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Research Article

Impact of Adopted Village Extension Project (AVEP) Agricultural Technologies Transfer on Income of Participants from Selected Research Institutes in Nigeria

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Abstract
This study determined the impact of Adopted Village Extension Project (AVEP) agricultural technologies transfer on income of participants from selected agricultural research institutes in Nigeria. Three-stage sampling technique was employed to select 492 respondents comprising 246 participants and 246 non-participants on which structured questionnaire was administered complemented with and interview schedule. Primary data collected were analyzed using descriptive statistics such as frequency counts, percentages and mean; Gini coefficient model and z-test statistics. Findings from the study revealed that majority (83.7%) of the participants were male and 91.9% were married, while majority (90.2%) of the non-participants were male and 93.1% were married. The mean age, education, farming experience, household size and farm size of the participants were 37 years, 13 years, 13 years, 6 people amd 3 hectares respectively, while mean age, education, farming experience, household size and farm size of the non-participants were 52 years, 8 years, 19 years, 10 people amd 5 hectares respectively. The result of the Gini-coefficient for the participants revealed mean annual income of ₦1,008,963 with gini index of 0.4474, while that of non-participants was ₦427,283 with gini index of 0.3001. The z-test statistics value of 27.084 at 1% level of probability revealed that there is a significant difference in income of the participants and non-participants. In conclusion, agricultural technologies transfer through AVEP of the selected research institutes had significant impact of the income of the participants. Therefore, the study recommended that the project should be scaled-up to accommodate more participants and other villages due to the significant impact.

Keywords: *Adopted Village Extension Project (AVEP), Agricultural technologies, Impact, Income, Participants*

Introduction
The Village Adoption Scheme was initially designed to serve as a model for revitalizing India's rural economy and reducing rural-urban migration, which has been proved via study to be detrimental to both rural and urban residents of India as well as their communities (Shahid, 2004). The scheme make use of the resources existing in social, traditional, cultural, legal, ethnic, religious, economic and political layers of the rural society and seeks to build upon them to generate further resources. It is assumed that the rural people know what they really need and so could really work towards their own goals. According to Reddy (2010), the village adoption study will make use of action research to fully develop and integrate a village or group of villages. The village adoption offers academics, policymakers, and civil society the chance to become aware of the issues and social dynamics that are present at the local level and to assimilate the enabling factors necessary to create sustainable and cohesive communities by encouraging, igniting, educating, and enabling them to grow by utilizing a variety of opportunities with a specific focus on the underserved sector. (Ready, 2010).

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Akinola *et al.* (2013) posited that adopted village extension project is one of the numerous models for agricultural technologies transfer to rural farmers. The main aim of adopted village model is to encourage large-scale adoption of improved technologies, empower resource poor farmers economically, create job opportunities and ensure food security. However, according to Reddy (2010), the implemented village extension projects seek to: increase village awareness; create organizations or groups for various developmental activities through workshops and meetings. It also aim to facilitate convergence or integration of various State, Local Governments, and other agencies' programs in the villages; and ensure socioeconomic and livelihood advancement with improved credit support and financial inclusion of all farming families in the villages. It identify the capacity-building requirements of the villagers; work with villagers and neighborhood organizations to develop the infrastructure in the villages; safeguard the forests, the village ecosystem, and other natural resources; and monitor the project's progress as it is being carried out.

According to Agricultural Research Council of Nigeria (ARCN) (2011), adopted village is a model where research institutes, universities and colleges of agriculture are encouraged to adopt at least one village and promote best farming practices and government's policies. Thus, the concept of adopted village is geared towards large scale improved agricultural technologies adoption that could have significant impact on overall well-being of rural farmers especially resources poor farmers. By adopting a village, the institutes or Universities are able to assist farmers within a locality to develop modern farming skills for increase output and income. However, since inception of Adopted Village Extension Project (AVEP) in the year 2009 in collaboration with West African Agricultural Productivity Programme (WAAPP), study to ascertain the impact of the AVEP on the target beneficiaries relative to their income are sparingly carried out especially in the selected study area. Thus, this study was conceived to provide answers to the following research objectives like to describe the socio-economic characteristics of the respondents; estimate the income distribution among the respondents and determine the impact of AVEP on income of the respondents in the study area.

MATERIALS AND METHODS

Study Area

The study was conducted at a few carefully chosen research locations in Kaduna and the Niger State of Nigeria. There are 25 Local Government Areas (LGAs) in Niger State. These LGAs are further divided into three agricultural zones (I, II, and III), each comprising eight, nine, and eight LGAs. It is located between Longitudes 4° 30′ East of the Greenwich Meridian and Latitudes 8° 11′ and 11° 20′ North of the Equator. According to National Population Census (NPC) (2006), there are 3,950,249 residents in total. However, the National Bureau of Statistics (NBS) (2023) estimated that the population to be 6,522,777 in 2021 based on a 3.4% growth rate. The three largest ethnic groups in the State are Nupe, Gwari, and Hausa, notwithstanding the presence of other lesser ethnic groups. The largest state in the country is Niger, which has a total area of 76,363 km2. Guinea savanna makes up the majority of the state's vegetation, and the average annual rainfall varies from 1110mm in the north to 1600mm in the south. At its lowest point, the temperature is 26°C, and at its maximum point, it is 36°C. The bulk of the population in the villages work is into agriculture such as crop and livestock production as their main source of income.

Similarly, Kaduna State has a total of 23 Local Government Areas categorized into four agricultural zones of Samaru, Lere, Chikun and Maigama. It is located within Latitude 9°12′ North and Longitude 6° 9′ East of the equator occupying an area of approximately 48,473.2 square kilometres with population of 6,066,562 (NPC, 2006). However, given the population growth rate of 3.2%, the projected population as at end of 2021 was 9,312,652 (NBS, 2023). The major ethnic groups in the State are Hausas, Fulani and Gbagyi while other ethnic group also settles in the State. The State has two distinct seasons: the Dry (windy) Season and the Rainy (wet), with a mean annual precipitation of 1016mm and a mean annual temperature of 35°C. Nearly 80% of the population of Kaduna State actively into

agriculture such as crop and livestock production which accounts for the majority of the state's economic dependence.

Sampling Procedure and Sample Size

Participants in the Adopted Village Extension Project (AVEP) (treatment group) and non-participants (control group) made up the study's two groups. The respondents for this study were chosen using three phases of selection. The first stage was purposive selection of five National Agricultural Research Institutes (NARIs) which are IAR, NAERLS and NAPRI from Kaduna State, and NCRI and NIFFR from Niger State due to establishment of adopted villages by the institutes. Meanwhile, agricultural zone outside the Research Institutes were selected as the control group. The second stage was random selection of six (6) adopted villages of the Research Institutes selected from each of the States to get a total of twelve (12) adopted villages, while 12 rural communities were randomly selected from the agricultural zones. The third stage was proportionate sampling of the participants from each of the adopted village and non-participants from each of the rural communities based on the list obtained as sample frame using Yamane (1967) sample size determination formula as used by Muhammed *et al*. (2019) at 6% level of precision. This gave a total of 246 participants and non-participants respectively used as respondents for the study. Yamane's formula is mathematically expressed as in equation (1):

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Where;
n = samples size
N = finite population
e = limit of tolerable error (level of precision at 0.06 probability)
l = constant

Data Collection and Analysis

Data were gathered from primary sources (the participants and non-participants) using a structured questionnaire along with an interview schedule. The primary data collected were examined using descriptive statistics, such as frequency counts, percentages, and averages, as well as the Gini coefficient model and z-test statistics. An equitable income distribution is indicated by a low Gini coefficient, whereas an unequal distribution of income is indicated by a high Gini coefficient. The definition of a Gini coefficient is a ratio with values between 0 and 1. Therefore, a Gini coefficient of zero (0) denotes perfect equality, while a value of one (1) denotes perfect inequality. The general assumption is that the closet the value is to the 0, the perfect equality in income distribution of the respondents. The Gini coefficient model as used by Harmon (2023) is mathematically expressed in equation (2):

$$G = [1 - \sum_{k=1}^{n}(X_k - X_{k-1})(Y_k - Y_{k-1})] \quad (2)$$

Where;
G = Gini Coefficient,
X_k = Cumulated proportion of the participants and non-participants,
Y_k = Cumulative proportion of the participants and non-participants' income
$\sum$ = Summation sign

Similarly, the z–test statistics is mathematically expressed as in equation (3):

$$z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad (3)$$

Where;
$\bar{X}_1$ = Mean income of the AVEP participants
$\bar{X}_2$ = Mean income of the AVEP non − participants
σ_1^2 = Variance of the AVEP participants's income
σ_2^2 = Variance of the AVEP non − participants's income
n_1 = Number of AVEP participants
n_2 = Number of AVEP non − participants

Results and Discussion

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents described in the study include sex, marital status, age, education, farming experience, household size and farm size. As revealed in Table 1, majority (83.7%) of the participant were male, while 90.2% of the non-participants were male. This implies that males are the dominant gender in agricultural production which could be attributed to the strenuous nature of farming. However, there was a marginal difference in number of female involvement in agricultural activities among the participants of AVEP as compared to non-participants of AVEP. Also, majority (91.9%) of the participant were married, while 93.1% of the non-participants were married. This implies that greater proportion of the

respondents were married which could be attributed to importance attached to marriage as tradition in the Northern part of the country. This finding agrees with the study of Oduehie (2015) who reported that majority of the respondents of agricultural project in the study area were males with higher female beneficiaries as compared to non-beneficiaries.

Majority (84.5%) of the participants were within the age bracket 26–55 years with a mean age of 37 years, while 75.7% of the non-participants were within the age bracket 26–55 years with a mean age of 52 years. This implies that the respondents were within their active productive age and has the capacity to carry out agricultural production. However, wide differences in mean age exist between the participants and non-participants which is vital to decision to utilize agricultural technologies transfer through AVEP for improve income. This finding is in agreement with the study of Muhammed *et al.* (2019) who reported that majority of project participants in their study area were actively engaged in agricultural production with the participants much younger than the non-participants.

More so, the results in Table 1 revealed that all (100.0%) of the participants acquired formal education with a mean of 13 years of formal schooling, while 82.1% of the non-participants acquired formal education with a mean of 8 years of formal schooling. This implies that there was a relative literacy attainment among the respondents. However, the participants of AVEP were more educated as compared to the non-participants which explains the reason why they could easily adopt agricultural technologies transfer by AVEP. This finding corroborates the position of Muhammed (2015) who reported high level of education among project beneficiaries which is an advantage for technologies transfer and adoption. More than half (52.0%) of the participants had farming experience of less than 11 years with a mean of 13 years, while most (68.7%) of the non-participants had farming experience within the range of 11-30 years with a mean of 19 years. This implies that greater proportion of the respondents were experienced farmers with the non-participants been into farming for longer period of time. This finding agrees with the work of Ajayi *et al*. (2020) who reported that many years of farming enables farmers to make sound decisions regarding resources allocation and management of their farms.

The results from Table 1 also showed that the majority of participants (59.2%) and non-participants (80.5%) lived in households with an average of 6 and 10 people, respectively. This suggests that the households are rather big and that there are more non-participants than participants. This is in line with a study by Oduehie (2015), who discovered that respondents to an agricultural initiative in his study area had rather large average household sizes. Compared to 48.8% of the non-participants, who had farms with a size between 2.1 and 4.0 hectares and a mean of 5 hectares, more than half (56.9%) of the participants had farms with a size of less than 2.1 hectares. This suggests that the majority of respondents are likely producing on a small scale, which may have modest revenue effects. However, the tiny farms of the participants may have an impact on their choice to adopt agricultural technologies to increase output and profitability. This result supports the findings of Muhammed et al. (2021), according to which small-scale farmers with agricultural holdings of less than 5.0 hectares dominate Nigerian agriculture.

Income Distribution among the Respondents

Gini coefficient model was used to estimate distribution of income among the respondents in the study area and the results are presented in Table 2. Gini index measures the extent to which the distribution of income among individuals or households in the study area deviates from a perfect distribution. The mean annual income of the participants was ₦1,008,963 with Gini index of 0.4474, while that of non-participants was ₦427,283 with Gini index of 0.3001 which are both less than the half-way point value of 0.5 which is generally perceived as a point where income is not equitably distributed. This implies that there is a relatively equitable distribution of income among the respondents. This can be clearly established in relation to the non-participants of Adopted Village Extenion Project (AVEP) having relative equality in the distribution of income as compared to the

participants of AVEP that had high income disparity with some participants earning more income than others. Therefore, the non-participants with Gini ratio of 0.300 had better equitable income distribution as compared to the participants with Gini ratio of 0.447 with relatively inequitable distribution in the study area.

The difference in Gini index between the participants and non-participants could be due to adoption of agricultural technologies transfer through AVEP by the participants that help to improve their income. Meanwhile, the increasing income inequality has continue to be the most challenging economic problem face by most developing countries including Nigeria. Majority of the people in Nigeria lives in the rural areas where agriculture is the main occupation. They own small plot of land where they carryout agricultural production hardly sufficient to generate adequate income for the houseold. Thus, the need to adopt proven agricultural technologies that could increase output and income. This finding is in corroboration with the work of Bakare (2012) who reported income inequality in Nigeria with Gini index between 0.46 to 0.60 which was relatively high. There was some level of improvement from then to now as reported by Harmon (2023) that Nigeria Gini index for 2022 was 0.351 and ranked 11th among West African Countries with income inequality. Waris *et al.* (2023) also used Gini Coefficient to measure income distribution among households in their study area and reported gini index value between 0.29 to 0.45 implying relatively equitable distribution of income among the respondents.

Impact of AVEP Agricultural Technologies Transfer on Income of the Respondents

The results of the z-test statistics as presented in Table 3 revealed mean difference in income value of ₦581,680.48 with bootstrapped standard error of ₦21,477.20 and t-statistic value of 27.084 which is significant at 1% level of probability. This implies that there was significant and positive impact of agricultural technologies transfer through AVEP on the income of the participants in the study area. Therefore, adoption and utilization of agricultural technologies transfer through adopted village extension project had significantly improved the income of the participants in the project as compared to those who did not participate in the project. This finding is in agreement with Owolabi (2019) who reported significant impact of animal traction technology on the income of users in his study area.

Conclusion and Recommendations

Based on the empirical evidence from the findings of the study, it could be concluded that the participants are young and still in their most productive stage of life as compared to non-participants thus have the capacity to actively participate in Adopted Village Extension Project (AVEP) that will facilitate agricultural technology utilization for improved income. Male are the dominant sex among the respondents, while greater proportion also were married. There is relatively high literacy level among the participants of AVEP as they were more educated compared to the non-participants. The respondents were relatively experienced in farming, while household size was fairly large among the non-participants as compared to participants. Also, the non-participants had moderate farm size as compared to participants who are operating on a small scale. In terms of income distribution, the non-participants of AVEP had relative equality in the distribution of income as compared to the participants who had high income disparity among themselves. There was a significant and positive impact of the agricultural technologies transferred through AVEP on income of the participants. The study therefore extension agency, NGOs and relevant Government parastatals should formulate policy that will guide the implementation of adopted village project to capture more participants. Thus, the need to scale-up the project by the research institutes to accommodate more participants and other villages.

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Table 1: Respondents' distribution based on their socio-economic characteristics

	Participants (n = 246)		Non-Participants (n = 246)	
Variables	**Freq. (%)**	**Mean**	**Freq. (%)**	**Mean**
Sex				
Male	**206 (83.7)**		**222 (90.2)**	
Female	**40 (16.3)**		**24 (9.8)**	
Marital Status				
Married	**226 (91.9)**		**229 (93.1)**	
Single	**14 (5.7)**		**9 (3.7)**	
Widowed	**5 (2.0)**		**8 (3.2)**	
Divorced	**1 (0.4)**		**0 (0.0)**	
Age (years)				
< 26	**32 (13.1)**	**37**	**0 (0.0)**	**52**
26 – 35	**97 (39.4)**		**9 (3.7)**	
36 – 45	**73 (29.7)**		**77 (31.3)**	
46 – 55	**38 (15.4)**		**100 (40.7)**	
> 55	**6 (2.4)**		**60 (24.3)**	
Education				
Primary	**15 (6.1)**	**13**	**97 (39.4)**	**8**
Secondary	**112 (45.5)**		**93 (37.9)**	
Tertiary	**119 (48.4)**		**12 (4.8)**	
Non Formal	**0 (0.0)**		**44 (17.9)**	
Farming experience (years)				
< 11	**128 (52.0)**	**13**	**38 (15.4)**	**19**
11 – 20	**74 (30.1)**		**101 (41.1)**	
21 – 30	**31 (12.6)**		**68 (27.6)**	
> 30	**13 (5.3)**		**39 (15.9)**	
Household size (numbers)				
< 6	**100 (40.7)**	**6**	**29 (11.8)**	**10**
6 – 10	**113 (45.8)**		**114 (46.3)**	
11 – 15	**33 (13.4)**		**84 (34.2)**	
> 15	**0 (0.0)**		**19 (7.7)**	
Farm size (hectares)				
< 2.1	**140 (56.9)**	**3**	**68 (27.6)**	**5**
2.1 – 3.0	**36 (14.6)**		**53 (21.6)**	
3.1 – 4.0	**33 (13.4)**		**57 (23.2)**	
> 4.0	**37 (15.1)**		**68 (27.6)**	

Source: Field Survey, 2022

Table 2: Gini coefficient estimate on income distribution among the respondents

	Participants				Non-Participants			
Income (₦)	**Freq.**	**X**	**Y**	**∑XY**	**Freq.**	**X**	**Y**	**∑XY**
< 500,001	21	0.0854	0.0418	0.0036	168	0.6829	0.5793	0.3956
500,001 – 1,000,000	125	0.5081	0.4149	0.2108	73	0.2967	0.9569	0.2839
1,000,001 – 1,500,000	77	0.3130	0.7980	0.2498	5	0.0203	1.0000	0.0203
1,500,001 – 2,000,000	9	0.0366	0.8607	0.0315	0	0	0	0
> 2,000,000	14	0.0569	1.0000	0.0569	0	0	0	0
Total	**246**			**0.5526**	**246**			**0.6999**
Mean Income	**₦1,008,963**				**₦427,283**			
Gini index (1 - ∑XY)				**0.4474**				**0.3001**

Source: Field Survey, 2022
Note: X = Proportion of respondents and Y = Cummulative proportion of income

Table 3: Z-test estimate of impact of AVEP agricultural technologies transfer on income

	Mean	**Standard dev.**	**t – stat**	**Decision**
Mean income of the participants	1,008,963.42	431,434.06	27.084***	Significant
Mean income of the non-participants	427,282.93	269,661.90		
Mean difference	581,680.49			

Source: Field Survey, 2022 ** implies significant at 5% probability level