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ASSESSMENT OF COMMUNITY DRIVEN DEVELOPMENT PROJECTS ON THE TECHNICAL EFFICIENCY OF CASSAVA FARMING COMMUNITIES IN EDO STATE, NIGERIA

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ABSTRACT

Community Driven Development (CDD) is an approach to implementing local development projects that advocates for community participation in decision-making and management with a goal of using knowledge and resources to run more effective projects. This study, therefore, assesses the social infrastructure facilities of the CDD on the technical efficiency of cassava farming communities in Edo State. 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 245 farmers for this study. The sampled farmers consist of 245 cassava farmers from Community and Social Development Projects (CSDP) beneficiary communities. The Stochastic Frontier Production Function (SFPF) was used to analyze the data. Regression modeling result showed that farm size (b = 1.436), labour (b = 0.143) and cassava cuttings (b = 0.301) were significantly ($p<0.05$) and positively affecting the output of cassava among farmers in the beneficiary communities and recorded higher technical efficiency of 96.5%. Healthcare centres (d = -0.181) and water projects (d = -0.009) contributed 18.1% and 0.9% respectively to technical efficiency of the farmers. Thus, the study recommends that Healthcare centres and water projects should be extended to more farming communities as these increases the efficiency of the farmers. The CDD approach adopted by the CSDP should also be adopted by the State and Local Governments in project execution in the State because bottom – up approach of the CDD gives better access to projects.

Keywords: social infrastructure; productivity; technical efficiency; stochastic frontier

INTRODUCTION

In recent years, Community Driven Development (CDD) has become the tool employed by both Governments and multilateral development partners, like the World Bank. This increased investment in CDD has been driven mostly by a demand from donor agencies and developing countries for huge, bottom-up and demand-driven, poverty reduction projects that can increase the institutional capacity of small communities for self –development and improvement. The success and scale of some CDD projects in the World Bank are especially notable.

Asian Development Bank (2011) recognizes the importance of CDD in promoting economic and social development. The Asian Development Bank's Long Term Strategic Agenda or Strategy 2020, which reiterates its commitment to promoting inclusive growth in Asia and the Pacific, places CDD at its core. As strategy 2020 is anchored on inclusive growth, the CDD approach is highly relevant by ensuring that poor communities benefit from and participate in development effort (Elekwa and Eme, 2013).

The Federal Government of Nigeria (FGN) and the World Bank (WB) agreed on the desirability of CDD approach adopted by the CSDP in the overall strategy for rural community development and poverty reduction in the country. The Community and Social Development project (CSDP) emerged in 2009 as a new intervention that was designed to effectively target social and environmental infrastructure at the community level. It is primarily targeted towards the rural poor groups; with projects focused on seven sectorial areas of intervention namely, Education, Health, Rural electrification, Water, Transportation, socio-economic development areas and Environment/Natural resources.

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 accounting for 4% of global gross domestic product (GDP) and in some least developing countries, it can account for more than 25% of GDP (World Bank, 2022). There is a school of thought that argue that since the majority 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. For agriculture to be effective in reducing poverty, rural social infrastructure must be provided as this will help to raise their current production effort for optimum results (Emokaro and Omoregbee, 2011).

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). Eweka (2021) opined that Farming communities with social infrastructure had higher land and labour productivity compared to the communities without such facilities *ceteris paribus.* Thus, the accurate measurement of the economic performance of the crop farms demands an understanding of differences in the working environment.

The environmental factors include farm – specific factors such as management skill, institutional constraints and attitude to risk, or innovations that are unmeasured but can be partially represented by observable variables such as age, experience, participation in farm improvement programs and education. Environmental variables can be expected to provide farmers with various types of opportunities and challenges, which ultimately affect their technical efficiency. In this regard, infrastructural facilities, such as electricity, water, schools and health centres also characterize the environment in which production takes place. Idachaba *et al.* (1980) identified health facilities, education facilities, and rural utilities such as water and electricity supply as Rural Social Infrastructure (RST).

In a study conducted on farmers' health and agricultural productivity in rural Ethiopia, Ulimwengu (2009) concluded that in rural communities, poor heath reduces farmers' income and efficiency. He further suggested that investing in the health sector in rural areas will increase not only efficiency and income but also the rate of return on other investments.

Similarly, Peter (2018) concluded that infrastructure enhances rural transformation. These measures are intrinsically related; productivity is reduced in the presence of inefficiency, whereas the more efficient a firm is, the higher the productivity, ceteris paribus (Ogieriakhi and Emokaro, 2018).

Incidentally, Edo state is one of the participating States in the FGN/WB sponsored Community and Social Development Project and predominantly made up of agrarian communities, which cultivates arable crops such as maize, yam and cassava amongst others. Hence, it is expected that an increased and efficient production of this crop in an environment with adequate social infrastructure could be useful in enhancing the efficiency of these farmers. This study assesses the CDD projects on the technical efficiency of cassava farming communities in Edo State.

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. Edo State lies between Latitudes 5º 44' N and 7º 34' N and between Longitudes 6º 04' E and 6º 43' E. 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

Prior to commencement of the data collection, a reconnaissance survey was conducted with a view 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.

A multi-stage sampling procedure was used to select the respondents for this study. The first stage involved the purposive sampling of two LGAs from each of the 3 agro-ecological zones of Edo State, where CSDP projects have been executed; giving a total of 6 LGAs for the study. The second stage involved the simple random proportionate sampling of 2/3 out 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 third stage and last stage involved a simple random sampling of 245 farmers from CSDP 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).

The stochastic frontier production function and cost function were used to estimate the technical efficiency of both farmer groups.as stated:

$$Yi=\beta o+X\beta i+v_i-\mu_i \quad \ldots (1)$$

Where Y_i = output of cassava farmers in Kilograms, X is the vector of inputs used, βi are the estimated parameters and v_i = stochastic error term and μ_i=estimate of technical inefficiency.

Technical Efficiency (TE) = $X\beta i+v_i-\mu_i/ X\beta i+v_i$………………………………………… (2)

The linearized cobb-Douglas production frontier is expressed explicitly as follows:

$lnY=ß_0+ß_1lnX_1+ß_2lnX_2+ß_3lnX_3+ß_4lnX_4+ß_5lnX_5(v_i\mu_i)$………………………………….(3)

Where Y= Output of Cassava (kg)
Ln=natural logarithm
$ß_0,ß_1-ß_5$= unknown parameters
X_1=farm size (hectares)
X_2=labour (man days)
X_3=agro chemicals used (litres)
X_4=cassava cuttings (bundles)
X_5=Fertilizer Used (kg)
V_i=the stochastic error term
μ_i=estimate of technical inefficiency

The technical efficiency lies between 0 and 1. If it is equal to zero, it shows the farmer is not efficient at all, if it is one, it means the farmer is efficient or is on the frontier. However, if it is greater than zero but less than one ($0<TE<1$), it implies the presence of inefficiency.

To know the possible factors causing the inefficiency, the technical inefficiency model is used. In this study, the presence of the four CSDP infrastructures namely electricity, boreholes, education, and health care centres were incorporated as dummy variable into the inefficiency model in addition to other socioeconomic characteristics that may be responsible for the inefficiency.

The technical inefficiency of cassava farmers in CSDP communities.

$\mu_i = \alpha_0+\alpha_1Z_1+\alpha_2Z_2+\alpha_3Z_3+\alpha_4Z_4+\alpha_5Z_5+\alpha_6Z_6+\alpha_7Z_7+\alpha_8Z_8+\alpha_9Z_9+\alpha_{10}Z_{10}$……………………(4)

Where:
μ = Technical inefficiency
Z_1 =Sex of Respondents (dummy .1=male.2=female)
Z_2 =Age (Years)
Z_3 =Household Size (Number of persons living in a house)
Z_4 =Years of schooling (Years)
Z_5 =Marital Status (dummy 1=single, 2=Married,3=separated,4=divorced,5=Widowed)
Z_6 =Farming experience (years)
Z_7 =Electricity (dummy Available=1, Non-available = 2)
Z_8 =Borehole (dummy Available=1, Non-available = 2)
Z_9 =Education facilities (dummy Available=1, Non-available = 2)
Z_{10} =Health Facilities (dummy Available=1, Non-available=2)
α_0, α_1…..α_{10} are unknown parameters to be estimated. We equally estimate the Technical Inefficiency model of farmers in non-benefitting communities as follows:

$$\mu_i = \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 \ldots\ldots (5)$$

Where:
μ = Technical inefficiency
Z_1 =Sex of Respondents (dummy .1=male.2=female)
Z_2 =Age (Years)
Z_3 =Household Size (numbers of persons living in House)
Z_4 =Years of schooling (Years)
Z_5 =Marital Status (dummy 1=single, 2=Married, 3=separated, 4=divorced, 5=Widowed)
Z_6 =Farming experience (years)

RESULTS AND DISCUSSION

The maximum likelihood estimate (MLE) of the stochastic production frontier parameters for cassava farmers in the beneficiary communities of Edo State is presented in Table 1 as well as the inefficiency model in Table 3. The variance parameters for the sigma square (∂^2) give the correctness of fit and the composite error term which is 0.029. The gamma (Ў) estimate for the study is 0.451 or 45.1% which implies that the inefficiency effect makes a relative significant contribution to the technical efficiency of the cassava farmers with stochastic noise contributing 54.9% The results showed that farm size (β = 1.436), labour (β = 0.143) chemicals (β = 0.084), cassava cuttings (β = 0.301) were significant at 5% level. Farm size, labour and cassava cuttings all had positive coefficients, implying that they had positive relationship with output. Thus, an increase in the use of these variables could lead to an increase in the output of cassava production. However, chemical was negatively significant ($p<0.05$) which implies an inverse relationship. A possible explanation for this is that the use of chemical herbicides by smallholder farmers is commonly limited to pre-planting operations, which is clearing of the farm. Also, most farmers still rely heavily on the use of family labour and hired for pre and post planting operations.

The distribution of the technical efficiency range of cassava farmers in the beneficiary communities as in Table 2 showed that 84.49% of the farmers had a technical efficiency of between 0.951-1.000 while 12.65% operated within the range of 0.901-0.950. In the same vein, the distribution of individual technical efficiency indices showed a large variation in the level of efficiency in the sample with individual index estimates ranging from a minimum of 0.740 to a maximum 0.989. The results also indicated the mean technical efficiency at 0.965 in Table 1, implying that production on average is about 3.5% below the frontier (or maximum feasible output). This also means that a proportion of production is lost due to farm – specific technical inefficiency. The variation in the level of technical efficiency suggests the importance of farm specific characteristics such as the nature of technology and other exogenous environmental factors such as provision of rural infrastructure in attaining higher level of productive efficiency.

Table 1: Effect of CSDP on the Efficiency of the beneficiary communities

	OLS				MLE			
Variables	Parameter	Coefficient	S.E.	t-ratio	Parameter	Coefficient	S.E.	t-ratio
Constant	b_0	6.261***	0.26	23.72	b_0	6.552***	0.29	22.87
LNFarm size (ha)	b_1	1.129***	0.28	4.05	b_1	1.436***	0.29	4.91
LNLabour (mandays)	b_2	0.094	0.06	1.54	b_2	0.143**	0.06	2.32
LNChemicals (lts)	b_3	-0.069	0.04	-1.60	b_3	-0.084**	0.04	-2.19
LNCassava cuttings (bundles)	b_4	0.449***	0.10	4.46	b_4	0.301**	0.12	2.61
LNFertilizer (kg)	b_5	0.001	0.01	0.11	b_5	0.003	0.01	0.46
sigma-squared		0.018				0.029	0.01	0.46
Gamma						0.451	0.31	1.46
log likelihood		150.94				156.2		
Mean Efficiency						0.965		
Minimum Technical Efficiency						0.740		
Max Technical Efficiency						0.989		

***, ** and * represent 1%, 5%, 10% significant level respectively

Table 2: Technical efficiency of farmers in the beneficiary communities'

Technical Efficiency (range)	Beneficiary	
	Frequency	%
0.701 - 0.800	3	1.22
0.801 - 0.900	4	1.63
0.901 - 0.950	31	12.65
0.951 - 1.000	207	84.49
Total	245	100.00

The inefficiency model presented in Table 3 shows the estimates for z-variables. The positive or negative sign of the estimates indicates that there is an increase or decrease in technical inefficiency respectively. A negative estimate indicates a positive effect on technical efficiency.

Table 3: Technical inefficiency estimates of the beneficiary communities

Variables	Parameter	Coefficient	S.E	t-ratio
Constant	δ_0	0.082	0.65	0.13
Sex	δ_1	-0.032	0.05	-0.69
Age Years	δ_2	-0.096	0.24	-0.40
Family size No	δ_3	-0.274***	0.07	-4.01
Educational level	δ_4	0.139	0.10	1.35
Marital status	δ_5	-0.564	0.45	-1.26
Experience (years)	δ_6	0.138	0.08	1.74
Electrification project	δ_7	0.003	0.12	0.02
Healthcare centre	δ_8	-0.181	0.14	-1.28
School building	δ_9	0.001	0.07	0.01
Borehole project	δ_{10}	-0.009	0.11	-0.08

***, **,* represent 1%,5% and 10% level of significant

The estimated coefficient (δ= -0.096) for age of the household head is negative which implied that it contributed positively to technical efficiency, implying that older farmers are more efficient than younger farmers. This is because older farmers have more experience and more contacts with extension agents. The finding that age significantly and positively affects technical efficiency is widely reported in findings of other studies in agriculture literature (Abate *et al*., 2019; Asefa, 2011, Ayele *et al*., 2019; Dessale, 2019; Tian *et al*., 2019). Other authors have also reported cases where farmer age might also have a negative impact on technical efficiency here it appears that much older farmers are less willing to adopt new practices and modern inputs than young farmers.

Famer's family size indicated negative and significant result (δ= -0.274). It is usually expected that large family size contributes to the labour needs of smallholder farmers' thereby increasing efficiency. However, the peculiar characteristics of the family such as age can also be a factor. A family with a young population will not have same level of efficiency with a family with an older population even if they have same size of family. Hence, we find in agricultural literature, some reporting positive relationship and others reporting negative. (Abate *et al.*, 2019; Mussa *et al*., 2012; Tchale, 2009) all reported that family size has a positive and significant coefficient with technical inefficiency. However, Asefa (2011) reported opposite results in line with this study.

The result for marital status (δ=-0.564) is negative and significant. It has a positive relationship with technical inefficiency. This implies marital status has got a significant effect on efficiency. This means that married couples were more efficient in the use of resources and had higher output. This infers married couples get support from each other in carrying farming operations. Similar finding was reported by Mukwalikuli (2018).

The provision of healthcare centres (δ= -0.181) is another dummy variable that equals 1 if this is available in the farming communities and 0 otherwise. Healthcare centres have a negative coefficient. This implies that healthcare centres have a positive impact on the technical efficiency of the farmers in the community. This means that availability of the health centre in the communities contributed 18.1% to the efficiency of the farmers. This is expected because the availability and accessibility of farmers to healthcare facilities increases their labour productivity. This finding is in tune with (Ulimwengu, 2009) that concluded that in rural communities, poor health reduces farmers' income and efficiency and suggested that investing in the health sector will increase not only efficiency and income but also return on investment.

The availability of borehole project (δ= -009) has a negative coefficient effect on technical inefficiency. This implies that provision of boreholes in these communities increases their technical efficiency. The availability of borehole project in these communities added a 9% to the efficiency of the cassava farmers. A plausible reason for this could be that citing of boreholes in the communities made access to water easier, as less time will be required to fetch water from the borehole compared to the longer distance trekked to get water from the stream or river. Emokaro and Oyoboh (2016) reported 61 % reduction in cases of water borne diseases, 65 % access to portable water. This improvement will translate to an increase in labour productivity which invariably will translate to increased agricultural production which in turn will increase technical efficiency.

CONCLUSION

The finding of the study showed that the CDD model of development adopted by the CSDP in providing social infrastructure in the communities contributed immensely to the technical efficiency of the cassava farmers.

It is therefore recommended that healthcare centres and boreholes should be built more in farming communities as these increases the efficiency of the farmers. Also, the Community Driven Development (CDD) approach adopted by the CSDP should also be adopted by the State and Local Governments in project execution in the State. This bottom – up approach of the CDD gives better access to projects.

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