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Research Paper

The Effect of Rural Social Infrastructure on Productivity and Profitability of Crop Production. A Case Study of Cassava Farmers in Edo State, Nigeria

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The dearth of infrastructural facilities in rural communities continues to impede on agricultural productivity, thereby complicating income generation and profitability of the rural farmers. This study examined the effect of rural infrastructures provided by CSDP in rural communities on the productivity and profitability of cassava farmers in Edo State, Nigeria. The data used in the study were obtained from a cross-sectional survey of cassava farmers in the state. A multi-stage sampling procedure was used to select 479 farmers for this study. The data collected were analyzed using descriptive statistics, gross margin analysis, profitability ratios, productivity ratios and t-test statistics were used to test for significant difference. The study showed that Land productivity and labour productivity were significant ($p<0.05$). The net farm income per hectare was significant at $p>0.05$ level. The finding of the study showed that rural infrastructure was not only beneficial to the cassava farmers but also improved on their productivity and profitability. It is therefore recommended that social infrastructures such as healthcare centres and boreholes should be built more in farming communities as these increases the efficiency of the farmers and also improved on their profitability

Keywords: Rural infrastructure, Healthcare centres, boreholes, Profitability, Productivity, Communities, Cassava, Social Development

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INTRODUCTION

Rural Infrastructure is seen as the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies, healthcare centres, and schools) needed for the operation of a society or enterprise. Infrastructure growth and development has ever been a continuous, though with high need of attention especially in developing countries like Nigeria which are mostly made of agrarian communities. Agriculture has continued to be a major driver of the economy of the third world or developing nation. It employs between 60 and 75% of the labour force in the continents and accounts for 4% of global gross domestic product (GDP) and in some least developing countries, it can account for more than 25% of GDP (WorldBank, 2022).

It is believed that since the majorities of the people in most developing countries live in rural communities and are engaged in agricultural production or agriculture related activities, agriculture is the most effective way to reduce poverty through effective and sustainable income generation. The dearth of infrastructural facilities in rural communities continues to impede on agricultural productivity, thereby complicating the poverty status of the rural farmers as a result of poor income generation. For agriculture to be effective in reducing poverty, sustained income generation and food

security, rural social infrastructure must be provided as this will help to raise their current production effort for optimum results (Emokaro and Oyoboh, 2016).

Agricultural productivity is considered to be the result of more efficient use of the factors of production. The ability of a farm manager to convert inputs into outputs via a given technology is often influenced by "exogenous variables" that characterize the environment in which production takes place, (different names have been used in the economic literature for exogenous variable, such as environmental variables, Z – variables and determinants of inefficiency (Coelli *et al.,*2005). Thus, the accurate measurement of the economic performance of the crop farms demands an understanding of differences in the working environment. Apart from socioeconomic characteristics which may contribute to the farmers' inefficiency, the environment in which production takes place is also a factor. Some of this environmental factor is the infrastructural backbone of the farming community.

Productivity is seen in economics as "output per unit of input" and the improvement in agricultural productivity is considered to be the results of more efficient use of the factors of production. Productivity of land is a very important factor of agriculture because it is the most permanent and fixed factor among the three categories of input, "land, labour and capital" Ogieriakhi and Emokaro, 2018).

Productivity of land may be raised by applying input packages consisting improved seeds, fertilizers, agro-chemicals and labour intensive methods, creation of physical infrastructure, like irrigation also help to increase the land productivity. Productivity of labour may be expressed as the man hours or days of work needed to produce a unit of output. Labour productivity is measured by the total agricultural output per unit of labour. It relates to the single most important factor of production. Productivity of labour is greatly affected by the health status of the labour. There is a correlation between the health status of the labourers and output.

Idachaba,Umubese, Mabawonku and Adegboye(1980) identified health facilities, education facilities,and rural utilities such as water and electricity supply as Rural Social Infrastructure (RST). One of the growing concerns of researchers in agricultural economics is to capture the value of the contribution of these infrastructures to the production process. Many have argued that it is an indirect contribution while others argued otherwise. Oghenekohwo2014; Emokaro and Oyoboh 2016; Peter 2018) in their works submitted that there was a significant relationship between agricultural productivity and rural development through the provisions of infrastructure.

Edo state is made up of mostly agrarian communities, which cultivate arable crops such as maize, yam, and cassava amongst others. Interestingly, Cassava is one of the dominant arable crops grown across the three agro –ecological zones of the State. Because of its economic potential and foreign exchange value, it is sometimes termed "White Gold".

To this end, this study carried out a comparative analysis of cassava farmers living in communities with infrastructures as provided by the Community and Social Development Projects. The CSDP is a poverty reduction program targeted at the rural communities through provision of social infrastructure. It is expected that these infrastructure will have a positive effects on the productivity and profitability of the farmers in selected communities of the state. The specific objectives are to:

1. ascertain the benefits of these infrastructures to the farmers
2. estimate the profitability of the Cassava farmers in the study area
3. determine the Land and labour productivity of the Cassava farmers

METHODOLGY

Study Area: This study was carried out in Edo State and covers two local governments each per three agro ecological zones of the State. The zones include Edo North zone consist six LGAs namely Owan West, Akoko-Edo, Etsako West, Etsako East, and Etsako central; Edo Central has five LGAs namely Esan central, Esan West, Esan North-east, Esan South east and Igueben; Edo South has seven blocks namely Oredo, Ovia Southwest, Ovia Northeast, Ikpoba-Okha, Egor, Uhunwode and Orhionwon. Edo State lies approximately between Longitudes 6^{o} 04' E and 6^{o} 43' E of the Greenwich Meridian and Latitudes 5^{o} 44' N and 7^{o} 34' N of the Equator. It is bounded in the South by Delta State, in the North by Kogi State, in the East by River Niger and in the West by Ondo State.

Sampling Procedure and Size: A multi-stage sampling procedure was used to select the respondents for this study. The first stage involved a reconnaissance survey to obtain a sampling frame of CSDP beneficiary and non-beneficiary Local Government Areas in Edo State based on the poverty endemic areas according to CSDP poverty mapping of the State. The second stage involved the purposive sampling of two LGAs from the 3 agro-ecological zones of Edo State, where CSDP projects have been executed; giving a total of 6 LGAs for the study. The third stage involved the simple random proportionate sampling of 2/3 of the 119 beneficiary communities in the CSDP intervention LGAs in the State. This is in consonant with Foot (2008) that explained that 2/3 of a population in any research represent the

population characteristics. This gave a total of 80 communities as a treatment block. The fourth stage involved a purposive sampling of 80 non-benefitting contiguous counterfactual communities from the selected LGAs in the State. This selection was based on communities with similar socioeconomic attributes with the beneficiary communities serving as the control block. The essence of this is to have a counterfactual effect from communities as close to benefitting communities as possible. A valid counterfactual must have identical observed characteristics to the intervention participants with the only difference being programme participation. For this study, the observed characteristics included the socio-economic and farming system characteristics of the households. This gave a total of 160 communities for the study. The last stage involved a simple random sampling of 245 farmers from CSDP beneficiary communities and 234 farmers from non-beneficiary communities.

Data Collection: In generating data for this study, primary data were obtained with the aid of a structured questionnaire. Secondary data were obtained from the monitoring and evaluation data sets of the Edo State office of the Community and Social Development Projects (CSDP)

Analytical Techniques: Four point rating scale scored as 1=Not beneficial, 2=slightly beneficial, 3=beneficial and 4=highly beneficial. ($\bar{x}$>2.5=Beneficial) was used to determine the perceived benefits of CSDP projects on the communities.

The profitability of farmers in beneficiary and non- beneficiary communities were analyzed with budgetary analysis such as gross margin, net farm income and return on investment was used.

Gross margin (GM) =TR-TVC …………………………………………………. .(1)
Net Farm Income (NFI) = TR-TC or GM-TFC ……………………………………. (2)
Return on Investment (ROI) =NFI/TC……………………………………………… (3)

Where TR= Total Revenue; TC= Total Cost; TVC= Total Variable cost; TFC=Total Fixed Cost
The t-statistics was used to compare the profitability levels of both groups to know whether there is a significant difference between them.
Land and labour productivities of cassava farmers in CSDP beneficiary and non-beneficiary communities was done by using the formula given below as used by Ogieriakhi and Emokaro (2018).

Land Productivity = Crop yield (kilogram)/Total Land Area (Hectares)……………… … (5)
Labour Productivity =Crop Yield (kilogram)/Total Labour (Man-days)………………… (.6)

The t-statistics was used to compare the productivity levels of both groups to know whether there are significant differences between them. According to Kothari and Garg (2014), the t-statistics is expressed as;

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where $\bar{x}_1$ =average land and labor productivities level of cassava farmers in benefiting community
$\bar{x}_2$ = average land and labor productivities level of cassava farmers in non-benefiting community
S_1^2 = the variance of farmers in benefiting communities
S_2^2 = the variance of farmers in non-benefiting communities
N_1 And N_2= the sample sizes for farmers in benefiting and non-benefiting communities respectively.

Results and Discussion

Table1. Benefits of micro-projects on cassava farmers

Benefits	Mean	Std. Deviation
ELECTRICITY		
Reduce workload on milling cassava	3.16	0.371
improve safety in the community	3.30	0.460
improvement in quality of life	3.31	0.495
Access to information electronic media	3.32	0.471
Reduction in rural-urban migration	3.35	0.481
use of electric motor to sharpen farm implements	3.31	0.466
HEALTHCARE CENTRES		
Quick treatment for illness	3.14	0.378
children get immunized easily	3.14	0.378
Reduction in infant mortality	3.14	0.378
Reduction in maternal mortality rate	3.14	0.378
Firs aid treatment in case of injury	3.14	0.378
Easy access to drugs	3.14	0.378
SCHOOL BUILDINGS		
Ability to read and apply chemical fertilizers, pesticides and herbicides	3.39	0.495
Increase in school enrolment	3.37	0.489
Increase capacity to understand extension agent	3.32	0.471
Taking decision on modern farm practices	3.26	0.446
Proximity to school for children	3.24	0.431
BOREHOLE PROJECT		
Adequate water for bathing and washing farm implements	3.31	0.468
Reduce time in going to the stream to fetch water	3.31	0.468
safe drinking water	3.27	0.449
Adequate volume of water to maintain farming implements	3.23	0.425
Reduction in number of cases of water borne diseases	3.21	0.410
Easy access to water	3.17	0.377

Significant benefit (≥2.5)
Source: Field survey, 2021

Electricity project

Table 1 show that reduction in rural – urban migration with a cumulative mean of (3.35) and standard deviation of (0.48) was the highest benefits derived from the electrification projects to communities and farmers. Other benefits include access to information on electronic media with a mean (3.32) and standard deviation (0.47), improvement in safety and quality of life ranked 3rd with a mean of 3.30 and standard deviation (0.46) and (3.31) and standard deviation of 0.49 respectively. The benefit from the reduction in rural – urban migration is critical because with reduction in rural – urban migration, the implication is that more young men and women will be available for labour in the communities. This has the capacity to increase labour productivity and eventually greater output

Healthcare centres

As shown in table, benefits from the healthcare centres included quick treatment for illness, first aid treatment in case of injury and easy access to drugs with a mean value (3.14) and standard deviation of(0.38). Reduction in infant and maternal mortality rate and immunization of children were among the benefits derived from the provision of healthcare centres in the communities. This result points out that all the farmers benefited from the provision of the healthcare facilities. As pointed out by the World Bank (2007), illness and death from HIV/AIDs, malaria, tuberculosis and other diseases reduce agricultural productivity the loss of labourers; certainly the provision of these healthcare centres in these rural communities will improve productivity.

Education Facilities

Some accrued benefits of the educational facilities; taking lead is the ability to read and apply chemical fertilizer, pesticides and herbicides (3.39) and standard deviation of (0.49). Increase in school enrolment (3.37 ± 0.48) and increased capacity to understand extension agent (3.32 ± 0.47). Other benefits included ease of taking decision on modern farm practices (3.26 ± 0.44) and proximity to school for children (3.24 ± 1.43).

According Oduro-ofori *et al*. (2014), the productive value of education has two main effects on agriculture, "workers effect and allocative effect". Worker effect is described as the situation whereby an educated farmer, given the same number of input can produce a greater output that is a better use of current resources. It is seen as increased output per unit change in education holding all other factors constant. With allocative effect, a worker is able to acquire information about cost and characteristics of inputs and interpret the information to make decisions that will enhance output. Ninh (2021) concluded that the positive and significant coefficient between farm size and education variables divulges the economic value of education since it is able to improve output and thus income of farming households. It is evident that the ability of the rural farmers to read and write enhanced their productivity which in turn increased profitability.

Borehole projects

The result shows that water project was also very beneficial to the communities. It reduced time in going to the stream to fetch water and ensured adequate volume of water to maintain farming implements had a mean of 3.31 and standard deviation of 0.47. Safe drinking water (3.27 ± 0.45) and reduction in number of cases of water borne diseases (3.21 ± 0.41) were some of the other benefits of the water project to the farming communities.

This result agrees with Emokaro and Oyoboh (2016) who reported 61% reduction in cases of water borne disease and 65% easy access to portable water in communities where borehole projects where sited by the CSDP. These benefits helped in improving labor productivity.

Table 2. Costs, Returns and Profitability Structure of Cassava production in the Study Area

	Average per Farmer		**Average per Farmer per Ha**	
	Non-beneficiary	**Beneficiary**	**Non-beneficiary**	**Beneficiary**
	Mean	**Mean**	**Mean**	**Mean**
Farm size (ha)	**0.78**	**0.85**	**0.78**	**0.85**
Labour(man-days)	**28**	**27**	**28**	**27**
INCOME				
Cassava output (kg)	6,996.58	7,656.47	8,969.97	9,007.61
Cassava (price / Kg)	90.17	92.42	90.17	92.42
Total sales (₦)	**630,881.62**	**707,610.96**	**808,822.59**	**832,483.48**
VARIABLE COSTS				
Cassava cuttings(₦)	44,851.28	50,789.39	57,501.64	59,752.22
Fertilizer(₦)	43,452.99	45,551.02	55,708.96	53,589.44
Chemicals(₦)	20,547.01	22,125.71	26,342.32	26,030.25
Labour(₦)	67,504.29	69,026.53	86,543.96	81,207.68
Land rent(₦)	31,841.88	36,455.10	40,822.92	42,888.35
TVC	**208,197.45**	**223,947.75**	**266,919.80**	**263,467.94**
FIXED COSTS				
Depreciation(₦)	6,594.44	6,571.02	8,454.41	7,730.61
TFC	**6,594.44**	**6,571.02**	**8,454.41**	**7,730.61**
TC	214,791.89	230,518.77	275,374.22	271,198.55
GM	422,684.17	483,663.21	541,902.79	569,015.54
NFI	**416,089.73**	**477,092.19**	**533,448.37**	**561,284.93**
ROI	**1.94**	**2.07**	**1.94**	**2.07**

**T-test result: Mean difference =N61,002.42;*
T value = 1.83; df = 477; prob. Level = 0.07 (NOTE: Not significant at 5% but significant at 10%)
Source: Field survey, 2021

The gross margin and profitability ratios are presented in Table 2 The gross margin value of ₦422,684.17 and net farm income (NFI) of ₦416,089.73 per farmer were estimated for non-beneficiary communities while the beneficial communities had a gross margin of ₦483,663.21 and NFI of ₦477,092.19 per farmer. These values clearly shows that farmers from beneficiary communities had ₦61,002.42 in revenue more than their counterpart in non-beneficiary communities. The mean difference in revenue was tested and was significant at 10% probability level. This implies that farmers in beneficiary communities earned more income from cassava production than their counterpart in non-beneficiary communities and that extra income improved on their profitability.

The profitability ratio showed return on investment of 1.94 and 2.07 for non-beneficiary and beneficiary communities respectively. This ratio revealed that for every N1 invested by the farmers in communities with infrastructure, they earned N1.07 as compared to their counterparts in the other communities without such infrastructure that earned only N0.94 for every N1 invested. The profitability ratios also showed a mean difference of □ = 0.13, which is significant at 10% probability level. This suggests that the farmers' better performance may have been as a result of the better conducive environment made possible as result of the rural social infrastructure they enjoyed.

Table 3. Land and Labour productivity of Cassava Farmers

	Non-beneficiary(n=234)		**Beneficiary(n=245)**	
	Mean	**SD**	**Mean**	**SD**
Farm Size(hectares)	0.78		0.85	
Labour(man-days)	27.85		26.91	
Cassava output(kg)	6996.58		7656.47	
Land productivity(kg/ha)	**8969.97**	909.4	**9007.62**	1074.3
Labour Productivity(kg/man-days)	**251.22**	54.6	**284.52**	71.7

Source: Field data, 2021

Table 4. Test of Difference of Land and Labour productivities between Cassava Farmers in both communities

	Non-beneficiary mean	**Beneficiary mean**	**Difference**	**T-value**	**Prob. level**	**Remark**
Land productivity	8969.97	9007.61	**38.61**	6.07***	P<0.05	Significant
Labour productivity	251.22	284.52	**33.34**	6.05***	P<0.05	Significant

Source: Field survey data 2021

***mean difference significant p<5%

Table 3 and 4 shows that with an average of 0.78 hectares of farm size and cassava output of 6996.58kg the mean land productivities for non-beneficiary farming communities was 8969.97kg/ha with standard deviation of 909.4 while that of the beneficiary farming communities was 9007.61kg/ha with SD of 1094.3 with an average farm size of 0.85 hectares and cassava output of 7656.47kg. Similarly, with an average of 27(man-days) of labour and cassava output of 7656.47kg the mean labour productivity for the beneficiary farming communities was 284.52kg/man-day as against 251.22kg/man-day recorded by the non-beneficiary farming communities with cassava output of 6996.58kg and 28 man-days of labour. The result showed remarkable difference. The values from Table 4 shows a mean labour productivity of (□ = 251.22 ± 54.6) for non-beneficiary farming communities and (□ = 284.52 ± 71.7) for beneficiary farming communities. Likewise the mean land productivity of (□ = 8969 ±909.4) for non-beneficiary communities and (□ =9007±1094.3). The mean differences were all significant at 5% probability level. This implies that farmers in the beneficiary communities had greater land and labour productivity. Improvement in labour productivity could be attributed to presence of the social infrastructure they enjoyed in the communities, *ceteris paribus.*

CONCLUSION

The finding of study showed that rural infrastructure was not only beneficial to the cassava farmers but also improved on their productivity and profitability. It is therefore recommended that electricity, Education facilities, healthcare centres and boreholes should be built more in farming communities as these increases the efficiency of the farmers and also improved on their profitability

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