access non-farm credit		
		Yes	No	Total
Opened a non-farm Enterprise	Yes	166	53	219
	No	105	43	148
Total		271	96	367

According to the report, 76% of farmers who had started a non-farm business since the road's construction had access to non-farm credit. This implies that by facilitating access to credit facilities outside of the agriculture sector, better rural road infrastructure may promote financial inclusion and entrepreneurial development. This result is in line with research showing that the development of rural infrastructure promotes the growth of non-farm rural businesses by increasing access to financial services, decreasing transaction costs, and improving mobility (Haggblade, Hazell & Reardon, 2020).

4.5 Linear Regression Analysis of Non-Farm Enterprises and Livelihood Outcomes of Small-Scale Farmers

Table 8 Regression Analysis for Non-Farm Enterprises and Livelihood Outcomes

Coefficients					
Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	T	Sig
Constant	10.155	.573		17.718	.000
Diversified source of income	-0.115	.182	-0.040	-0.632	.052
Access to Non-farm Credit	-0.035	.110	-0.020	-0.319	.000

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	Df1	Df 2	Sig. F Change
	0.053	0.003	-0.003	1.47335	0.003	5.022	2	364	.053

Predictors: (Constant, Access to Non-farm Credit, Diversified source of income)

ANOVA						
Model	Sum of Squares	Df	Mean Square	F	Sig	
Regression	2.267	2	1.133	5.022	0.053	
Residual	790.161	364	2.171			
Total	792.428	366				

According to the study, small-scale farmers' livelihood outcomes are significantly impacted negatively by diversified sources of income ($\beta = -0.115$; $p = 0.052 < 0.05$). This indicates that small-scale farmers' livelihood outcomes are adversely impacted by revenue diversification. This might be because, as proposed by Dedehouanou & McPeak (2021), diversification into several revenue streams spreads resources thinly, resulting in decreased efficiency.

Additionally, the study revealed a substantial negative relationship between small-scale farmers' livelihood outcomes and their access to non-farm credit ($\beta = -0.035$; $p = 0.000 < 0.05$). These results imply that small-scale farmers' livelihood outcomes are strongly and adversely related with their ability to obtain non-farm credit. This indicates that farmers' overall livelihood outcomes is likely to decrease when they can readily acquire credit for non-agricultural activities. High repayment obligations or improper use of borrowed money in unsuccessful endeavours could be the cause of this (Saha, Abbasai, Begum, & Rola, 2025).

A substantial coefficient of determinations ($R^2 = 0.003$; $p = 0.053 \leq 0.05$) is displayed in the model summary. This shows that non-farm businesses created by rural road infrastructure have a statistically significant impact on small-

scale farmers' livelihood outcomes. The results show that non-farm businesses can account for 0.3% of small-scale farmers' livelihood outcomes due to rural road infrastructure. The influence of non-farm companies caused by rural road infrastructure on the livelihood outcomes of small-scale farmers has an ANOVA statistic of 5.022. Because the computed F-statistic (5.022) is higher than the critical value of 2.996 and the p-value is 0.053, which is equal to or less than 0.05, it is inferred that non-farm enterprises have a significant impact on the livelihood outcomes of small-scale farmers. This demonstrates that improved rural road infrastructure promotes the expansion of non-farm businesses, which raises the living outcomes for small-scale farmers. This is due to the fact that, as noted by Neglo, Gebrekidan, & Lyu (2021), non-farm enterprises give small-scale farmers alternate sources of income, decreasing their dependency on agriculture and strengthening their resistance to risks like market volatility or climate change.

5. Discussion

The study evaluated how non-farm enterprises due to rural road infrastructure affected small-scale farmers' livelihood outcomes. The following parameters were used to measure this variable: access to non-farm credit and diversified sources of income. According to the study, household income security was positively and significantly correlated with both income diversification and non-farm credit availability. Accordingly, households with a variety of sources of income typically have more stable incomes. Also, these households are better protected from industry-specific risks, seasonal fluctuations, and economic shocks when they diversify their sources of income. This suggests that they are more resistant to crop failure, price drops, and job loss in any given area. Therefore, having a variety of sources of income contributes to increased agricultural output, financial stability, and food security, all of which eventually improve livelihood outcomes.

Additionally, there was a strong negative correlation between household food security and non-farm credit availability. This implies that rather than increasing food availability and stability, these factors may be linked to increased food insecurity because households that diversify their sources of income are likely to spend less time in agricultural production, which lowers the quantity of food available for household consumption. Overall, the study found that small-scale farmers' livelihood outcomes are statistically significantly impacted by non-farm enterprises driven by rural-road infrastructure.

6. Conclusion

The study showed that small-scale farmers' livelihood outcomes are statistically positively impacted by non-farm enterprises. According to the study, households that have access to non-farm credit and participate in a variety of income generating activities typically have greater levels of financial security. This indicates that households are more resilient because they are protected against risks, seasonal variations, and economic upheavals by diversifying their sources of income. Additionally, food security was negatively correlated with both income diversification and non-farm credit availability. This is because diversity of income sources results in a trade-off with agricultural productivity, which lowers the quantity of food available for household consumption.

6.1 Recommendation

The study suggests the following in light of its findings:

1. To provide all-weather accessibility and minimize seasonal disruptions in market connectivity, national and local governments should concentrate on improving rural roads.
2. In order to improve farmers' livelihood outcomes through improved economic stability and resilience, there is need to emphasize the significance of growing rural non-farm sectors through infrastructure development, non-farm enterprises and training.
3. Enhancing financial services to make it easier for farmers to obtain financing would motivate them to take part in worthwhile non-farm enterprises.
4. To preserve household food security, policies that encourage income diversification should ensure that agricultural productivity is not overlooked.

5. Further research should examine intervening factors between the effect of non-farm enterprises due to rural road infrastructure on the livelihood outcomes to offer a more comprehensive picture of rural development dynamics.

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