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Assessing the Impact of Off-Farm Income Sources on Rural Agribusiness Development and Poverty Alleviation

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ABSTRACT

Poverty continues to be a critical global challenge with profound consequences on human welfare. This research investigates how livelihood diversification and income improvement strategies can contribute to reducing rural poverty, with a focus on relevant policy implications. Utilizing a combination of descriptive statistics and econometric models, including FGT, Tobit, and Logit analyses, the study examines data collected from the target area. The results show an aging population with an average age of 52 years, and a gender distribution of 67% male and 32% female respondents. The predominant income-generating activities include trading (92%), civil service (83%), and livestock rearing (75%), while barbing/hairdressing, restaurant operations, and gardening see lower levels of participation at 32%, 32%, and 8%, respectively. The Tobit regression analysis reveals that higher educational attainment plays a significant role in enhancing non-farm income diversification, while larger farm sizes negatively affect autonomous income diversification by 0.171 units. Furthermore, larger household sizes are more likely to engage in non-farm income activities, and 67% of respondents report utilizing diversified livelihood strategies. Key factors such as education, income diversification, access to credit, farm size, and monthly income show a negative relationship with poverty, whereas household size and dependency ratio are positively correlated with increased poverty levels. These findings suggest the need for targeted interventions, such as promoting family planning awareness among farming communities and establishing rural skill development centers supported by state and local governments. Strengthening the skillsets of farming households will empower them to pursue more profitable non-farm activities, while encouraging the adoption of productivity-enhancing technologies can improve overall agricultural efficiency, contributing to better living standards and reduced poverty.

Keywords: Income, Off-farm, Firm, Options, Rural, Agribusiness, Growth, Poverty

1. Introduction

Since gaining independence, development of other Sub-Saharan African (SSA) countries, including Nigeria have been driven by one form of reform or the other with poverty reduction and food security at the forefront as the center of policy. Yet, the impact of constant political instability, economic uncertainty, absence of infrastructure, and insufficient access to credit has restricted incredible advancements in this regard (Zhang et al., 2019) To overcome these challenges, many SSA governments have prioritized the scaling of agricultural production. The whole concept of business models for SDGs is applicable to farmers in emerging economies where commercial farming has been introduced (through 'carrot' means of infrastructure improvement, 'stick' approach of better access to credit) and farmers diversified their income sources to improve per capita earning and living standards (Ma et al., 2019; Kadiri et al., 2017). A growing number of studies in development have considered the phenomenon of income diversification at the level of rural households in developing countries (Middlemiss, 2017; Mottaleb et al., 2017). This process leads to more investments in several on-farm and off-farm income-generating activities (Muller and Yan, 2018). This trend of activity diversification has been particularly prominent in the rural areas of developing countries over the past few decades. Thus, the diversification in the rural household economy is believed to be a common coping strategy to the market liberalization or a part of risk management behavior under the impact of factors effecting to their livelihoods (Sahn et al. 1990). These changes significantly affect household income, income redistribution, and welfare (Okorie and Sosoo, 2017; Papada & Kaliampakos, 2021).

The diversification of income sources in rural regions is significant for rural development, both through its impact on income generation and poverty alleviation and as an indicator of migration and rural outflows (Rahut et al., 2020; Astatike and Gazuma, 2019; Babatunde and Qaim, 2010; Barrett et al., 2021; Dhungana et al., 2019; Houngue and Nonvide, 2020; Iqbal et al., 2018). Agriculture has been seen as a major path to both rural poverty alleviation and economic development on a continent-wide level (Rufai, Salman and Salawu 2018). Improving agricultural productivity is a necessary condition to reduce poverty and to bring about much stronger economic growth in Sub-Saharan Africa (David 2020). According to Obayelu and Orosile (2015), food poverty is based on the ability of rural farming households to have access to sufficient amounts of nutritious food required for a balanced diet. The rural farmers rely on agriculture to fend for their families but still suffer from both food insecurity and poverty in the country as a

result of low income. According to data from the China Family Panel Studies, 48.98% of households are energy poor, indicating the accessibility and affordability of energy (Zhang et al., 2019; Ouedraogo, 2015; Tesema et al., 2019).

Read other news on Nigeria and politics here Three steps to advance the Nigerian economy in 2023 and beyond Most countries across the world, especially the developing nation, Nigeria, grapples with prevailing socioeconomic, political, environmental, and climatic challenge in recent years, thus adding to the burden felt by the people. These changes have aggravated poverty, political instability and the effects of climate change. These shifts have been especially hard on rural households. In fact, shared experience of such effects in larger economies is driving people to resort to income diversification and self-help communities to mitigate the consequences. Even so, it has become increasingly important to assess how income diversification can work to help residents along the.. The current investigation aims to closely look into this important feature.

2. Methodology

Study area

The study was carried out in Abia State in the southeastern geo-political zone of Nigeria, which comprised about 17 Local Government Areas (LGAs). It is a state with a landmass of 6,320 km2 (at 11° 30′ north latitude and 7° 10′ east longitude) where agriculture is the most important occupation of the people. Agriculture is varied within the state; it encompasses the production of maize, yam, cassava, cocoyam, potatoes, rice and other vegetables, including mixed cropping. Organic farming of livestock such as cow, birds, sheep and goats is also common.

Data collection was done using a multi-stage sampling method across three selected agrarian zones: Bende, Ikwuano and Obingwa. They were selected from four agricultural zones in Abia State. From each zone, two blocks were randomly chosen, and then two cells were randomly chosen from each block. Of those farms, 10% of farmers were randomly selected based on their similarity to represent the larger population. As a result, a sample size of 60 respondents was achieved using this sampling strategy.

The study collected primary data using structured questionnaires, which elicited the socio-economic characteristics of households, food security and poverty status, and alternative cash sources among households.

Descriptive Statistics

For the first study objective to describe the socio-economic characteristics of the respondents, descriptive statistics were used to calculate frequency counts, means and percentages.

Diversity Index

The diversity index was used to identify the various off-farm income options available to entrepreneur agribusiness. Diversity index

$$Diversity\ index = \sum_{i=1} \left(\frac{(n-1)}{N(N-1)}\right) \qquad 1$$

Where:

i = 1, 2, ------- n income sources

n = the receipts from ith income sources

N = number of respondents

If no options are available, the diversity index is set to unity. The degree of diversification increases as the diversity index exceeds unity, with higher values indicating a broader range of income options available to the farmers.

Tobit Regression Model

The Tobit regression model was employed to assess the factors influencing off-farm income diversification. The model is specified as:

$$Y_i = X_i\beta \text{ if } i^* = X_i\beta + u_i > T_i \qquad (2)$$

Where:

- Yi= Income option (1 if farmers did not diversify income, greater than 1 if farmers diversified income).
- X1 = Education (years of formal schooling).
- X2= Household size (number of persons in the household).
- X3 = Technology (modern vs. obsolete).
- X4 = Farm size (in hectares).
- X5= Amount of credit (in Naira).

- X6 = Government policy (favorable vs. unfavorable).
- X7 = Number of dependents.

Poverty Line

The study also uses the standard Foster-Greer-Thorbecke (FGT) poverty index to measure the incidence, depth, and severity of poverty among the selected households. The FGT poverty measures are defined as follows:

$$P_a = \frac{1}{N_{i=1}} \sum \frac{(Z-Yi)^a}{Z}$$

Where:

α = strictly positive parameter (0, 1 or 2) showing social valuation of low degree of poverty Its value is 0 for poverty incidence, 1 for poverty depth and 2 for severity of poverty, Yi = per capital expenditure (N/person/day) n = number of households with per capital consumption below the United Nations recommended income; defined US$2 per person per day which during the period of the survey was equivalent to N320 per person per day (US$1 = N160), Z = poverty line (N320 per person per day); and N = number of household in the sample

Logit regression model

The effect of income options on poverty status and rural agribusiness growth of the respondents was determined using Logit regression model. The underlying response variable of the economic status of a household leads to the probability of a household classified by food security. In the case of binary choice, the underlying response variable y* can be defined by the multivariate logit regression relation.

$$Y^* = (\sum Xi\beta j) + \mu \qquad 3$$

where: $\beta_j = \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$, and $Xi = Xi_1, Xi_2, Xi_3, Xi_4, Xi_5, Xi_6, Xi_7, Xi_8$.

3. Results and Discussion

The socio-economic characteristics of the respondents are presented in the tables below:

Table 1: Frequency Distribution of Respondents According to Age

Age Range (Years)	Frequency	Percentage
25-34	5	8
35-44	11	18
45-54	15	25
55-64	19	32
65-74	8	14
75-84	2	3
Total	**60**	**100**

Source: Field Survey, 2022.

The results show that a large percentage of respondents 32% were between the ages of 55 and 64 years old, while 25% were in the 45 to 54-year bracket. The remaining age cohorts (25–34, 35–44, 65–74, and 75–84 years of age) comprised 8%, 18%, 14%, and 3% of the sample, respectively. With most of the respondents being between the ages of 45 and 64, which is typically representative of middle to later years individuals. Given age-related physical, social or economic limitations, we posit that these individuals may encounter limited opportunities to adopt more than 1 livelihood strategy.

Table 2: Frequency Distribution of Respondents According to Gender

Gender	Frequency	Percentage
Male	40	67
Female	20	33
Total	**60**	**100**

Source: Field Survey, 2022.

Table 2 shows the Percentage distribution of Gender of the respondents. We found that the majority of participants (67%) were men and this was more than 2 times that of women (32%). Implying that men were more engaged in livelihood vulnerability activities compared to their female counterparts, revealing an imbalance and marginalization of women in the study location.

Table 3: Frequency Distribution of Respondents According to Marital Status

Marital Status	Frequency	Percentage
Single	4	7
Married	47	78
Widow	9	15
Total	**60**	**100**

Source: Field Survey, 2022.

The table shows that the vast majority of participants (78%) were married, as opposed to 7% unmarried and 18% widowed. It indicates that the majority of married people decided to be engaged in our study area to be benefitting from paid jobs. In such households, the labor supply should increase and thus may help to increase the overall means of livelihood of the family.

Table 4: Frequency Distribution of Respondents According to Level of Education

Level of Education	Frequency	Percentage
No formal education	4	6
Primary education	14	23
Secondary education	28	47
Tertiary education	14	24
Total	**60**	**100**

Source: Field Survey, 2021.

6% of respondents stated they had no education, 23% had completed primary, 47% had secondary, and 24% had tertiary level education. Over 70% of persons in the study site had some degree of formal education, whether primary or tertiary, as demonstrated by these statistics. This indicates relatively high literacy (reading and writing ability) in the region, which could improve the entrepreneurs' capacity to efficiently harness accessible resources and pursue diversified livelihood options. The high literacy rate also likely facilitates higher uptake of technology2, potentially increasing household income.

Table 5: Frequency Distribution of Respondents According to Cooperative Membership

Cooperative Membership	Frequency	Percentage
Members	45	75
Non-members	15	25
Total	**120**	**100**

Source: Field Survey, 2022.

Cooperative membership of the respondents is reflected in figure 1, where 75% of the respondents are members of cooperatives, while 25% of the respondents are not members. Which implies almost all the respondents have loans and innovation ideas since they belong to a cooperative or cooperative (non-member) whose members would lack access to loans, coming up with innovative ideas.

Table 6: Frequency Distribution of Respondents According to years of Experience

Business Experience (Years)	Frequency	Percentage
1-5	23	39
6-10	28	47
11-15	4	7
16-20	4	6

21-25	1	1
Total	**60**	**100**

Source: Field Survey, 2022.

As seen in Table 1, 39% of the respondents had 1-5 years of experience and 47% had 6-10 years of experience. This would imply that about 86% of the respondents have intermediate experience. Older farmers have greater experience with production as well as sales and price determination which will make them more active and economically better off — more likely to invest in non-farm activities and capable of mobilizing capital for future investments. Thus, such mature farmers might choose to engage in multiple avenues of income instead of being solely dependent on farming.

Table 7: Frequency Distribution of Respondents According to Household Size

Household size	Frequency	Percentage
1-3	15	25
4-6	30	50
7-9	12	20
10-12	3	5
Total	**60**	**100**

Source: Field Survey, 2022.

The findings in Table 7 indicate that a large number of respondents (50%) have households between 4 - 6 members, and families between 1 - 3 members contribute to 25% of the total. A distribution like this suggests that, in general, respondents have neither large families, like five or more kids, nor very small families. This pattern The trend may be due to the existing economic situation and increasing poverty situation in most of the respondents, encouraging them using such forms of family planning for reducing the number of children. Having more children in a family generally means that the family does not have to hire help, because that additional labour is available for free. Additionally, agribusiness entrepreneurs have aimed for additional income-generating activities other than farming to enhance per capita income and standards of living. Table 8 shows a summary of the income diversification strategies, which we will elaborate further in the next section.

Table 8: Off-farm income diversification strategies of the agribusiness entrepreneurs

S/N	Income activities	*Freq. (f)	Perc. (%)	Av. monthly income (N)
1	Civil service	100	83	60,000
2	Transportation	40	33	30,000
3	Food processing	60	50	42,000
4	Restaurants	35	29	50,000
5	Gardening	10	8	15,000
6	Artisanship (mason etc.)	46	38	25,000
7	Barbing/hair dressing	39	32	29,000
8	Tailoring	45	35	35,000
9	Livestock rearing	90	75	40,000
10	Trading	110	92	55,000

Source: Field survey, 2022

***Multiple responses**

The results showed that trading (92%), civil service (83%), and livestock rearing (75%) were the most common sources of income. In contrast, fewer students had engaged in activities related to barbing/hairdressing, restaurant operation, and gardening, accounting for 32%, 32%, and 8%, respectively. As such, the broad participation in trading attests to its viability as a lucrative source of income, whilst civil service, and local government employment in particular, represented a large share of the livelihood of the populace. The analysis also finds civil service, trading, and restaurant operation to be the most lucrative activity with average income of 60,000, 55,000, and 50,000 Naira respectively. In contrast, barbing/hairdressing, artisanship and gardening respectively reported low monthly incomes of 29,000, 25,000 and 15,000 Naira. In relation to Tobit regression analysis, the results show that the model fits the data well. Maximum likelihood estimates are performed by maximizing the log-likelihood functions, which means that the coefficients of the regression line maximize the chances of observing the sample values for income diversification. This indication implies that this

model is good at explaining variations in the determinants of income diversification among agribusiness entrepreneurs. In addition to that, the Pseudo R-squared value of 0.89 suggests a good fit, which indicates approximately 89% of the variations in income diversification is accounted for by the variations in the given explanatory variables. This emphasizes the model's strong explanatory capacity to elucidate alterations of income diversification amongst respondents. Results are reported in detail in Table 9.

Table 9: Determinants of income diversification

Variables	Coefficient	Standard error	t	p>|t|
Constant	.2735	.1008	2.713**	0.006
Education	.2039	.0977	2.09*	0.042
Household size	1.3037	.3978	3.28**	0.002
Technology	-.2181	.0984	-2.22*	0.031
Farm size	-.3650	.3559	-1.03	0.310
Credit access	.8149	.3532	2.31*	0.025
Govt. policy	.0759	.1227	0.62	0.539
Coop. membership	1.4476	1.0984	1.32*	0.193
χ^2	21.85			
Log likelihood	-46.746			
Pseudo R^2	0.89			

Source: Field survey, 2022

This result too showed that the co-efficient of education level is significant and positively related to non-farm income diversification at 10% probability level. This means that people with more education have higher income diversification. Education: As for education, the coefficient in this model was found to be 0.2039 which means for an increase of education in a unit, there was an increase of 0.2039 in the probability to diversify non-farm income sources. This outcome is consistent with expectations because higher education provides heads of households with the skills and knowledge needed to enter better-paid, more diversified forms of employment. Education covers the ability of individuals to find well-paying jobs, and therefore income diversification. Conversely, the scheme coefficient of farms size was -0.171 denoting that increase in the area of farm results to a decrease in the diversification of non-farm income by 0.171. This means that increasing farm size could reduce their dependence on non-farm income sources and, instead, households could rely more on farming activities. The potential for larger still farms to deliver more turnover could reduce the incentive to diversify income. This indicates that households who are members in a cooperatives tend to have a higher dependence on income diversification than those that are not (the coefficient for cooperative membership was significant at the 10% level). It means that for every 1 unit increase in cooperative membership, the odds of diversifying income increase by a factor of 1.447. This makes sense, since cooperatives gain better access to credit which can lead to income diversification. Similarly, there was a positive and significant relationship between the household size and the number of non-farm income-generating activities in place at 5% level of significance. This relationship is especially crucial for rural African farm families, where population control is a difficult problem and children are often used as farmhands. The larger household size can provide higher labor for income-generating activities other than agriculture, thereby stimulating diversification to other income-generating activities. This study also examines the types of diversified income sources as well as their effect of poverty status of the respondents. Table 10 delineates the results in detail.

Table 10: Effect of income diversification on poverty status of the rural households

			Poverty status				Poverty indices		
Diversification			**Poor**		**Non-poor**				
	F	**(%)**	**Freq**	**Perc**	**Freq**	**Perc**	**P_0**	**P_1**	**P_2**
Diversified	40	67	12	20	28	47	0.29	0.32	0.14
Non-diversified	20	33	15	25	5	8	0.39	0.38	0.19
Total	**60**	**100**	**27**	**45**	**33**	**55**			
MPCHHE			6,000		10,000				
2/3 MPCHHE			4,000		6,667				

67% of respondents report diversifying their livelihoods: many households are involved in other income-generating activities beyond farming. Among households with diversified income, mean per capita household expenditure (MPCHHE) was 10,000 Naira compared to 4,000 Naira for non-diversified households. Households were poor according to this expenditure, if the MPCHHE was less than 4,000 Naira for non-diversified and less than 6,667 Naira for diversified respondents. As a result, out of all of the income-diversified respondents, 20% ended up being classified as poor, while 25% of the non-diversified respondents ended up being classified as poor. 19% meaning that the only 8% of non-diversified respondents were non-poor category, contrary to 47% of income-diversified respondents.

It then expands on poverty decomposition, the poverty gap and the severity of poverty. The poverty gap quantifies how rich poor individuals are with respect to two-thirds of the population mean consumption expenditure (which varies by the population sample). 29% of income-diversified respondents, and 39% of non-diversified ones, could not meet this benchmark in 2022. On poverty severity, which accounts the squared poverty gap divided by the total number of individuals below the poverty line, 14 and 19 percent of income-diversified and non-diversified respondents, respectively, fell into this category. These findings highlight the crucial importance of income diversification in alleviating poverty. The study estimated respondents' poverty status using a logistic regression model to explore determinants of respondents' poverty status. The chi-square value of -22.734 indicates that the model fits the data well statistically. The explanatory variables included in the model explain 42% of the variability of respondents' poverty status (Nagelkerke R^2 value of 0.423). The findings show that income diversification, education, credit access, farm size, and monthly income have statistically significant negative relationships with poverty at the 10%, 10%, 10%, 1% and 5% significance levels respectively. On the other hand, household size and the dependency ratio had a positively significant relationship with poverty at 10% level. These results in detail are given in Table 11.

Table 11: Factors affecting the poverty profile of the respondents

Variable	Coefficient	Std. error	Z	P>z
Constant	-5.822	3.342	-1.740*	0.081
X_1 = Diversification	-.0435	.0195	-2.230	0.071
X_2 = Household size	.8694	.3422	2.540	0.011
X_3 = Non-farm income	.4544	.3701	1.230	0.220
X_4 = Education (Years)	-.1241	.0672	-1.846	0.023
X_5 = Credit access	-3.2167	1.2498	-2.570	0.010
X_6 = Farm size	-.0401	.0110	-4.010	0.000
X_7 = Age	-.0929	.2745	-0.34	0.735
X_8 = Monthly income	-.3412	.1109	3.077	0.003
X_9 = Dependency ratio	.1797	.0705	2.549	0.024

*p<0.10; **p<0.05; ***p<0.01 Nagelkerke R^2 = 0.4234; -2 log likelihood = -22.734

Source: Field Survey, 2022.

The coefficient of income diversification strategy is statistically significant at the 10% level which negatively relates to the poverty severity. This suggests that there are less likelihood of being severely poor among households with diversified income sources with their involvement in a mix of farm and non-farm activities. Farming income loss bufferAlthough diversified income is most broadly recognized as a risk mitigation strategy, in this case, it acts as a buffer against farming income loss. Diversification of income sources can stabilize income streams for households, reducing vulnerability to fluctuations in farm income and therefore minimizing the risk of extreme poverty. Having income from multiple sources strengthens the safety net and improves both the welfare and standards of living. Household size has a positive and significant association with the severity of poverty at the 10% significance level. This correlation exists because larger households tend to compound the economic burden due both to their size and the number of dependents they may carry – be they children or elderly relatives with diminishing economic productivity. The size of the household simply means allocating more resources to meet basic nutritional needs, making it more intense than poverty. Consequently, families with fewer members are expected to be impoverished.

The formal education, especially that of household head is significantly inversely associated with the severity of poverty at 10% level. 4. Higher level of education leads to better management practices and production techniques. More educated heads of households can earn money, which enables them to take care of their family and avoid poverty. On the other hand, the level of people with low or no education tends to be greater so their chances of obtaining high income roles or adopting productive farming methods are limited. The extent of poverty has also been reduced through access to credit. Logistic regression results indicate that there is a significant negative relationship between credit access and poverty severity at the 10% significance level. Credit allows households to invest in productive resources like equipment and inputs, expanding their ability to earn income. And this, in turn, enhances their welfare and makes famine less likely. As expected, farm size is strongly negatively related to poverty severity, with a coefficient statistically different from zero at the 1% significance level. Households with larger farm holdings tend to have higher incomes and are less

likely to be poor. Big farms generate more income hence the households will fulfill their consumption needs in aggregate better than the small households and thereby reduction in intensity of poverty. Another very important factor that affects how bad the poverty is is the monthly income. Monthly income is statistically significant at the 5% confidence level in terms of poverty. As households with higher incomes are able to better meet their basic needs, pursue productive assets or enhance their quality of life, an increase in income is associated with a decrease in the severity of poverty. Finally, the dependency ratio —°the ratio of dependents (i.e., children and elderly) to the working-age members of a household — demonstrates a strong positive correlation to poverty severity at a 10% significance level. As a higher dependency ratio means more dependants per one working person, it leads to an increase in the financial burden for the working household members, making funds for basic needs even harder to acquire. When the number of dependents is high, the chances and depth of poverty also increase.

Conclusion

Based on test results, the study, therefore, concludes that aging population, average being 52 years coupled with education, income and the likes are significant predictors of poverty in rural Abia State and recommended that proper agricultural policies that will reduce poverty level in rural areas should be drawn from the conclusions. Diversification of income and livelihood are crucial in improving the poverty status of households. Specifically, diversification diminishes the severity of poverty, whereas variables such as the size of a farm and household size affect the likelihood of participating in income-generating activities. In this process, families generate multiple streams of income, contributing to rural development and offering them with a strategy to reduce poverty through reduced vulnerability to external shocks. Thus, policy-based measures promoting education, credit access, and farming extension might also strengthen income diversification initiatives and reduce rural-level poverty.

Reference

Zhang, D. Y., Li, J. J., Han, P. (2019). A multidimensional measure of energy poverty in China and its impacts on health: An empirical study based on the China family panel studies. Energy Policy 131, 72–81.

Ma, W. L., Zhou, X. S., Renwick, A. (2019). Impact of off-farm income on household energy expenditures in China: Implications for rural energy transition. Energy Policy 127, 248–258.

Middlemiss, L. (2017). A critical analysis of the new politics of fuel poverty in England. Crit Soc Policy 37, 425–443.

Mottaleb, K. A., Rahue, D. B., Ali, A. (2017). An exploration into the household energy choice and expenditure in Bangladesh. Energy 135, 767–776.

Muller, C. and Yan, H. J., (2018). Household fuel use in developing countries: Review of theory and evidence. Energy Economics 70, 429–439.

Nawaz, S. and Iqbal, N. (2021). How cash transfers program affects environmental poverty among ultra-poor? Insights from the BISP in Pakistan. Energy Policy 148, 111978.

Okorie, D. I. and Sosoo, V. E. (2017). The dynamics of carbon dioxide (CO_2) emission on Nigerian capacity utilization. Scholars Bulletin 3 (2), 101–112.

Papada, L. and Kaliampakos, D. (2021). Measuring energy poverty in Greece. Energy Policy 94, 157–165.

Rahut, D. B., Behera, B. and Ali, A. (2020). Household energy choice and consumption intensity: Empirical evidence from Bhutan. Renew Sust Energ Rev 53, 993–1009.

Astatike, A.A and Gazuma, E. G (2019). The Impact of Off-Farm Activities on Rural Household Income in Wolaita Zone, Southern Ethiopia. Journal of World Economic Research, 8 (1): 8 – 16.

Babatunde, R.O and Qaim, M (2010). Impact of Off-Farm Income on Food Security and Nutrition in Nigeria. Poster Presented at the Joint African Association of Agricultural Economists (AAAE) and 48th Agricultural Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19 – 23, 2010.

Barrett, C. B., Reardon, T and Webb, P (2021). Non-Farm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications Food Policy, 26 (2): 315 -331. 4

David, S (2020). The Rural Non-Farm Economy, Livelihood Strategies and Household Welfare. African Journal of Agricultural Research, 4 (1): 82 – 109.

Dhungana, B.R., Nuthall, P.L and Nartea, G.V (2019). Measuring the Economic Inefficiency of Nepalese Rice Farms using Data Envelope Analysis. The Australian Journal of Agricultural and Resource Economics, 48 (2): 347 – 369.

Houngue, V and Nonvide, G.M.A (2020). Estimation and Determinants of Efficiency among Rice Farmers in Benin. Cogent Food and Agriculture, 6: 1, 1819004.

Iqbal, M. A., Abbas, A., Ullah, R., Ahmed, U.I., Sher, A and Akhtar, S (2018). Effects of NonFarm Income on Poverty and Income Inequality: Farm Households Evidence from Punjab Province Pakistan. Sarhad Journal of Agriculture, 34 (2): 233 – 239.

Kadiri, F.A., Eze, C.C., Orebiyi, J.S., Lemchi, J.I., Ohajianya, D.O and Nwaiwu, I.U (2017). Technical Efficiency in Paddy Rice Production in Niger Delta Region of Nigeria. Global Journal of Agricultural Research, 2 (2): 33 – 43.

Obayelu, O.A and Orosile, O. R (2015). Rural Livelihood and Food Poverty in Ekiti State Nigeria. Journal of Agriculture and Environment for International Development, 109 (2): 307 – 323.

Ouedraogo, S (2015). Technical and Economic Efficiency of Rice Production on the Irrigated Plain of Bagre (Burkina Faso), A Stochastic Frontier Approach. Journal of Economics and Sustainable Development, 6 (14): 78 – 85.

Rufai, A.M., Salman, K.K and Salawu, M.B (2018). Input Utilization and Agricultural Labor Productivity: A Gender Analysis. Pg 55 – 79 in: Shimless, et al (eds). Building a Resilent and Sustainable Agriculture in Sub-Saharan Africa.

Tesema, T., Kebede, T and Shumeta, Z (2019). Economic Efficiency of Smallholder Farmers in Maize Production in Gudeya Bila District, Oromia National Regional State, Ethiopia: Parametric Approach. Journal of Applied Agricultural Economics and Policy Analysis, 2(1): 1 – 7.