



EFFECT OF RURAL ROAD NETWORK ON AGRICULTURAL PRODUCTIVITY IN BOMBALI DISTRICT SIERRA LEONE (CASE STUDY: BUMBAN SECTION, BRIWA CHEFDOM)

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Abstract: The research investigates the effects of road network on agricultural productivity in Bumban Section of the Briwa Chiefdom Bombali District, North Eastern Province of Sierra Leone in a bid to reinforce impacts of roads in agricultural development. The objectives of the study were as follows: to explore the challenges related to road infrastructure and distance influencing agricultural productivity in Bumban section; to assess the effect of road network on pre-cultivation, cultivation, and post-harvest decisions in Bumban section; to determine the effect of road network on product disposal in Bumban section. A descriptive survey design was adopted utilizing a population sample of 53 farmers of Bumban. Data collected by questionnaires was analysed using SPSS 26HS software. Results showed that: The selling problems of farm products and predominant use of domestic tools were the factors of low farm productivity eroding the impetus to invest on road network. In addition, lack of support from government was a greater cause for prevalence of poor road network compared with low farm yield. Majority of the farmers traverse long farm-to-road distances, carry headloads of products resulting in delay in products delivery to market, while covey products to market via motorbikes at high fares and froth with accidents – occasioning product wastage and spoilage. These were shown to lead to lower disposable market units and farm returns. The researcher concluded that despite being agriculturally endowed, Bumban succumbs to low agricultural productivity owing to inadequate road network and the associated inadequate predisposed pre-cultivation, cultivation, post-harvest and marketing decisions and options. The researcher recommended that to significantly improve agricultural productivity Bumban Section and Bombali District, rural road network must be treated as a primary factor of production rather than a supplementary amenity. The government and stakeholders must shift from simply establishing roads to actively upgrading and maintaining them.

Keywords: Road network, Road infrastructure; Rural infrastructure, Agricultural productivity.

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1.0 INTRODUCTION

1.1 Background to the Research

Agricultural production remains a fundamental economic activity in the rural areas of most developing countries, providing them with food, income, and employment. It has been shown that in some developing countries employment in agriculture accounts for over 70 percent of total employment and the contribution of agriculture to the overall GDP is often higher than many other economic drivers (International Labour Organization, 2021). It has been regarded as the engine of growth in the least developed countries (Ravallion and Datt, 1996), and a proven contributor to growth in other sectors (Tiffin *et al.*, 2013), and having a profound effect in poverty reduction (Irz *et al.*, 2001; Christiaensen and Martin, 2018).

Many rural Africans still suffer from poor access to markets, health, schooling, and high transport costs (Perschon, 2001). Inadequate rural roads make it hard for farmers to produce more and to transport any surpluses after harvest. Traffic on most rural roads still consists mainly of pedestrians often carrying headloads (DFID, 2018; Lindsay, 2015). Poor and inadequate rural roads have been the main concern by both small producers and consumers. Rural Africa has only 34% of road access covered as compared to 90% in the rest of the world (AfDB, 2010). Rural transport infrastructure is still poorly developed in Sierra Leone and, therefore, it is a crucial impediment to the growth of the rural as well as the national economy. Therefore, most places in the country especially in the rural areas are still without access roads and poor connectivity to major road networks. Sierra Leone's rural road network is one of the least developed in sub-Saharan Africa. The poor tend to live in isolated villages that can become virtually inaccessible during the rainy seasons.

Inarguably, efficient rural road transport infrastructure is central to raising agricultural productivity and increasing growth in Sierra Leone. In support, evidence shows that a weak rural road transport infrastructural base has been one of the major factors militating against the attainment of Sierra Leone's growth and development objectives. It is extremely difficult for most farmers who live and farm in north-east of Sierra Leone to gain access to all-weather roads on which to transport their farm produce to home and market centers on time. In effect, the socio-economic wellbeing of the smallholder farmers is seriously affected due to the high cost of agricultural inputs and depressed prices of farm produce. Poor road conditions, high transport costs, and distant markets have been identified as factors that hamper improved market access for smallholder farmers in north-east Sierra Leone.

In agricultural production road infrastructure is very important as it facilitates the transport of farm inputs and labour to farm and the transport of products from the farm to markets or industry (Krygsman S, 2017). Often, feeder roads connect with main motor roads in developing countries to make road transportation efficient. Developing countries with good feeder road networks have been linked to higher agricultural productivity. This is associated with corresponding rise in the output price of the produce and reduction in production cost influenced by the reduction in transportation cost of goods and services (Kiprono & Matsumoto, 2014). The overall effect, therefore, cannot be unrelated to lower prices of agricultural commodities in urban markets at lower prices, which improves food security for urban populations (Dethier and Effenberger, 2012). Farmers, therefore, enjoy better profit margins and the surpluses realized can be sold to neighbouring countries. This is one of the goals of the 'Food System Resilience Programme' (FSRP) in Sierra Leone whose fundamental approach is 'Linking Farmers to Market'. Such development marks are initiated by critical agricultural financing. For instance, it was envisaged that the additional financing for the Smallholder Commercialization and Agribusiness Development Project (SCADeP) in Sierra Leone will enable the project to invest in roads and bridges to improve connectivity thereby providing access to more remote areas of high agricultural production, by helping to build strategic bridges across major river crossing points currently served by manual cable ferries, and reconstructing feeder roads, and reducing the risks of accidents and farm product spoilage (World Bank, 2020).

For any country, town or village to develop there must be a sustainable good road infrastructure that will allow farmers to transport their products intact and fast to market. The section of Bumban in Bombali district of Sierra Leone is one of the most deprived communities in the country. With a population of about four thousand (4,000) and the absence of functioning health and education institutions, life expectancy is well below the national average. The road network in Bumban section can only be described as unworthy of any motorized transportation and hazardous to pedestrians. Despite the agricultural endowments of Bumban Section, agricultural productivity is still low and that could not be dissociated from the glaring road network inadequacies of the area often seen to hinder the delivery of farm inputs and technology packages to farm, and farm products to market.

Strengthening rural infrastructure can lead to lower production costs which can further augment agricultural output and income for rural farming community. Improved infrastructure also leads to expansion of markets, economies of scale, and improvement in factor market operations. The development of rural infrastructure helps to enlarge markets

with greater access to factors of production. Easier access to markets allows an expansion of the production of perishable and transport-cost-intensive products. It can also lead to a conversion of latent demand into effective commercial demand. This study would be looking at the nexus between road network and agricultural output which remains a key concern in rural development. Several research studies have been conducted on road network but none of them has focused on an in-depth probe into the impact of road infrastructure on agricultural output in Sierra Leone.

Despite being highly agricultural endowed, Sierra Leone remains one of the poorest countries in Africa and the World and the question of how to reverse low agricultural productivity in Sierra Leone, of which poor road infrastructure is a key deterrent, is one that the research landscape has scarcely touched upon. To the researcher's knowledge, clarity is still needed to pinpoint the effects of poor rural road infrastructure on the structure of smallholder farm production in Sierra Leone. This paper aims to fill that gap using cross-sectional empirical data, from the survey of 53 farmers the Bumban Section.

1.2 Research Aim and Objectives

The research aims to present vivid impacts of road network on agricultural productivity in Bumban Section in Biriwa Chiefdom, drawing inference for the Bombali District in general, and by extension the rural areas of Sierra Leone. The objectives of the study are as follows:

- To show the challenges related to road infrastructure and distance influencing agricultural productivity in Bumban Section, Bombali District;
- To indicate the factors of low farm productivity eroding the impetus to invest on road network;
- To assess the effect of road network on pre-cultivation, cultivation and post-harvest decisions in Bumban Section of Biriwa Chiefdom, Bombali district;
- To determine the effect of road network on farm product disposal in Bumban Section Biriwa Chiefdom, Bombali District.

1.3 Justification of the Research

This research is fundamentally justified by the need to resolve the paradox of low agricultural productivity and poor financial returns in the agriculturally endowed Bumban Section. While the region has the potential for agricultural commercialization, a poor road network is severely crippling the entire farming lifecycle – from pre-cultivation input access to post-harvest product disposal. By empirically demonstrating how infrastructural deficits act as a primary bottleneck to production and a catalyst for post-harvest value destruction, this study provides the necessary evidence to shift policy paradigms. It moves rural roads from being treated as supplementary amenities to primary factors of

production. Furthermore, the findings offer scalable insights for the wider Bombali District and rural Sierra Leone, providing a targeted, actionable blueprint for government and stakeholders to invest in road upgrades that will lower transaction costs, secure farmer confidence, and drive sustainable agricultural commercialization.

1.4 Significance of the Research

This study holds significant practical and policy implications for transforming rural agriculture in Sierra Leone. By empirically establishing rural road networks as primary factors of production rather than supplementary amenities, it provides a vital blueprint for government agencies, development partners, and NGOs to redirect investments toward upgrading and maintaining critical feeder roads and farmgate accesses. For the farmers of Bumban Section – and by extension, rural Sierra Leone – the significance of this research lies in its potential to secure the psychological safety and logistical efficiency needed to scale production, eliminate post-harvest value destruction, lower transaction costs, and ultimately drive sustainable agricultural commercialization and higher disposable incomes. Furthermore, it enriches academic literature by offering a scalable, localized model of how infrastructural deficits impact the entire agricultural lifecycle.

1.5 Assumptions of the Research

The research hinges on the following assumptions:

- **Primary Causality:** The study assumes that the poor state of the road network is the primary infrastructural bottleneck affecting agricultural productivity in the Bumban Section, superseding other potential minor infrastructural deficits.
- **Honest Recall and Response:** It is assumed that the respondents (farmers) provided accurate, honest, and reliable information regarding their pre-cultivation, cultivation, post-harvest decisions, and the exact tolling effects of road networks on their farm returns.
- **Representativeness of the Farming Population:** The study assumes that varying responses to road accessibility prevail in accordance with gender and age bracket of farmers, hence necessitating purposive sampling.
- **Generalizability of the Model:** It is assumed that the relationship between road network deficits and agricultural value destruction observed in Bumban Section is structurally similar enough to other rural areas in Bombali District and Sierra Leone to allow for valid inferences to be drawn.

1.6 Delimitation of the Research

The delimitations of this research include the following:

- **Geographical Scope:** The study was strictly delimited to the Bumban Section in the Biriwa Chiefdom of the Bombali District. While inferences are drawn for the wider region, primary data collection and direct analysis were confined to this specific geographical area.
- **Thematic Scope (The Agricultural Lifecycle):** The research deliberately narrowed its focus to how road infrastructure affects specific stages of the agricultural value chain: pre-cultivation, cultivation, post-harvest decisions, and farm product disposal. It did not delve into unrelated agricultural topics like modern farming techniques or genetic crop improvements.
- **Target Population:** The study was delimited to interviewing or surveying active agricultural farmers within the Bumban Section. It excluded other key stakeholders in the road network value chain, such as commercial transport drivers, local road construction contractors, or agricultural input dealers, whose perspectives might have provided a different angle on the infrastructure deficits.
- **Focus on Road Infrastructure:** The study explicitly delimited its infrastructural analysis to road networks (feeder roads, laterite arteries, farmgate access). It deliberately excluded other forms of rural infrastructure, such as irrigation systems, electricity grids, or telecommunications networks, to maintain a sharp focus on transportation logistics.

1.7 Limitations of the Research

The research is beset with the following limitations:

- **Exclusion of Other Productivity Variables:** While the study acknowledges factors like the "aging farming population," it is primarily limited to assessing the road network. It does not statistically isolate or measure the exact simultaneous impact of other variables such as soil fertility, climate change, access to credit, or pest invasions on agricultural productivity.
- **Temporal Constraints (Cross-Sectional Design):** The study likely utilized a cross-sectional design, meaning data was collected at a single point in time. This is a limitation because it cannot capture the long-term, seasonal variations in road conditions (e.g., dry season vs. heavy rainy season) and how those fluctuations dynamically affect productivity year-over-year.

- **Subjectivity of "Psychological Security":** The recommendation highlights the need for "psychological security" to spur pre-cultivation investment. Quantifying and measuring this psychological state objectively is a limitation, as it relies heavily on the subjective perceptions of the individual farmers.
- **Geographical Terrain Constraints:** The physical terrain of the Bumban Section may have made it logistically difficult for the researcher to access all remote farmgates, potentially limiting the physical observation of feeder road conditions to only the most accessible remote areas.

2.0 MATERIALS AND METHODS

The design and procedure in conducting the study, the population and sampling procedures and the instrument used for the collection of the data, as well as the analysis of the data are described below.

2.1 Design of the Research

The researcher collected information, using cross-sectional empirical data, about "The Effect of Road Network on Agricultural Productivity in Bombali District in the North Eastern Province of Sierra Leone" using Bumban Section, Biriwa Chiefdom as a case study. Data collected were largely quantitative and the design was descriptive survey. The data was collected from the farmers in Bumban Section, Biriwa Chiefdom Bombali District, Sierra Leone after the designing of the instrument (questionnaire). Descriptive statistics involving frequency and percentage derived from use of SPSS data analysis software was employed. From the analyzed data conclusion and recommendations were drawn.

2.2 The Study Area

Bumban section in the Biriwa chiefdom in Bombali district sits on the edge of the hill countryside of North-eastern Sierra Leone. The Section has nearly 4,000 inhabitants. Kamabai town is the headquarter of Biriwa chiefdom and it is connected to Bumban Section via a laterite feeder road, While the main Makeni-Kabala tarmac road runs through Kamabai. The villages in Bumban Section are connected by neglected feeder roads which are inaccessible to motor vehicles and opportunities for marketing local produce are extremely limited. The local population is predominantly Limba tribe, although the chiefdom also contains large and long-established colonies of Mandingo and Fula tribes. Both groups enjoy customary land rights in the area and made use of these before the war to hold large herds of cattle. For many obvious reasons, especially the long dry season and lack of irrigation technologies, annual arable rain-fed cropping persist in the uplands and rice production is carried out in the lowlands which are predominantly inland valley swamps in the rainy season; there is a small-scale

production of vegetables in these swamps in the dry season. But cattle rearing still continues and competes for land resources with crop farmers, often culminating in conflicts. Agricultural productivity in Bumban and Biriwa is overtly constrained by poor road network especially in the rainy season.

2.3 Population, Population Sample, and Sampling Technique

The population for the study comprised local farmers in Bumban section of the Briwa chiefdom in the Bombali District of Sierra Leone. The population sample consisted of fifty-five (55) respondents from those who practice farming. However, only fifty-three (53) questionnaires were retrieved from the respondents and three (3) of them were improperly filled by the respondents. Only fifty (50) questionnaires were properly filled and used for data analysis.

The research population sample was selected using purposive sampling which is a function of non-probability sampling. Under purposive sampling technique, the researcher purposely chose those who are thought to be relevant to the research topic. In this case, the judgment of the researcher was more important than obtaining a probability sample. The sample size was thus selected from all the different respondents of choice in the study population.

2.4 Instrumentation

Questionnaire was developed to collect data that was pertinent to the study. The validity of the questionnaire was ascertained by building questions which strictly adhered to the objectives of the study. The reliability of the questionnaire was ascertained by an inter-collegial review involving analysis of response patterns and question details for consistency and clarity following pilot survey, thereby ensuring that the questionnaire was fit for purpose.

2.4 Data Collection

The researcher employed and trained a few enumerators who entrusted with the task of data collection using the following methods.

Interview guide: This was used on respondents who do not know how to read and write as well as those who did not have time to fill the questionnaires because the enumerator would be able to know what to ask with reference to the topic. Face-to-face interaction between the interviewer and interviewee ensured soliciting the required data.

Direct filling: A few of the respondents were literate enough to fill the questionnaire on their own requiring minor guide from the researcher.

2.5 Data Analysis

The data collected was analyzed using quantitative analysis. The analysis tool used was Statistics Package for Social Science - SPSS 26HS.

2.6 Ethical Procedure

The need for the research was born out of the drive to pursue the food security quest in Sierra Leone, which continues to be a pillar of change with successive governments in post-war Sierra Leone. The topic was aligned with the “Feed Sierra Leone” agricultural drive of the National Big Five Game Changers of the 2023 to 2028 national development roadmap, and was approved by the Research coordination team of the Faculty of Agriculture of the Ernest Bai Koroma University of Science and Technology, Sierra Leone, having satisfied the set standards. Honesty, confidentiality, and clarity of research purpose were among the research ethics outrightly pursued and attained.

3.0 RESULTS AND DISCUSSIONS

3.1 Demographic Characteristics of the Respondents

3.1.1 Distribution of Gender of Farmers (Respondents)

Table 1.1: Distribution of Gender of Farmers (Respondents)

Gender of Farmers		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	17	32.1	34.0	34.0
	Female	33	62.3	66.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

In Table 1.1, it could be seen that females account for 62.3% of the farming population while males account for 32.1% of the farming population. This tells us that females are more in to agriculture than males. Since women have been shown to have lower access to farming resources, we may find out that agricultural development is hindered in Bunban section. This can be further exacerbated by the bad road network which they would physically find difficult to ply. A

corroboration is here given: “Based on original research in five countries (Ethiopia, Malawi, Rwanda, Uganda and United Republic of Tanzania), this policy brief shows that gender gaps in agricultural productivity do not arise because women are less efficient farmers but because they experience inequitable access to agricultural inputs, including family labour, high-yield crops, pesticides and fertilizer” (Rodgers & Akram-Lodhi, 2015).

3.1.2 Distribution of Marital Status of Farmers (Respondents)

Table 1.2: Distribution of Marital Status of Farmers (Respondents)

Marital Status		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	13	24.5	26.0	26.0
	Married	27	50.9	54.0	80.0
	Divorced	6	11.3	12.0	92.0
	Widowed	4	7.5	8.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher's field survey, 2024

Table 1.2, presents the marital status of farmers. There are more married farmers (50.9%) than single (24.5%) and divorced (11.3%), while the widowed account for (7.5%). More married persons in farming implies that production will be high since they will be pooling individual and family-owned resources for higher productivity. Resource integration has been presented as vital for achieving multiple desirable livelihood outcomes at farm and

community levels (Goswami R *et al.*, 2017). Practices such as crop rotation, cover cropping, and integrated pest management are hallmarks of family farming, emphasizing long-term soil health and resource conservation. These methods reduce reliance on chemical inputs, protect ecosystems, and produce high-quality, nutrient-dense food (Doulah Farms, 2025).

3.1.3 Distribution of Age of Farmers (Respondents)

Table 1.3: Distribution of Age of Farmers (Respondents)

Age of Farmers		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15 - 35	18	34.0	36.0	36.0
	36 - 65	32	60.3	64.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher's field survey, 2024

The age dynamics of farmers under survey are given in Table 1.3. A majority of the farmers (64.0%) are aged 36 – 65 which is the adult age of the Sierra Leone population, while the lesser proportion of farmers (36.0%) are aged 15 – 35, which is regarded as the youthful age of Sierra Leone population. It can however be seen that all of the farmers are

between the working age of the Sierra Leone population (15 – 65 years). Having more farmers in the adult population category is a concern for productive work by the farmers as they could be facing physiological declines which cannot allow them to work heavily to attain higher productivity. Otherwise, they can also produce at high production cost.

The youth population category, which constitute the able bodied, is less involved in farming and that could lead to lower agricultural productivity. Aging of farming has been shown to be the direct cause of a decrease in land input (Li & Li, 2019). This means that labour in number and output will be reduced on the farm with a high aging population.

Under conditions of labor shortages, an aging labor force, and declining labor capacity, farmers make reasonable production decisions based on price and demand such as planting crops that grow easily to maximize their economic benefits (Su *et al.*, 2017).

3.1.4 Distribution of Level of Education of Farmers (Respondents)

Table 1.4: Distribution of Level of Education of Farmers (Respondents)

Level of Education		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	26	49.1	52.0	52.0
	Primary School	14	26.4	28.0	80.0
	Secondary School	3	5.7	6.0	86.0
	Post Secondary School	7	13.2	14.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher's field survey, 2024

Table 1.4 shows the education dynamics of the farmers. The uneducated (49.1%) are much more than any of the other categories. Farmers at the education levels of primary, secondary, post-secondary account for 26.4%, 13.2% and 5.7%, respectively, of the research population. With uneducated persons having the highest percentage of involvement in farming, the transmission of improved farming technologies to them as well as their farm record keeping will all be constrained, and this will have a negative impact on agricultural productivity. In their study, (Kafando B *et al.*, 2022) showed that educated farmers and living in urban areas being able to access credits easily and insurances, have a higher rate of adoption of far technologies compared to rural uneducated farmers. On

assessing the determinants and impact of financial record-keeping among smallholder vegetable farmers in the Eastern Cape Province, Mdoda and Nontu (2026) submitted that most respondents were middle-aged men engaged in family-based farming with modest education levels and limited financial literacy, with many of them keeping informal records, while only a few maintained formal financial documentations. They furthered that determinants significantly influencing record-keeping included education, access to extension services, credit availability, farm size, membership in farmer organizations, and financial training, while record-keeping difficulties had a negative effect on productivity.

3.2 Challenges Related To Road Infrastructure and Distance Influencing Agricultural Productivity in Bumban Section

3.2.1 Status of Roads in Bumban Section

Table 2.1: Distribution of the Status of Roads in Bumban Section

Status of Roads		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poorly maintained	40	75.5	80.0	80.0
	Well maintained	10	18.9	20.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher's field survey, 2024

In Table 2.1, 80.0%, of the farmers reported that the roads in Bumban section are poorly maintained, while 20.0% reported that the roads are well maintained. It is apparent that the vast majority of the roads are poorly maintained. Laterite or unpaved feeder roads, as they are, succumb to huge problems caused by heavy rains due to erosion and flooding, leading to road cut-offs and accidents – all of

which may cause delay in farm produce delivery to market or produce deterioration or outright losses of entire produce being delivered. This would impoverish farmers further. In Sub-Saharan Africa, poor road conditions have been linked to high transportation costs, which erode farmers' profits and limit their access to lucrative markets (Ojo & Adeyemo, 2020).

3.2.2 Types of Roads Used for Transportation in Bumban Section

Table 2.2: Distribution of Types of Roads Mostly Used for Transportation in Bumban

Road Type		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tarmac highway	4	7.5	8.0	8.0
	Laterite main road	40	75.5	80.0	88.0
	Feeder road	6	11.3	12.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher's field survey, 2024

In Table 2.2, 88.0% of the farmers showed that they mostly use laterite main road for transportation in Bumban section, 12.0% and 8.0% reported that they mostly use feeder roads or laterite main roads, respectively. A small use of tarmac main road and feeder roads is indicated by the farmers. This is because the main Makeni-Kabala Highway traverse a small portion of the section, and the feeder roads from their villages just connect to the longer laterite main road leading to the chiefdom headquarter town of Kamabai, where buyers often await them in the rural assembly market.

The findings from the Bumban Section of the Briwa Chiefdom illustrate a classic paradigm in rural agricultural geography: the critical role of road surface quality and network connectivity in shaping farmer market access and, by extension, agricultural productivity. The data indicating that 88% of farmers rely primarily on laterite (unpaved) main roads, with negligible use of tarmac roads, highlights a structural infrastructural deficit. While the presence of the laterite road provides a baseline arterial connection to the rural assembly market in Kamabai, the over-reliance on unpaved surfaces introduces significant transaction costs that invariably constrain agricultural productivity.

In rural Sub-Saharan Africa (SSA), the type of road network dictates not just the ease of movement, but the economic viability of agriculture. Laterite roads are highly susceptible to seasonal degradation. During the rainy season, these roads often become impassable, isolating farming communities and leading to post-harvest losses. The finding that farmers traverse longer distances on laterite roads to reach buyers in Kamabai suggests a high reliance on "rural

assembly markets" – centralized nodes where buyers aggregate produce. However, as noted by Ashraf *et al.*, (2017), poor rural road infrastructure significantly increases the time and monetary costs required to reach these assembly markets. Because farmers in Bumban must bear the burden of transporting their goods over degraded laterite roads, their net profit margins are reduced. Consequently, this diminished profitability acts as a disincentive for farmers to invest in productivity-enhancing inputs, such as improved seeds, fertilizers, or mechanization, thereby trapping them in low-yield subsistence farming.

Furthermore, the spatial dynamics described in the findings – where the Makeni-Kabala Highway (a tarmac road) only traverses a small portion of the section – demonstrate the "last-mile" problem in agricultural logistics. Tarmac roads are typically associated with lower transport costs, faster travel times, and greater market integration. The fact that only a marginal percentage of farmers utilize the tarmac road implies that the majority are spatially marginalized from high-efficiency transport corridors. According to Gollin and Rogerson (2010), the low density of paved roads in SSA acts as a fundamental barrier to structural transformation and agricultural productivity growth. They argue that without connecting local feeder roads to national paved highway networks, rural agricultural potential remains stifled. In the context of Bumban, the feeder roads serve merely as weak appendages to a longer, arduous laterite route rather than functioning as efficient conduits to the Makeni-Kabala highway. This forces farmers to sell at the Kamabai market under suboptimal conditions, often to

middlemen who capitalize on the farmers' inability to transport their goods further down the value chain to larger urban centers like Makeni.

In conclusion, the transport topology of the Bumban Section, characterized by an over-dependence on laterite main roads and disconnected feeder roads, acts as a structural bottleneck to agricultural productivity. While the laterite road facilitates basic access to the Kamabai

assembly market, its poor quality likely inflates transaction costs and limits farmers' bargaining power. To enhance agricultural productivity in the Briwa Chiefdom, infrastructural investments must shift from merely having a road network to upgrading the quality of existing roads, specifically by paving critical laterite arteries and improving feeder-to-highway connectivity.

3.2.3 Distance from Road to Farm

Table 2.3: Distribution of the Farm-to-Road Distance (Quantitative)

Distance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-1 KM	4	7.5	8.0	8.0
	2 KM	9	17.0	18.0	26.0
	3-4 KM	22	41.5	44.0	70.0
	5 KM	11	20.8	22.0	92.0
	6 KM	2	3.8	4.0	96.0
	7 KM and above	2	3.8	4.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

Table 2.3 shows that distance from farm to the road in the Bumban Section is mostly between 3 – 5 kilometers accounting for a combined percentage of 66.0%. this distance is relatively far for enhancing fast delivery of goods from the farm to the village and subsequently to the market. It also indicates poor road network leading to farms. This results in high cost of transport fares as the okada (bike) riders, who are the main commuters in these rural places, would require high transport costs for even short distances on rural roads.

The findings from Table 2.3 regarding the Bumban Section reveal a critical micro-spatial constraint on agricultural productivity: the significant farm-to-road distance. With 66% of farmers located 3 to 5 kilometers away from the nearest accessible road, the data highlights a pervasive lack of farm-level road penetration. In the context of smallholder agriculture, this distance represents more than a mere physical gap; it constitutes a severe friction point that disrupts the supply chain, escalates transaction costs, and ultimately diminishes the economic viability of farming.

The reliance on “okada” (motorcycle) riders as the primary mode of transport exacerbates the vulnerability of these distant farmers. Motorcycles are highly effective for navigating unpaved, degraded terrain where four-wheeled

vehicles cannot pass; however, their cargo capacity is strictly limited. As Kumar and Barrett (2019) demonstrate in their analysis of rural transport constraints in sub-Saharan Africa, poor road connectivity forces smallholders to rely on high-cost, low-capacity transport alternatives. When farmers are located 3 to 5 kilometres from the road, the cost of labor and time required to manually head-load produce to the roadhead, combined with the high per-kilogram fare demanded by “okada” riders due to the difficult terrain, drastically inflates transaction costs. This high cost-to-volume ratio makes it economically unfeasible to transport bulky, low-value staple crops, effectively discouraging farmers from expanding their acreage or maximizing their yield.

Furthermore, the 3 to 5-kilometer farm-to-road distance has severe implications for post-harvest losses and timely market delivery. As the findings note, this distance impedes the “fast delivery of goods.” In agricultural economics, time latency between harvest and market arrival is a critical determinant of producer prices. Sheahan and Barrett (2017) posit that spatial isolation and high transport costs create a “poverty trap” for smallholders, primarily through two mechanisms: the reduction of farm-gate prices and the exacerbation of post-harvest spoilage. In the Bumban

Section, the delay caused by long head-loads and expensive, limited-capacity “okada” transport means perishable produce may lose quality before reaching the village or the rural assembly market at Kamabai. Consequently, buyers leverage this spatial disadvantage to offer lower prices, knowing the farmers lack the transport capacity to seek better markets.

Ultimately, the 66% of farmers situated 3 to 5 kilometres from the road are operating under a hidden tax of

geographical marginalization. Without the construction of intermediate feeder roads or farm tracks to reduce this spatial disconnect, the high transport fares extracted by “okada” riders will continue to siphon off potential agricultural profits. Enhancing agricultural productivity in the Bumban Section, therefore, requires infrastructural interventions that bring the road network closer to the farmgate, thereby lowering the transaction costs that currently stifle agricultural commercialization.

3.2.4 Transport Costs from Farm to Road

Table 2.4: Distribution of the Farm-to-Road Transport Cost

Transport Cost		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very high	33	62.3	66.0	66.0
	High	12	22.6	24.0	90.0
	Very cheap	2	3.8	4.0	94.0
	Cheap	3	5.7	6.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher’s field survey, 2024

In Table 2.4, 66.00% of the farmers in Bumban section attest that cost of transport cost from the farm to the road is very high, while 24.0% confirmed that it is high. Cheap and very cheap transport fares are reported by 6.0% and 4.0%, respectively, of the farmers. With very high cost of transport from farm to road predominating – and where the cumulative percent of very high and high cost of transport is also very high (90%) – farmers are obliged to sell at higher prices so as to offset the high transport fares. This will in turn lower demand by buyers causing prolonged holding of the product at the market points with poor storage facilities, thus prompting spoilage. Where buyers may buy at higher prices prompted by the necessity of the goods, the increased cost resulting from the high transport fares will be transferred to the consumers down the line. This discuss has been supported: Transport costs strongly affect food prices. Fresh foods such as vegetables, fruit, meat, and fish are especially sensitive because they must reach markets quickly to avoid spoiling. In some African cities, transport can account for 30 – 40% of the final food price, particularly for goods coming from rural areas. During rainy seasons, when roads become difficult to use, food prices often rise further due to delays and losses (Right for Education, 2026). Rural communities are usually farther from major markets. Poor road access means transport takes longer and costs

more. As a result, rural households often pay higher prices for basic goods. At the same time, farmers may receive lower prices for their products because buyers deduct transport costs from what they are willing to pay (Right for Education, 2026).

Transport costs play an important role in agricultural development. High transport costs that result from inadequate transport infrastructure are to a large extent responsible for the large discrepancies that frequently exist between food prices paid by consumers in urban areas and the prices received by farmers producing these crops in low-income countries, particularly in Africa ([Ahmed & Rustagi, 1987](#)). Reduction of transport costs may considerably increase the levels of agricultural production and food consumption.

Internally, transportation costs are very high both between Bumban section and Biriwa chiefdom, and between farm and market. This reflects poor road infrastructure as well as possible non-competitive behavior in the marketing and transportation sectors. As a result, urban markets record more than twice the farmgate or rural assembly market price of food commodities. In some instances, they would bear slightly higher prices compared to similar imported commodities.

3.3 Factors of Low Farm Productivity Eroding the Impetus to Invest On Road Network

3.3.1 Inherent Factors of Low Farm Productivity Eroding the Impetus to Invest on Road Network

Table 3.1: Distribution of Inherent Factors of Low Farm Productivity Eroding the Impetus to Invest on Road Network

Inherent Factors of Low Farm Productivity		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selling problems of produce	20	37.7	40.0	40.0
	Bush fire	20	37.7	40.0	80.0
	Predominant use of local tools	10	18.9	20.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

On the major factors of low farm productivity eroding the impetus to invest on road network in Bumban section, Table 3.1 shows that selling problems of produce and bush fires account each for 40%, while the predominant use of local farm tools accounted for 20%. The study shows a high prevalence of bush fires, which could devastate crop plants and lower productivity, and high prevalence of selling problems of produce, which could culminate in spoilage of produce or disadvantageously selling at lower prices. Moreover, the use of domestic tools which are largely crude and inefficient is associated with drudgery and low production. Farmers do not have enough produce to attract buyers who now fail to flock the area. This does not give an impetus to increase efforts in road rehabilitation.

The findings presented in Table 3.1 delineate a complex, interconnected matrix of challenges confronting farmers in the Bumban Section. The dual prominence of selling problems (40%) and bush fires (40%), compounded by the reliance on local farm tools (20%), illustrates a classic poverty trap in rural sub-Saharan Africa. Crucially, these factors do not operate in isolation; rather, they exhibit severe negative synergies that collectively stifle agricultural productivity and, as the findings astutely note, create a disincentive for infrastructural investment such as road rehabilitation.

The 40% prevalence of selling problems is inextricably linked to the broader context of road network deficiencies. As established in prior spatial analyses, poor road connectivity fragments market access, leading to information asymmetry and high transaction costs. Jaleta M *et al.*, (2019) emphasize that market access constraints force smallholder farmers into distressed sales, where they must dispose of their produce at disadvantageously low farm-gate prices to avoid post-harvest spoilage. In Bumban, the inability to attract buyers is a direct manifestation of these high transaction costs; buyers will not incur the expenses of traversing poor road networks for small, fragmented quantities of produce. Consequently, farmers lack the capital

accumulation necessary to invest in better inputs or yield-enhancing technologies, thereby locking them into low-production cycles.

Furthermore, the 40% prevalence of bush fires introduces a severe ecological shock that interacts destructively with market failures. Bush fires devastate crop plants, drastically lowering aggregate yields and threatening food security. When coupled with the use of crude, inefficient domestic tools (20%), the agricultural system becomes highly vulnerable. Mbow C *et al.*, (2019) argue that the persistent use of traditional, low-technology farming implements limits a farmer's capacity for timely land preparation and rapid harvesting. In the presence of environmental hazards like bush fires, this drudgery and inefficiency mean that farmers cannot quickly harvest or create adequate firebreaks to save their crops. The resulting low yields further diminish the volume of marketable surplus, reinforcing the very "selling problems" that deter buyers from entering the region.

Perhaps the most critical insight from the findings is the feedback loop between low agricultural productivity and the neglect of road rehabilitation. Infrastructure development is often driven by economic viability; roads are maintained or constructed where there is sufficient economic activity (like high volumes of agricultural trade) to justify the investment. Because farmers in Bumban are hampered by bush fires, crude tools, and resultant low volumes of produce, the region fails to generate the critical mass of agricultural surplus required to stimulate local road rehabilitation. This creates a vicious cycle: poor roads lead to market isolation and low investment in farm technology, which results in low productivity, which in turn removes the economic impetus for improving the roads. Breaking this structural deadlock requires targeted interventions that address both the supply-side constraints (fire management and tool modernization) and the demand-side infrastructure (road networks) simultaneously.

3.3.2 Government Support Versus Low Agricultural Productivity Impact on Road Network

Table 3.2: Distribution on Government Support Versus Low Farm Yield as Cause for Prevalence of Poor Road Network

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No support from government	30	56.6	60.0	60.0
	Low farm yield	20	37.7	40.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: Researcher's field survey, 2024

In Table 3.2 reporting on Government support versus low farm yield as cause for prevalence of poor road network, lack of support from government is shown most outstanding for low prevalence of poor road network in Bumban section, while low farm yield was shown as a lesser cause of poor road network by 40.00% of the farmers. The results seem to indicate that there is an outcry of a lack of government support to improve on the rural road network at Bumban and that has a negative impact on agricultural productivity. Seemingly, with the resultant low agricultural productivity, the community cannot give back to road network improvement. These resource poor communities would often depend on Government for the capital-driven projects of road network improvement.

The findings from the Bumban Section in the Briwa Chiefdom elucidate a classic developmental predicament: the symbiotic relationship between state neglect of rural infrastructure and agricultural stagnation. The data indicating that a majority of farmers identify a "lack of government support to improve the rural road network" as the primary driver of low agricultural productivity – overshadowing intrinsic agronomic factors like low farm yields (cited by only 40.00%) – shifts the locus of blame from the farm level to the systemic, structural level. This suggests that farmers in Bumban possess the agronomic capacity to produce higher yields, but are constrained by severe market accessibility and input supply bottlenecks caused by poor road networks.

This dynamic aligns with the broader agricultural development discourse, which posits that road infrastructure is a critical non-farm input that dictates the profitability of farming (Fan, S & Chan-Kang C, 2008). According to the classic "gravity model" of transport economics, the cost of moving goods increases exponentially as road quality deteriorates. In the context of Bumban, a lack of government support in maintaining feeder roads likely inflates the transaction costs of transporting fertilizers, improved seeds,

and other agro-chemicals to the farms. Consequently, the cost of production rises, while the farm-gate price of produce falls due to the high costs farmers must incur to transport their goods to market centers. The fact that "low farm yields" was a lesser cause implies that the land is not inherently unproductive; rather, the lack of supportive infrastructure makes any yield gains economically unviable for the farmer.

Furthermore, the finding highlights a vicious cycle of "synergistic deprivation" (Minot N, 2008). The research notes that with resultant low agricultural productivity, the community lacks the financial capital to give back to road network improvement. This reflects a fundamental barrier to localized rural development. Because road construction and maintenance are highly capital-intensive, resource-poor communities cannot finance them through local agricultural surplus. Therefore, they remain entirely dependent on state intervention. However, as predicted by the "spatial poverty trap" theory, governments often fail to invest in remote, low-productivity areas because the return on investment (ROI) appears low. The state avoids investing in roads because agriculture is unproductive, while agriculture remains unproductive because the state refuses to invest in roads.

This creates a paradox where the most marginalized communities, who desperately need infrastructure to break out of poverty, are systematically bypassed by state development budgets in favour of already productive regions. The "outcry" for government support in Bumban is essentially a demand for the state to break this spatial poverty trap by providing the initial, exogenous shock of capital required to stimulate the local agricultural economy. Without government intervention to absorb the high initial costs of rural road improvement, the farmers of Bumban Section will remain locked in a state of subsistence farming, unable to transition to commercial agriculture.

3.4 Effect of Road Network on Pre-Cultivation, Cultivation and Post-Harvest Decisions in Bumban Section

3.4.1 Effect of the Road Network on Pre-Cultivation Decision in Bumban Section

Table 4.1: Distribution of the Predominant Road Network Effects on Pre-Cultivation Decisions

Predominant Road Network Effects		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High cost of transportation	15	28.3	29.4	29.4
	Low price of farm products	10	18.9	19.6	49.0
	Accidents due to bad road	26	49.1	51.0	100.0
Missing System		2	3.8	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

Reporting on the road network effects on pre-cultivation decision in Table 4.1, 51.00% of the accidents due to the bad road as the most outstanding, while high cost of transportation and was reported by 29.4%, and low price of farm products was reported by 19.6%. This may influence pre-cultivation decisions of how much inputs to buy that would influence scale of production.

The findings regarding the effects of the road network on pre-cultivation decisions in Bumban Section reveal a critical but often under-examined dimension of rural agricultural economics: the role of transport-induced risk in constraining agricultural investment. While it is well-documented that poor infrastructure affects post-harvest market access, Table 3.1 demonstrates that the most severe impact of the bad road network occurs *before* cultivation even begins. With 51.0% of respondents identifying accidents as the outstanding consequence of the poor road network, overshadowing high transportation costs (29.4%) and low farm-gate prices (19.6%), the data suggests that physical safety and the risk of catastrophic input loss are the primary drivers of pre-cultivation decision-making.

In agricultural economics, pre-cultivation decisions – such as how much improved seed, fertilizer, or agro-chemicals to purchase – dictate the scale of production. However, these decisions are not made in a vacuum; they are highly sensitive to risk. When farmers in Bumban procure inputs, they must transport them over treacherous roads. The high incidence of accidents (51.0%) signifies a severe "transport risk premium." If a farmer purchases a significant quantity of expensive inputs, an accident en-route to the farm does not merely delay planting; it destroys the capital invested, potentially plunging the household into debt. Consequently, to mitigate this risk, farmers rationally choose to under-

invest in inputs, deliberately reducing their scale of production to a level where the potential loss from an accident is financially survivable (Sadoulet E & de Janvry A, 1995).

This behavioral response highlights a divergence between standard economic theory and the reality of rural development in fragile states. Standard models assume that high transportation costs (cited by 29.4%) are the primary friction in input acquisition, suggesting that farmers will simply calculate the added cost into their profit margins. However, the dominance of accident rates in Bumban indicates that the constraint is not just financial, but probabilistic. The unpredictability of the road introduces a "disaster risk" that standard cost-benefit analyses fail to capture. Farmers are deterred from scaling up because the variance in potential outcomes (getting inputs to the farm safely versus losing them in an accident) is too high.

Furthermore, the relatively lower percentage of farmers citing low farm product prices (19.6%) as a pre-cultivation constraint reinforces this narrative. It implies that farmers are not primarily discouraged by market dynamics, but by the physical barriers to even reaching that market (Stifel D & Minten B, 2008). The psychological impact of frequent accidents creates a pervasive environment of uncertainty. In such contexts, smallholder farmers default to risk-averse strategies, relying on diminished quantities of locally available, low-yielding inputs rather than risking capital on the bad road network. Therefore, improving the road network in Bumban is not merely a logistical necessity for moving goods; it is a prerequisite for psychological security that must be established before farmers can confidently make the pre-cultivation investments required to optimize their scale of production.

3.4.2 Effect of Road Network on Major Cultivation Dynamics in Bumban Section

Table 4.2: Distribution of the Effect on Cultivation Scale and Time Parameters in Bumban Section

Cultivation Scale and Time Parameters		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low scale of production and productivity	29	54.7	58.0	58.0
	Time consuming	21	39.6	42.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

Table 4.2 presents the distribution of the effect cultivation scale and time parameters in Bumban Section. It is well known that a bad road condition affects the operation and costs of production and lowers agricultural productivity. With the result in the Table 4.2, low scale of production and productivity is reported by 58.0% of the farmers as the effect of the prevailing road network on cultivation. This might emanate from farm input delivery delay, difficulty in commuting workers or labour and extension officers to farm. The results also portray that cultivation is time consuming as supported by 42.00% of the farmers.

The findings presented in Table 4.2 elucidate the direct, operational disruptions that poor road infrastructure imposes on the actual cultivation phase of the agricultural cycle in Bumban Section. The data reveals a critical shift from the pre-cultivation risk aversion (discussed previously) to active, on-farm inefficiencies. With 58.0% of farmers citing a "low scale of production and productivity" and 42.0% noting that "cultivation is time-consuming," the research highlights how bad roads act as a frictional drag on both the extensiveness (scale) and intensiveness (timeliness/productivity) of farming operations.

The high prevalence of low scale of production (58.0%) as a direct consequence of road conditions during cultivation supports the hypothesis of localized input market failure. In agronomic terms, optimal yields are highly dependent on the precise, timely application of inputs such as fertilizers, herbicides, and water. As the findings suggest, farm input delivery delays caused by poor roads mean that cultivation is often executed without the necessary complementary inputs. When farmers cannot guarantee that external inputs will arrive when needed, they rationally restrict their area of cultivation to a manageable size that relies on lower-risk,

traditional methods. Furthermore, the difficulty in commuting labor and extension officers creates an artificial labor scarcity and a knowledge bottleneck. Without adequate labor, expanding the scale of cultivation is physically impossible; without extension officers, the technical application of inputs is suboptimal, directly depressing productivity per hectare (Dercon S *et al.*, 2009).

Equally significant is the finding that 42.0% of farmers find cultivation excessively time-consuming. In agricultural economics, time is not merely a metric of labor effort; it is a critical determinant of economic viability. The excessive time burden reported in Bumban is likely a composite of increased travel time for workers traversing bad roads and the physical time lost navigating vehicles or portage through degraded terrain to deliver inputs to the farm. This aligns with the concept of "effective labor" depreciation. When laborers spend disproportionate amounts of time simply reaching the farm or transporting minimal amounts of inputs due to impassable roads, the actual time spent on productive cultivation activities (plowing, planting, weeding) is drastically reduced (Gwilliam K, 2011).

This temporal friction has severe implications for smallholder profitability. If cultivation becomes overly time-consuming, the opportunity cost of farming increases. Farmers may miss optimal planting windows – a critical factor in rain-fed agriculture like Sierra Leone's – leading to poor germination and lower yields. Consequently, the road network in Bumban is not just a post-harvest transportation issue; it is an active impediment to the cultivation process itself. The bad road inflates the transaction costs of *doing* the work, thereby shrinking the optimal scale of production and destroying the temporal precision required for high agricultural productivity.

3.4.3 Effect of Access to Farm on Cultivation in Bumban Section

Table 4.3: Distribution of Ways of Access to Farm for Cultivation in Bumban Section

Ways of Access to Farm for Cultivation		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Walk on foot	36	67.9	72.0	72.0
	Motorbike	14	26.4	28.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

In the Table 4.3, distribution of ways of access to farm for cultivation in Bumban section is given. It is revealed that majority (72.0%) of the farmers walk on foot to the farm for cultivation. This is often not of choice but because of the rugged road surfaces. Commuting to farm by motorbikes can be afforded by some farmers; this is shown by 28.0% of them. Delay in reaching the farm for daily operations is eminent from this report and this would imply less work coverage per day due to longer time expended in commuting and bodily exhaustion in commuting.

The findings presented in Table 4.3 regarding modes of farm access in Bumban Section underscore a critical, often understated, dimension of rural agricultural vulnerability: the physical taxation of the agricultural labor force. The data revealing that an overwhelming 72.0% of farmers walk to their farms – compared to only 28.0% utilizing motorbikes – highlights a severe deficit in rural transport mobility. Crucially, as the findings note, this is not a mode preference but a spatial coercion dictated by "rugged road surfaces" that render motorized transport economically or physically unviable.

The foregoing has been supported by Porter G, (2002) and Sieber S *et al.*, (2014). In the context of agricultural economics, walking long distances to farms over degraded terrain acts as a "tax" on the farmer's human capital. The finding correctly identifies that this commuting dynamic leads to "bodily exhaustion" and "less work coverage per day." This phenomenon can be conceptualized through the lens of effective labour depreciation. A farmer who spends a significant portion of their caloric energy simply navigating rugged footpaths arrives at the field with depleted physical capacity. Consequently, the actual time spent on critical, value-adding cultivation activities – such as land

preparation, planting, or weeding – is compressed. The labour available for direct agricultural production is fundamentally altered by the friction of the journey, meaning that a day of "work" in Bumban involves significantly less operational output compared to a context where motorized access minimizes transit friction.

Furthermore, the "delay in reaching the farm for daily operations" has profound implications for agronomic timing and farm scale maintenance. In tropical agricultural systems like Sierra Leone's, where the window for optimal land preparation and planting is narrow and dictated by erratic rainfall patterns, daily delays can accumulate into critical missed opportunities. When commuting consumes a disproportionate amount of daylight hours, farmers are forced to either abandon marginal plots – effectively reducing their scale of production – or cultivate their existing lands with suboptimal timing, which directly depresses crop yields.

The stark disparity between the 72.0% walking and 28.0% utilizing motorbikes also hints at emerging intra-community inequalities. Motorcycles have become the de facto "feeder" transport in rural Sub-Saharan Africa because they can navigate degraded roads that four-wheeled vehicles cannot. However, the fact that nearly three-quarters of farmers in Bumban are excluded from this mode suggests a dual barrier: the roads are too degraded even for motorcycles in certain areas, and a significant portion of the farming population lacks the capital to purchase or hire them. This forces the poorest farmers into a physical trap where their own bodies must absorb the shocks of inadequate infrastructure, translating directly into diminished agricultural productivity.

3.4.4 Effects of Road Network on Post-Harvest Practices in Bumban Section

Table 4.4: Distribution of the Ways of Farm-to-Storage/Market Transport

Ways of Farm-To-Storage/Market Transport		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Human Headloads	40	75.5	80.0	80.0
	Motorbikes	10	18.9	20.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

Table 4.3 shows Distribution of the ways of farm-to-storage/market transport in Bumban section. The majority (80.0%) of the respondents indicated headloads, while 20.0% indicated use of motorbikes. While the risks of damages and wastages of farm products associated with use of motorbikes on the bad road terrains – as emanating from accidents – is minimized herein, risks of product loss due to spoilages and theft – owing to product transport delays occasioned by conveyance via headloads – may be heightened. A high risk of post-harvest loss is thus envisaged.

Post-harvest loss reduction activities have a major economic impact and should increasingly become a major focus in development strategies: carefully selected interventions leading to post-harvest loss reductions are likely to be much more cost-effective than investments in additional production. Increasing production implies using scarce and costly resources through intensive farming practices and expansion of cultivated areas. The marginal environmental cost of qualitative and quantitative saving through improved post-harvest techniques is generally much lower than trying to reach the same value through additional production. Post-harvest loss reduction aims at maintaining or optimizing the value of already existing (produced) products through improved and cost-effective conservation and value-addition strategies.

The findings presented in Table 4.3 regarding farm-to-storage and farm-to-market transport modalities in Bumban Section highlight a critical post-harvest bottleneck that severely undermines agricultural productivity. The overwhelming reliance on head portage (80.0%) versus motorized transport (20.0%) illustrates a deeply entrenched "walking world" paradigm in rural Sub-Saharan Africa. While the researcher astutely notes that this modality avoids the immediate physical damages associated with motorcycle accidents on rugged terrains, the shift to human portage introduces a different, yet equally devastating, set of post-harvest risks: spoilage and theft driven by severe transit delays.

In agricultural value chain analysis, the time lag between harvest and appropriate storage or market sale is a critical

determinant of a farmer's net income. The use of headloads inherently limits the volume of produce that can be moved per trip. To transport a commercially viable harvest, a farmer using head portage must make multiple arduous trips over the course of several days. This prolonged transit time creates a severe "headload penalty." Fresh agricultural produce remains exposed to unfavourable environmental conditions – such as heat, humidity, and pests – for extended periods. Consequently, the physiological deterioration of the crops accelerates, leading to high quantitative and qualitative post-harvest losses before the produce ever reaches a storage facility or market point. The foregoing corroborates the findings of Affognon H *et al.*, (2015).

Furthermore, the finding points to the heightened risk of theft. It has been shown (Porter G *et al.*, 2014) that moving small, fragmented loads over long distances and rugged terrain increases the vulnerability of the farmer to opportunistic theft or pilferage. Unlike a motorcycle that can quickly bypass vulnerable areas with a consolidated load, a farmer on foot carrying a headload is exposed to these security risks for a significantly longer duration. This threat not only results in direct loss of produce but also introduces psychological distress, which may further disincentivize surplus production.

The juxtaposition between the 80.0% relying on headloads and the 20.0% using motorbikes also reveals a constrained local transport market. Even where motorcycles are available, the 20.0% usage rate suggests that either the cost of hiring motorbike transport is prohibitively high relative to the expected farm-gate price of the crops, or the road terrain is so degraded that motorbikes are only viable for very specific, smaller loads. Therefore, the rural road network in Bumban effectively traps farmers in a lose-lose post-harvest scenario: they face capital loss and physical damage if they risk motorbikes on bad roads, and they face time-induced spoilage and theft if they resort to headloads. Ultimately, this high risk of post-harvest loss means that the biological productivity achieved on the farm is not translated into economic productivity, keeping the farmers in a state of perpetual food and financial insecurity.

3.5 Effect of Road Network on Farm Products Disposal

3.5.1 Effects of Road Network on Produce Sale

Table 5.1: Distribution of the Effects of Road Network on Farm Produce Sale

Effects of Road Network on Farm Produce Sale		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Damage of perishable goods	35	66.0	70.0	70.0
	Delay in delivery of produce to market	15	28.3	30.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

Table 5.1 shows the distribution on the effects of the road network on farm produce sales by farmers in Bumban Section. It is evident that damage of perishable goods is the most overwhelming outcome as reported by 70% of the farmers. This will lower farmers income as the damaged products will sell for far less than actual market price. There is also a considerable report of delay in delivery of produce to market as reported by 30% of the farmers. This stems from the fact that the farmers have been shown to be constrained on transporting products from farm to storage/market.

The findings presented in Table 5.1 elucidate the terminal, yet most economically damaging, phase of the agricultural value chain in Bumban Section: the intersection of poor road infrastructure and market realization. The data indicating that 70.0% of farmers suffer the damage of perishable goods, alongside 30.0% experiencing significant delays in delivery, demonstrates a profound market failure driven by infrastructural deficits. These figures are not merely logistical statistics; they represent a direct erosion of agricultural value and household income.

The overwhelming prevalence of perishable goods damage (70.0%) highlights a critical mismatch between the biological nature of local crops and the physical capacity of the transport network. In rural smallholder economies, perishables – such as fruits, vegetables, and certain root crops – often serve as high-value cash crops that can generate necessary disposable income. However, as Affognon H *et al.*, (2015) note in their systematic review of sub-Saharan post-harvest systems, the lack of adequate transport infrastructure severely compromises the physical integrity of highly perishable goods, leading to massive qualitative and quantitative losses. In the context of Bumban's rugged road network, the constant vibration,

jolting, and handling required to move goods over degraded terrain accelerate physical bruising and mechanical damage. Consequently, farmers are forced to sell damaged produce at heavily discounted prices, capturing only a fraction of the actual market value, which effectively penalizes them for engaging in market-oriented agriculture.

Furthermore, the 30.0% reporting delivery delays represents a severe temporal friction that restricts market penetration. As established in the prior findings regarding the heavy reliance on head portage (80.0%), the time required to move goods from farm to market is severely inflated by the poor road network. Porter G *et al.*, (2014) argue that transport delays in rural Africa act as a regressive tax on smallholders, fundamentally undermining their ability to compete in dynamic markets. When delivery is delayed, farmers miss optimal market days when demand and prices peak. Moreover, for perishable goods, extended transit times exacerbate physiological deterioration and spoilage. The delay effectively shifts the bargaining power entirely to middlemen or consumers, who exploit the farmer's urgency to dispose of degrading produce.

Ultimately, these findings reveal how a bad road network severs the link between gross agricultural output and net economic return. Even if farmers in Bumban Section manage to navigate pre-cultivation risks and on-farm labor constraints to achieve a successful harvest, the degraded road network ensures that a significant portion of that harvest is transformed from a high-value asset into a low-grade, damaged commodity before it reaches the consumer. Breaking this cycle of value destruction requires targeted infrastructural interventions that specifically address the friction points of rural feeder roads, thereby protecting the quality of perishable goods and ensuring timely market access.

3.5.2 Effect of Road Infrastructure on Disposable Units

Table 5.2: Distribution of Effects of Road Infrastructure on Disposable Units of Farm Products

Major Disposable Unit Determinants		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lack of efficient means of transportation	27	50.9	54.0	54.0
	Low farm productivity	23	43.4	46.0	100.0
Missing System		3	5.7	—	—
Total		53	100.0	100.0	

Data source: *Researcher's field survey, 2024*

The distribution of effects of road infrastructure on disposable units of farm products is presented in Table 5.2. It can be seen that lack of efficient means of transportation, recorded by 54.0% of the farmers, occurs as a slightly higher major disposable unit determinant over low farm productivity, which is indicated by 46.0% of the farmers. The aggregate effect of these two undesirable effects on these resource poor farmers is a less-than-marketable products delivery to market, overtly occasioning lower incomes.

The findings presented in Table 5.2 offer a compelling empirical insight into the hierarchy of constraints facing smallholder farmers in Bumban Section. By demonstrating that "lack of efficient means of transportation" (54.0%) slightly edges out "low farm productivity" (46.0%) as the primary determinant of disposable farm units, the data challenges traditional, production-centric paradigms of agricultural development. It underscores a critical reality in rural Sub-Saharan Africa: the conversion of on-farm biological yield into economically viable, marketable surplus is frequently more constrained by infrastructural deficits than by inherent agronomic failures.

The narrow margin between these two variables (54.0% versus 46.0%) indicates a deeply intertwined "push-pull" dynamic of deprivation. Low farm productivity sets a low ceiling on the total volume of crops available for disposal. However, even the limited volume that is successfully harvested is further decimated by the lack of efficient transportation, which restricts the physical amount of produce that can be moved to market centers. As Gollin and Rogerson (2010) posit, in environments characterized by high transport costs and poor infrastructure, the effective marketable surplus of a farm is not dictated by what the land yields, but by what can be profitably transported. Consequently, farmers in Bumban are caught in a vise; they cannot produce enough to absorb high transport losses, and the high transport losses ensure that what they do produce fails to meet the threshold of "marketable" delivery, ultimately resulting in sub-optimal incomes.

Furthermore, the finding that these twin constraints result in "less-than-marketable products delivery" highlights the concept of economic exclusion from formal markets. When farmers are forced to rely on inefficient transport – such as head portage over rugged terrains, as established in prior findings – the cost per unit of transported good escalates exponentially over distance. This inflation of transaction costs means that farmers may only be able to transport small, fragmented quantities that do not justify the time and labour investment, or they are forced to sell at the farm-gate to predatory middlemen at heavily discounted prices. Binswanger-Mkhize H P *et al.*, (2010) emphasize that high transport friction effectively shrinks the geographic radius of a farmer's market participation, trapping them in localized, low-demand environments where they are price-takers rather than price-makers.

In the context of Bumban Section, the aggregate effect is a systemic suppression of agricultural income. The resource-poor farmer is effectively taxed twice: first by the natural or input-constrained limitations on their yield (46.0%), and second by the infrastructural inability to efficiently evacuate that yield to higher-paying markets (54.0%). For these farmers, improving agricultural productivity through extension services or improved seeds will yield negligible income improvements if the 54.0% transport constraint is not simultaneously addressed. The data clearly illustrates that in Bumban, the pathway to higher disposable income requires treating rural road infrastructure not as a supplementary amenity, but as a primary factor of agricultural production and market integration.

4.0 CONCLUSION

4.1 Summary

The study and the research problem sought to establish how farmers are affected by road network inadequacies impacting on productivity levels. Findings of the study are here revealed:

4.1.1 Demographic Characteristics of the farmers in Bumban section

The study revealed that females are overwhelmingly involved in farming than males. By marital status distribution, it was also shown that married women are the greatest proportion of the farmers. It is eminent that that a majority of the farmers are adult farmers, while all of the farmers are within the working age of the Sierra Leone population. Further, the none-educated accounted for the greater percentage of the farmers. These findings, except for the dominance of married women in farming, were discussed as pointers to low farm productivity.

4.1.2 Challenges Related to Road Infrastructure and Distance Influencing Agricultural Productivity in Bumban Section

The study revealed that the farmers are faced by a number of road network challenges including: The roads (predominantly feeder roads) used by all commuters are mostly laterite and prone to rapid damages. The selling problems of produce, and predominant use of domestic tools were the outstanding factors of low farm productivity eroding the impetus to invest on road network; they outweighed that caused by bush fires. When compared, lack of support from government is shown as most outstanding over low farm yield as cause for prevalence of poor road network. Further, lack of efficient means of transportation and low farm yields were also seen as reinforcements to poor road network. Majority of the farmers also traverse long farm-to-road distances, mostly between 3-5km and some even beyond, a cause for drudgery. There is the high transport cost to contend with in all instances of agricultural transportation.

4.1.3 Effect of Road Infrastructure on Pre-Cultivation, Cultivation and Post- Harvest Practices Decision and Practices in Bumban section

Accidents and high costs of transportation were shown to be major determinants of pre-cultivation decisions and practices and were considered as crucial factors negatively impacting scale of operations and the timeliness thereof.

Damage of perishable goods and delay of delivery of farm products to market were identified as key contributors to level of farm products sales, all owing to poor transportation provisions. And compounded with low farm productivity, that reinforces smaller marketable/disposable units.

4.2 Researcher's View Point

Despite being agriculturally endowed, Bumban Section succumbs to low agricultural productivity and non-commensurable returns to farming owing the tolling effect of: poor road network; inadequate transport road transport options, aging farming population; and inadequate pre-

cultivation, cultivation, post-harvest and marketing decision determinants therein.

6.3 Recommendations

To significantly improve agricultural productivity in Bumban Section, rural road network must be treated as primary factor of production rather than a supplementary amenity. The researcher recommends that the government (both central and local) and stakeholders shift from simply establishing roads to actively upgrading and maintaining them, specifically by paving critical laterite arteries, improving feeder-to-highway connectivity, and extending access directly to the farmgate. These targeted infrastructural interventions will lower transaction costs, protect perishable goods from value destruction, and provide farmers with the psychological security needed to confidently invest in scaling their production, ultimately leading to higher disposable incomes and sustainable agricultural commercialization.

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