



## Impact of Agricultural Technologies on Sorghum Farmers' Livelihoods under USAID MARKETS Programme in Kaduna and Kano states, Nigeria.

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### ABSTRACT

The study assessed the impact of agricultural technologies on sorghum farmers' livelihoods in Kaduna and Kano states, Nigeria. Specifically, the study determined the level of adoption of improved agricultural technologies in sorghum production value chain facilitated by the United States Agency for International Development Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites [USAID MARKETS] programme. Also, the study determined the impact of the technologies on the farmers' income and level of living. Multi-stage sampling technique was adopted to collect data from 237 participating farmers and 237 non-participants. Data were collected with structured questionnaire and analyzed using descriptive statistics and propensity score matching analyses. The findings show that 95 percent of the farmers had high level of adoption of improved technologies. Also, the Average Treatment Effect on the Treated (ATT) of 32483.92 and T-value of 1.730 were obtained for income while the level of living had ATT of 182000 and T = 1.496. Therefore, it can be concluded that the farmers had high level of adoption of improved agricultural technologies with significant impact on their income. But the farmers' level of living was not significantly impacted by the technologies used. Hence, it is recommended that the extension service should be encouraging farmers to always convert some of their incomes to assets so that they build their physical capital stock that can be used to improve their level of living.

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### INTRODUCTION

Despite the various efforts of government to reduce incidence of poverty through different poverty alleviation programmes and strategies and the quest to be one of the 20 largest economies by the year 2020, Nigeria continues to be one of the poorest countries in the world (Adepoju, 2012). However, Nigeria is a country of high potentials for economic development given the abundant natural and human resource endowment in every part of the country. The country obtains most of its revenue from oil and gas while other sectors like

agriculture, industry and service remain largely under exploited.

Agriculture as the main source of livelihood in Nigeria (especially in rural areas) is plagued with various problems (FMARD, 2017). The bright economic prospects in Nigeria lends to the fact that the country is blessed with ecological conditions well suited to agricultural production in which various economic crops can be produced at commercial quantities with favourable competitive advantage. The food and fibre industry in Nigeria despite not receiving the

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attention as required, constitutes the largest GDP contributor to the Nigerian economy.

In response to the poverty and food security situation in Nigeria the government at all levels initiated several projects over the years that were aimed at curbing the scourge of hunger and poverty in the country. The efforts were supported by international agencies like Food and Agriculture Organization of the United Nations (FAO), The World Bank, and International Fund for Agricultural Development (IFAD), and United States Agency for International Development (USAID) among others. The assistance rendered by these organizations has been in the form of capacity building through technical assistance, training, funding and research that help to improve farmers' livelihoods to overcome poverty and vulnerability. A lot of achievements have been recorded from the services provided by these non-governmental foreign organizations as seen by increased awareness and adoption of improved agricultural innovations and technologies. Adoption of improved technologies has been an important determinant of impact of agricultural technologies (Takahashi, Muraoka & Otsuka, 2019; Arslan, Floress, Lamanna, Lipper, Asfaw & Rosenstock, 2020).

USAID MARKETS was launched in Nigeria in 2005 to improve farmers' livelihoods. The programme was carried out in 24 Nigerian states, including Kaduna and Kano states. Since the programme was launched and executed, a lot of resources both human and material were committed until it was closed in 2012 at phase I. Hence, it is necessary to understand what has been achieved in terms of the programme performance towards improving the farmers' livelihoods, the main goal of the programme. The study was therefore carried out for the purpose of assessing the achievement of the programme objectives towards the improvement of livelihoods.

### **Objectives of the Study**

The objectives of the study were to:

1. Identify the level of adoption agricultural technologies among the farmers under the USAID MARKETS programme in the study areas.

2. determine the impact of the improved technologies on the farmers' income and level of living

### **Hypothesis**

There is no significant impact of improved technologies on the farmers' income and their level of living.

### **LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

The study was backed by the theory of sustainable development and specifically on sustainable livelihoods. The sustainable livelihoods (SL) framework was developed by the British Department for International Development [DFID] (DFID, 1999). The framework has been adapted by many development agencies to livelihoods studies especially in rural areas. The Framework can be understood as a tool or checklist to understand poverty in response to poor people's views and their own understanding of poverty.

The SLF shows how sustainable livelihoods are achieved through access to a diverse livelihood assets or resources (natural, economic, human and social capitals) combined in a pursuit of different livelihood strategies (agricultural intensification or extensification, livelihood diversification and migration) (Scoones, 1997, 2009, 2015). These activities are often facilitated by institutions and organizations in the society. The analysis of the range of formal and informal organizational and institutional factors influencing sustainable livelihood outcomes forms the central focus of the framework (Scoones, 2009, 2015). Thus, institutional processes in the form of interventions like USAID MARKETS enhances capacities of the rural communities to make choices in their pursuit of livelihoods by making decisions in their own ways the best livelihood strategies for them with their given resources.

Agriculture and rural livelihoods have received attention in various studies all focused on the agriculture and rural livelihoods globally and in Nigeria. It was reported that Nigeria produced 71% of the total sorghum output of the whole African region, thus making the country the largest producer in the area. The volume of production tells much about the importance of sorghum to rural farmers' livelihoods.

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## METHODOLOGY

The study was conducted in Kaduna and Kano states of Nigeria. Kaduna state is located in the Guinea Savannah zone of Nigeria. It lies between Latitudes and Longitudes  $10^{\circ} 31'$  North and  $7^{\circ} 26'$  East respectively. As home to many diverse ethnic groups, Kaduna State has a total population of 8,849,840 million inhabitants projected with the growth rate of 2.7 percent in 2021; and a total land area of 46,053 km<sup>2</sup>. There are two distinct seasons of the wet and dry, from April/May to September/October and October/November to March/April respectively. This makes the state favourable for the growth of a wide range of different crops like cereals, tuber crops, vegetables and even some tree crops.

Kano state is located in the north western part of Nigeria geo-politically. In ecological terms the state is within Sudan-sahelian zone. Kano state lies between  $8^{\circ} 45' - 12^{\circ} 05'$  East Longitude and  $10^{\circ} 30' - 13^{\circ} 02'$  North of the Equator. Kano state is bounded in the west by Katsina state; in the east by Jigawa and Bauchi states; in the south-west by Kaduna state. Niger Republic bounds Kano state from the northern part. The estimated population of 16,597,774 inhabitants was projected at 2.5% for 2021.

All the sorghum farmers who took part in the USAID MARKETS I intervention programme constituted the population of the study. Three stage sampling was conducted consisting of random selection of (1) local government areas, (2) communities and (3) farmers who served as respondents. First, all the nine (9) participating Local Government Areas (LGAs) from the two states were selected. Six (6) LGAs, purposively selected from Kaduna state and three (3) LGAs from Kano. The selected LGAs from Kaduna state were Giwa, Ikara, Kudan, Lere, Makarfi and Soba and the ones from Kano state were Bebeji, Dawakin Kudu and Kumbotso. The LGAs were purposively selected due to the fact that they were the sites of the operation during implementation stage. Secondly, three (3) communities were randomly selected from each LGA, making 27 communities from which respondents were sourced. Thirdly, the sample of 8 or 9 farmers was drawn from

each community, using simple random sampling technique, making a total of 237 farmers. Similarly, a sample of 237 farmers who were not part of the programme was selected randomly from a list of sorghum farmers to serve as control group.

A questionnaire was administered face to face to the selected farmers by the research assistants in the local language and the responses were recorded in English Language. Descriptive statistics (namely frequencies, percentages, and means) and propensity score matching technique were used to achieve the objectives of the study.

## RESULTS AND DISCUSSION

### *Level of Use of Improved Agricultural Technologies among the Participating Farmers*

Index representing a category in an interval or class was used to determine the farmers' level of use of the improved technologies. The categories, made up of groups of 10 technologies, were ordered from very low to very high showing the degree of use of the technologies by farmers with an index. The level ranged from 2.0 or less (very low) to 8.1 - 10.0 (very high). Sixty four (64) percent of the farmers had the highest level of use of improved technologies (very high), followed by thirty one (31) percent of the farmers having high level of use (Table 1). However, only 2.21 percent and 2.94 percent of the farmers had the least level of use (low and medium respectively). This implies that the level of adoption of improved technologies among the farmers under the programme was very high and that signifies participation in a programme increases (the chances of) adoption level of improved technologies.

Abubakar (2010); Jamilu *et al* (2015); Ugochukwu & Phillips (2018) reported that adoption and use of improved agricultural technologies bring impact of the technologies at farm and household levels. Level of adoption of improved technologies has been hypothesized to be a very important indicator of impact of an agricultural extension programme or project.

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**Table 1:** Level of use of improved technologies on sorghum production

*Technology use Index	Level of use of the Technologies	Frequency	Percentage of farmers	Cumulative percentage
0.0 – 2.0	Very low	0	0.00	0.00
2.1 – 4.0	Low	3	2.21	2.21
4.1 – 6.0	Medium	4	2.94	5.15
6.1 – 8.0	High	42	30.88	36.03
8.1 – 10.0	Very high	87	63.97	100.00
<b>Total</b>	136		100.00	
<b>Mean</b>	8.63			
<b>Standard deviation</b>	1.22			

Source: Field survey 2019. \*Improved technologies were, site selection, land clearing, land preparation, planting, weeding, fertilizer application, herbicide application, earthing up, harvesting and processing.

### **Impact of the Improved Sorghum Technologies on the Farmers' Income and Level of Living**

Propensity Score Matching (PSM) test was used to analyze the impact of the improved sorghum technologies introduced by the USAID MARKETS on the participating farmers' income and level of living towards achieving Objective two and testing the hypothesis that there is no significant impact of USAID MARKETS technologies on the farmers' income and level of living..

The results in Table 2 show that Average Treatment Effect on the Treated (ATT). Using the Kernel Matching (KM) algorithm, the results were income (ATT = 32483.92, SE = 14413.54, T = 1.730) and level of living (ATT = 182346.50, 116782.10, T = 2.254). Also, Radius Matching (RM) and Stratification Matching (SM) show similar results as income (ATT = 32483.92, SE = 16337.9, T = 1.988) and level of living (ATT = 182000, SE = 122000, T = 1.496).

The findings indicate that there is a significant impact of USAID MARKETS technologies on the income of the farmers but not on their level of living. This means the average income of the participants has increased higher than that of the non-participants but the assets of the two groups of farmers were the same. The fact that there was a significant impact of the technologies on the farmers' income but not on their level of living shows that the income might not have been used to acquire assets by the participating farmers. It also

indicates that the participating farmers did not add to their expenses the increased income obtained from the farming activities. Assets and expenditures were the indicators of level of living used. The result supported that of Adebayo (2019) in the impact on income but differed on level of living.

The hypothesis that there is no significant impact of USAID MARKETS technologies on the income and on level of living of the participating farmers was tested. From Table 2, given the ATTs, SE and T-statistics, the values for income were found to be statistically significant at  $p \leq 0.05$  levels and the null hypothesis was rejected. Thus, the findings reveal that the technologies introduced by the programme (USAID MARKETS), has impact only on participating farmers' income. The implication of the findings is that though the participating farmers were found to be better off than the non-participating farmers in terms of income, it is not the case for the level of living because they might not have converted their incomes into assets and welfare enhancing items. This has implication for their ability to reduce vulnerability and build resilience that can be crucial to poverty reduction. This study confirms others on agricultural development programmes that have had significant impact on output, income and level of living of the beneficiary farmers who participated in the programmes include Abubakar (2010), Umaru (2015); Jamilu *et al* (2015); and Adebayo (2019).

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**Table 2:** Estimates of PSM on farm income and level of living of the participating farmers in the study area.

Matching Algorithm	Outcomes	ATT	SE	T
<b>Kernel Matching (KM) (using bandwidth of <math>k(5)</math>)</b>				
	Income	32483.92	14413.54*	2.254
	Level of living	182346.50	116782.10	1.561 <sup>NS</sup>
<b>Radius Matching (RM) (using Caliper of 0.01)</b>				
	Income	32483.92	16337.9*	1.988
	Level of living	182000	122000	1.496 <sup>NS</sup>
<b>Stratification Matching (SM)</b>				
	Income	32483.92	16337.92*	1.988
	Level of living	182000	122000	1.496 <sup>NS</sup>

\*Significant at 5% level; NS = Not Significant

### CONCLUSION

The findings of the study revealed that participating farmers, by having access to the programme extension services recorded a very high level adoption of improved sorghum technologies and that made significant impact on their farm income. However, the farmers' level of living was not significant. This suggests that the farmers were not converting their gains in income into assets and/or have inconspicuous consumption and this might affect their livelihood sustainability.

### RECOMMENDATIONS

The findings show that impact of improved agricultural technologies on farm income was significantly positive but not on the level of living among the USAID MARKETS participants. The participating farmers therefore need to be encouraged by the extension agents to be converting their income into assets as the best way to overcome any shock and stress in the event of unforeseen disaster that would make them vulnerable and affect their livelihood sustainability. Such shocks include crop failure due to drought and stress might be long term price instability due to government policy or climate change. This helps a lot in strengthening their resilience and their abilities to overcome the vulnerabilities through creating options in their livelihoods by adopting various livelihood strategies.

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