EFFECT OF LIVELIHOOD DIVERSIFICATION AND TECHNOLOGY ADOPTION ON FOOD SECURITY STATUS OF RICE FARMING HOUSEHOLD IN SOUTHERN TARABA, TARABA STATE NIGERIA.

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ABSTRACT

This study analyzed effects of livelihood diversification and technology adoption on food security status of rice (Oriza sativa) farming households in Southern Taraba, Taraba State Nigeria. The research employed a multi-stage sampling technique to collect primary data from 209 respondents using structured questionnaires. The data was analyzed using both descriptive and inferential statistics. Socioeconomic characteristics showed that the mean age was 45 years, majority (59.3%) were male, 65.6% were married, mean household size was 6 persons and 93.8% have diverse educational levels. The livelihood activities result showed that 91.4% engaged in crop farming, trading 32.1%, livestock keeping 21.1% and 97.6% had low diversity. Livelihood diversification, technology adoption, education level, farm size were positive and significant while age is negative with their probability level of 1%, 1%, 1%, 5% and 1% respectively. The study concludes that households with diversified livelihoods, adopting modern technologies, younger household heads, higher education level and larger farm sizes are more likely to be food secure. It is recommended that policies and programs focus on promoting livelihood diversification and technology adoption, alongside supporting educational advancement and farm size expansion, these factors significantly influence food security outcomes.

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INTRODUCTION

Livelihood diversification is a process by which rural households construct a diverse portfolio of activities and social support capabilities in their struggle for survival and improvement in their standards of living and the means of gaining a living (Gebru *et al.,* 2018). It includes both on and off-farm activities, which are undertaken to generate additional income to the main household agricultural activities through the production of other agricultural and non-agricultural goods and services or self-employment undertaken in small firms and other strategies undertaken to spread risk. According to Loison (2019), livelihood diversification plays a crucial role in promoting economic growth and reducing rural poverty in developing countries. It is the process of combining both agricultural and non-agricultural activities to survive and improve the standard of living (Martin and Lorenzen, 2016; Pritchard *et al.,* 2019). Risk may play a role, but is not a necessary condition for individuals to choose to diversify (Igwe *et al.,* 2020). Smallholder farmers engage in both on-farm (planting drought-tolerant crops and mixed farming) and off-farm (selling household assets, migration of the entire households and decreasing food consumption/changing diets) diversification strategies. These diversified activities allow farming households to manage risk and improve their lives (Aniah *et al.,* 2019; Baird and Hartter, 2017).

According to Karki (2021) livelihood comprises the capabilities, assets and activities required for a means of living. There are various components of livelihood. It includes tangible and intangible assets. Asset can be human capital (skills, knowledge and ability to work), social capital (informal networks and membership of groups and other similar relationships that facilitate cooperation and economic opportunities), natural capital (land, soil, forest, water and fisheries), physical capital (basic infrastructure such as roads, water and sanitation, schools, markets and producer goods) and financial capital (savings, credits, income from employment and trade). Agriculture technology has a significant impact on raising food productivity (Sennuga 2019; Adeyongo *et al*., 2021). Therefore, it is important to look at how farmers utilize new technologies. Several types of advanced methods and practices which impact the expansion of agricultural output are referred to as agricultural technology (Sennuga *et al*., 2020; Adeyemi *et al*., 2023).

MATERIALS AND METHODS

Study Area

The study was conducted in Southern Taraba State, Nigeria. The region consists of five (5) Local Government Areas which are: Wukari, Takum, Ussa, Ibi and Donga. It lies between latitudes $8^{0}30^{0}$N and $9^{0}30^{0}$E of the equator and between longitudes $8^{0}30^{0}$N and $10^{0}30^{0}$E of the Greenwich Meridian. The area covers an area of 14,099Km^2 land mass with a population of about 687,077 people at 2006 (NPC, 2006). The National Population Commission had projected an annual growth rate of 3.5% which brought the population figure to 1,233,080.294 people as at 2023. The area shares boundaries with Gassol, Bali, Kurmi, Gashaka and Karim-lamido Local Government areas to the North, Nasarawa state and plateau state to the North-west, Benue state to the south-west and Republic of Cameroon to the South-East. It has a tropical wet and dry seasons, well drained alluvial soils and characterized by both savannah and rain forest vegetation. Its dry season last for a minimum of four months (December to March) while the wet season spans early March to late November in the south. The area has mean annual rainfall to 180mm.

Majority of its inhabitants depending on subsistence agricultural practices mainly in food and cash crops like Sorghum, yam, maize, sesame, rice, cassava among others at a small-scale level, fresh water fishing and forestry. Livestock keeping is a minor occupation of the population of the area dealing on poultry, goats, rabbits, cattle, pig and fish farming. Other activities include local and regional trading in agricultural products, civil service, livestock, palm oil processing, rice milling and other small-scale industries. Ethnic groups include; Jukun, Chamba, Kuteb, Tiv, Fulani, Hausa, Yoruba, Igbo among others (Rukwe *et al.,* 2019).

Sampling Procedure

A multi-stage sampling techniques was used for obtaining relevant data for this research work. In the first stage, Southern Taraba was purposively selected based on its rice farming activities. In stage two, three (3) local government areas were purposively selected from southern Taraba based on their predominance in rice production in the area. They are Donga, Ibi and Wukari. In stage three, three (3) wards were purposively selected from each of the selected local government areas based on concentration of rice farmers which are: Asibiti, Akate, Fada, Rimi uku I, Rimi uku II, Nwonyo II, Bantaje, Jibu, and Tsokundi. In the last stage, farmers were selected using simple random sampling in proportion to the population of the farmers in each selected wards. The Taro Yamane sample size formula was used to determine the sample size of 216 respondents and 209 questionnaire were retrieved from the respondents and used for data analysis. The Taro Yamane formula for sample size calculation, as modified and adopted by Obianefe *et al*. (2022) is presented as follows:

$$n = \frac{N}{(1+N\varepsilon^2)} \quad \text{.....(1)}$$

Where:

n = Sample size

N = population of rice farmers, and
ε = adjusted margin error (5%)
Therefore, sampling size (n) = $\frac{470}{1+470\ X\ 0.05^{\ 2}} = 216$
Following (Shaikh *et al.,* 2016) the number of respondent in each wards were obtained with the help of formula below as shown on Table 1.
Ni = $\frac{n}{N}\ X\ Ni$
Where:
Ni = sample size in each ward
n = actual sample size, that is 216
N = actual number of rice farmers in the targeted population, that is total sample frame (470)
Ni = actual number of rice farmers in each ward.

Table 1: Sample Frame /Sample Size for the Study

LGA	Wards	Sample Frame	Ni = $\frac{n}{N}\ X\ Ni$	Sample Size
Donga	Asibiti	34	(216/470)x 34	16
	Akate	88	(216/470)x 88	40
	Fada	38	(216/470)x 38	18
Ibi	Rimi uku I	92	(216/470)x 92	42
	Rimi uku II	56	(216/470)x 56	26
	Nyonyo	66	(216/470)x 66	30
Wukari	Bantaje	28	(216/470)x 28	13
	Jibu	35	(216/470)x 35	16
	Tsokundi	33	(216/470)x 33	15
Total		**470**		**216**

Source: Taraba State Agricultural Development Programme (TADP), 2023

Data Collection
Primary data was used for this research work. The primary data was obtained by administering structured questionnaires to respondents.
Data Analysis Techniques
The data was analyzed using descriptive statistic and inferential statistic. Descriptive statistics such as frequency, percentage, mean, ranking, was use to achieve objectives of the study.
Logistic regression was adopted to analyze the effect of livelihood diversification and technology adoption on food security status of rice farming households.
$Yi = \gamma_0 + \Sigma\gamma jxj + \varepsilon j$ ……..…….....(2)
$Yi = a_0 + X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + X_8 + X_9 + \varepsilon i$……..(3)
Where:
Yi = Food security status (Food Secure = 1, Non-Food Secure = 0)
X_1 = Livelihood diversification
X_2 = Age (in years)
X_3 = Technology adoption
X_4 = Marital status (Married =1, Not married =0)
X_5 = Educational level (in years)
X_6 = Farm size (hectare)
X_7 = Access to credit (Access to credit = 1, no access to credit = 0)
X_8 = Extension visit (Yes=1, No=0)
X_9= Household size (number)
a_0= Constant
εi = Random term

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondents

The socioeconomic characteristics consider in the study were: age, gender, household size, marital status, educational level, cooperative membership, access to credit, sources to credit, extension visit, farm size. The study presents a demographic and socio-economic profile of rice farmers in Southern Taraba. The average age of the farmers is 45 years, with the majority (33.9%) aged between 41-50, indicating that the farmers are relatively young and physically active. Most respondents (59.3%) were male, reflecting a gender gap in rice farming, likely influenced by cultural and resource disparities. Household sizes averaged 6 individuals, with larger households contributing more labor. The majority (65.6%) were married, and 33.5% had secondary

education, suggesting receptivity to new farming techniques. Most farmers (90%) were not part of cooperatives, limiting access to credit, which was available to only 37.3%. Funding came primarily from family sources (43%), and most farmers (62.7%) had no contact with extension agents, potentially hindering innovation adoption. The average farm size was 2 hectares, signifying small-scale farming reliant on traditional tools. These findings are consistent with previous studies.

Table 2: Respondents demographic profile

Variable	Frequency	Percentage
Age		
≤ 30	32	15.3
31 – 40	48	22.9
41 -50	71	33.9
51 – 60	29	13.9
≥ 61	29	13.9
Gender		
Male	124	59.3
Female	85	40.7
Household size		
1 -5	99	47.3
6 -10	90	43.1
11 -15	20	9.6
Marital status		
Married	137	65.6
Single	54	25.8
Divorced	10	4.8
Widow/widower	8	3.8
Educational level		
No formal	13	6.2
Primary	61	29.2
Secondary	70	33.5
Tertiary	65	31.1
Cooperative membership		
Yes	21	10.0
No	188	90.0
Access to credit		
Yes	78	37.3
No	131	62.7
Sources of credit		
Personal saving	55	26.3
Family	90	43.0
Bank	33	15.8
Friends	16	7.7
Cooperative	15	7.2
Extension visits		
Yes	78	37.3
No	131	62.7
Farm size		
≤1	71	33.9
1.1 -3.0	103	49.3
3.1 – 5.0	25	11.9
≥ 5.1	10	4.8

Source: Field Survey, 2023

Various livelihood activities of rice farming households

Farming households in the study area engage in a variety of livelihood activities to sustain themselves, with few depending solely on one activity. The primary livelihood strategy is crop farming, practiced by 91.4% of households, underscoring their agrarian lifestyle and reliance on farming for daily sustenance. This finding aligns with Echebiri et al. (2017), who noted that most rural farm households in Abia State depend on farm proceeds to meet their daily needs. Other significant activities include trading (32.1%) and livestock keeping (21.1%). Smaller percentages of households engage in civil service (15.3%), grinding (13.4%), tailoring (9.1%),

and other activities such as fishing, carpentry, blacksmithing, and hire labor. This diversification helps households meet food requirements and increase income, supporting the argument of Jirgi et al. (2018) that farmers diversify into different profitable livelihood activities to enhance their standard of living.

Table 3: Distribution of Respondents by Various Livelihood Activities n= (209)

Activities	*Frequency	Percentages	Rank
Crop farming	191	91.4	1st
Trading	67	32.1	2nd
Livestock keeping	44	21.1	3rd
Civil Service	32	15.3	4th
Grinding	28	13.4	5th
Tailoring	19	9.1	6th
Fishing/hunting	17	8.1	7th
Carpentry	15	7.2	8th
Blacksmith	15	7.2	8th
Hire labour	15	7.2	8th
Painting	14	6.7	9th
Brewing	14	6.7	9th
Commercial/ cyclist	11	5.3	10th
Food vending	11	5.3	10th
Mechanic	10	4.8	11th
Welding	8	3.8	12th
Others	5	2.4	13th

***Multiple responses**

Source: Field Survey, 2023

Rice farmers' level of livelihood diversification indices

Table 3: presents the extent of livelihood diversification among rice farmers, measured using the Simpson index of diversification due to its simplicity and robustness. The findings revealed that 97.6% of households exhibited low diversification, while only 2.4% had a medium level of diversification. This suggests that most rural rice farmers rely on multiple livelihood sources alongside their primary occupation to address food insecurity. Diversification is vital for ensuring a steady income flow and reducing poverty by minimizing income fluctuations. These findings align with Challa et al. (2019), who noted low diversification among rural households in Ethiopia.

Table 4: Distribution of Respondents by their Level of Livelihood Diversification Indices

SID Range	Frequency	Percentage	Level of diversification
≤ 0.25	204	97.6	Low
> 0.25	5	2.4	Medium
Total	209	100	

Source: Field Survey, 2023

Effects of Livelihood Diversification by Rice Farmers in the Study Area.

The effect of livelihood diversification and technology adoption on food security status of the rice farming households in the study area were analyzed using binary logit regression model. The Pseudo R^2 0.76 implies that all the explanatory variables included in the model were able to explain76.3% of the variation in food security status of the rice farmers. The log-likelihood ratio (LR) test is significant at one percent (1%) meaning that the model was adequate in explaining the probability of the effect of the explanatory variables on food security status. The result of the model is given in table 16 and it was revealed that livelihood diversification, technology adoption, educational level and farm size were positively significant to the respondents' food security status, while age is negatively related to the food security status. Livelihood diversification (X_1) had a positive and statistically significant (1%) relationship with food security. This signifies that for a unit rise in the livelihood diversification of rice farmers will reduce their food insecurity by 3.13 units. It is therefore worthy to note that livelihood diversified households are more income stable and food secured than the reverse households. This is in line with Raphael *et al.* (2017) which says that increasing the number of livelihoods by a household, increase income level and consequently lead towards food security. Age of household is expected to have impact on his labour supply for food production. It is also expected to have impacts on ability to seek and obtain off-farm jobs and income, which could increase household income.

The result showed that age (X_2) of the respondents had negative effect on food security and was significant at 1%. The negative sign of the coefficients implies that additional one year of the rice farmers will lead to 0.04

units decrease in the food security status of the farmers. This thus suggest that as farmers grow older, they tend to be less productive and thus less food secure. This is in line with Olayiwola *et al.* (2016) who reported that the older the household heads, the lower the probability that the household would be food secure. Technology adoption (X_3) coefficient was also observed to be positive and significant at 1%, which means that a year increase on technologies adoption will lead to 170.8 units increase in food security status of the rice farmers. This study is in line with Afodu *et al.* (2020) who also said technologies adoption is positively affecting the livelihood diversification of food security in his study area. The coefficient of education level (X_5) is positive and significant at 5%. This implies that a year increase in educational level of the rice farmers will lead to 2.12units increase of food security. Educated household is more sensitive to adopt technology to maximize the output they generated from farm activities and this contributed directly to food security status. This result is in line with Afodu *et al.* (2020) a positive effect of educational level in his study area. Farm size (X_6) had a positive and statistically significant 1% relationship with food security status of rice farmer. This signifies that a unit rise in this variable will lead to an increase in level of food security of the rice farmer by 40.72 units

Table 5: Binary Logit Regression Result Showing Effects of Livelihood Diversification and Technology Adoption on Food Security Status of Rice Farming Household

Variables	Odd Ratio	Coefficient	Std. Error	Z- Statistic	P> [Z]
Livelihood diversification	3.12977***	1.140959	0.3079574	3.70	0.000
Age	0.0374676***	-3.284278	1.031468	-3.18	0.001
Technology adoption	170.7983***	5.140483	1.100818	4.67	0.000
Marital Status	3.019503	1.105092	0.7742148	1.43	0.153
Educational level	2.12315**	0.7529008	0.3644236	2.07	0.039
Farm size	40.72158***	3.706758	1.197719	3.09	0.002
Access to Credit	3.52364	1.259495	0.795578	1.58	0.113
Extension Visit	4.187891	1.432197	0.8805846	1.63	0.104
Household Size	0.4834681	-0.7267699	0.7093797	-1.02	0.306
Constant		-13.36788***	2.920246	-4.58	0.000
Pseudo R^2 0.7637					
Prob > chi^2 0.0000***					
LR $chi^2(9)$ 195.38					

***** 1% Significance and ** 5% Significance**
Source: Field Survey, 2023

CONCLUSION AND RECOMMENDATIONS

Based on the findings from the study, it can be concluded that livelihood diversification and technology adoption are key factors that improve food security status among rice farming households in southern Taraba. Younger farmers are more likely to be food secure, indicating the importance of targeting the demographic in food security interventions. Education level and farm size also play a crucial role in determining food security status with higher education level and larger farms associated with greater food security.

Recommendations

Based on the finding from this research the following recommendations were drawn;

i. Design interventions targeting younger farmers, providing training and resources to enhance livelihood diversification and technology adoption.
ii. Encourage rice farming households to diversify their income sources and adopt modern technologies to improve agricultural productivity and food security.
iii. Provide education and training programs for rice farming households, focusing on younger farmers and those with smaller farms, to enhance their knowledge and skills in technology adoption and livelihood diversification.

References

1. Adeyemi, S. O., Sennuga, S. O., Alabuja, F. O., and Osho-Lagunju, B. (2023). Technology Usage and Awareness Among Smallholder Farmers in Gwagwalada Area Council, Abuja, Nigeria. *Direct Research Journal Agriculture Food Science*, *11*(3), 54-59.
2. Adeyongo, I. L., Chibuike, F., Sennuga, S. O., and Alabuja, F. O. (2021). Adoption of Agricultural Innovations among Rice Farmers in Federal Capital Territory, Nigeria. *International Journal of Agriculture Extension and Social Development*, *10*(6), 12-19.
3. Afodu, O. J., Afolake, A., C.and Lawrence, B., O. (2020). Effect of Livelihood Diversification and Technology Adoption on Food Security Status of Rice Farming Households in Ogun State. Nigeria,

Agricultural Socio- Economics Journal, 20(3), 233-244 DOI: http://dx.doi.org/10.21776/ub.agrise.2020.020.3.7

4. Aniah, P., Kaunza-Nu-Dem, M. K. and Ayembilla, J. A. (2019). Smallholder Farmers' Livelihood Adaptation to Climate variability and Ecological Changes in the Savanna Agroecological Zone of Ghana. *Heliyon*, 5(4), 1–25.
5. Asiga, D. A. (2013). Multi-Local Livelihoods and Food Security in Rural Africa. *Journal of International Development*, 14(1): 1-3.
6. Attah, A. W. (2012). Food Security in Nigeria: The Role of Peasant Farmers in Nigeria. *An International Multidisciplinary Journal, Ethiopia Vol. 6 (4). Serial No. 27. October 2012.*
7. Ayana, G.F, Magento, T.L. and Kussa, F.G. (2022). The Extent of Livelihood Diversification on the Determinants of Livelihood Diversification in Assousa Werede, Western Ethiopia. *Geojournal*, 87: 2525-2549.
8. Ayantoye, K. Yusuf, S.A. Omonona, B. T., and Amao, J. O. (2011). Food Insecurity Dynamics and its Correlates among Rural Households in South Western Nigeria. *International Journal of Agricultural Economics and Rural Development 4(1):43-55.*
9. Ayoade, A. R. and Adetunbi, S. I. (2013). Determination of farmers Coping Strategies to Household Food Insecurity In Oyo State, Nigeria Am. *Journal of Social Managers Science, 2013, 40): 1-7*
10. Babatunde, H.J. (2013). Non-Farm Inequality and Land in Rural Egypt. *Economic Development and Cultural Change*, 50(2), 339-363.
11. Babatunde, R. O. Omotesho, O. and Sholatan, O.S., (2007). Socio-econmic Characteristics and Food Security Status of Farming Households in Kwara State, North-Central Aligeria, *Pakistan Journal of Nutrition, 6, 49-58.*
12. Baird, T. D. and Hartter, J. (2017). Livelihood Diversification, Mobile Phones and Information Diversity in Northern Tanzania. *Land Use Policy*, 67, 460–471.
13. Bertuglia, A. and Calatrava-Requena J. (2006). Factors Related to the Adoption of Good Agrarian Practices (GAP) in Plastic Covered Horticulture of Southeastern Spain. In: 2006 International Association of Agricultural Economists Annual Meeting, August 12-18, Queens land, Australia (No. 25545).
14. Biam, C. K. and Tavershima, T. (2020). Food Security Status of Rural Farming Households in Benue State, Nigeria**.** *African Journal of food, agriculture, nutrition and development. Volume 20, No 2, march 2020. DOI: 10.18697/ajfand.90.17980.*
15. Bickel, W. K., Madden, G. J. and Jacobs, E. A. (2000). Three predictions of the economic concept of unit price in a choice context. *Journal of the Experimental Analysis of Behavior*, *73*(1), 45-64.
16. Carletto, C., Zezza, A. and Banerjee, R. (2013). Towards Better Measurement of Household Food Security: Harmonizing Indicators and the Role of Household Surveys. *Global Food Security*, 2, 30-40.
17. Challa, M. (2013)**.** Determining Factors and Impacts of Modern Agricultural Technology Adoption in West Wollega, Munich, GRIN Publishing GmbH, http://www.grin.com/en/e-book/280336/determiningfactors-and-impacts-of-modern-agricultural-technology adoption. Challenges and Opportunities. E-ISSN: 2580-2828 Pages: 18-27 DOI: 10.13057/tropdrylands/t020104.
18. Challa, T.G., Mamo, A.T. Tibeso, A. N. and Dawud, I. (2019). Rural Livelihood Diversification Status and Determinant Factors in Arsi, Ethiopia. *Int. J. Bus. Econ. Res*., **8**, 23 – 30.
19. Chandio, A.A., Jiang, Y., Gessesse, A.T., Dunya, R. (2017). 'The Nexus of Agricultural Credit, Farm size and Technical Efficiency in Sindh, Pakistan: A Stochastic Production Frontier Approach', *Journal of the Saudi Society of Agricultural Sciences,* 18(3), pp. 348-354.
20. Echebiri, R. N., Onwusiribe ,C. N. and Nwaogu, D. C. (2017). Effect of Livelihood Diversification on Food Security Status of Rural Farm Households in Abia State Nigeria. *Scientific Paper Series Management, Economic Engineering in Agriculture and Rural Development*, 2017, **17**, 159-166.
21. FAO (Food and Agriculture Organization of the United Nations). (2017). The Future of Food and Agriculture: Trends and Challenges. Retrieved May 2018 from: http://www. fao.org/3/a-i6583e.pdf. Accessed May 2018.
22. FAO (Food and Agriculture Organization). (2006). Food Security, FAO's Agriculture and Development Economics Division (ESA) with Support from the FAO Netherlands Partnership. Amsterdam.
23. Gebru, G. W., Hyacinth, E. I. and Ogbonnia, P .E. (2018). Determinants of Livelihood Diversification Strategies in Eastern Tigray Region of Ethiopia. Agriculture & Food Security. (2018) 7:62 https://doi.org/10.1186/s40066-018-0214-0.
24. Goodman, B. A. (2020). Utilization of Waste Straw and Husks from Rice Production: a Review. *Journal of Bioresources and Bioproducts*, *5*(3), 143-162.
25. Igwe, P. A., Rahman, M., Odunukan, K., Ochinanwata, N., Egbo, P.O. and Ochinanwata C. (2020). Drivers of Diversification and Pluriactivity among Smallholder Farmers—Evidence from Nigeria. *Green Finance*, 2020, **2**, 263-283.

26. Jirgi, A. J., Adewumi, A., Yisa, E. S. and Okpanachi, F. O. (2018). Raising the Income of Smallholder Farmers in Kwara State, Nigeria: A Case Study of Cassava-Based Crop Farmers. *Ethiopian Journal of Environmental Studies and Management*, 11(6): 697 – 706.
27. Karki, S. (2021). Sustainable Livelihood Framework: Monitoring and Evaluation. *International Journal of Social Sciences and Management*, *8*(1), 266–271. https://doi.org/10.3126/ijssm.v8i1.34399
28. Loison, S. A. (2019). Household Livelihood Diversification and Gender: Panel Evidence from Rural Kenya. *Journal of Rural Studies*, *69*, 156–172.
29. Martin, S. M. and Lorenzen, K. (2016). Livelihood Diversification in Rural Laos. *World Development*, 83, 231–243.
30. National Population Commission (2006). *Nigeria Population Census Figures, 2006 Abuja, Nigeria.* NPC Publication. Nigeria.
31. Obianefe, C. O., Okoroji, N. O., Obiekwe, N. J., Osuafor, O. O. and Shah, Z. A.(2022). Economics of good Agronomic Practices Adoption by rice Farmers in value chain Develepment Programme, Anambra State, Nigeria. African Journal of food, Agriculture, Nutrition and Development 22(8): 21308-21330
32. Olayiwola, S. A., Olakunle, A. I. and Micheal, A. (2016). Effect of Awareness of Ebola Virus Disease on Food Security Status among Bush Meat Market in Ibadan, Oyo State, Nigeria. Scientific papers Series Management, Economic Engineering in Agriculture and Rural Development vol.16.Issue 3. 2016.
33. Pritchard, B., Rammohan, A. and Vicol, M. (2019). The Importance of Non-Farm Livelihoods for Household Food Security and Dietary diversity in Rural Myanmar. *Journal of Rural Studies*, *67*, 89–100.
34. Raphael, N. E., Chigozirim, N., Onwusiribe, D. and Chinedu N. (2017). Effect of Livelihood Diversification on Food Security Status of Rural Farm Households in Abia State Nigeria. '*Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*' 17(1): 159-166.
35. Rukwe, D. T., Abdullahi, Y.M., Faruk, A.U and Nwaeze U. and Nweze U. (2019) The Effects of Farmers-Headers Conflict on Farming Households in Southern Taraba State, Nigeria. South Asian Research Journal of Agriculture and Fisheries 1 (3); 106-111
36. Sennuga, S. O. (2019). Use of ICT among Smallholder Farmers and Extension workers and its Sanusi, Relevance to Sustainable Agricultural Practices. A Thesis Submitted for the degree of Doctor of Philosophy (PhD), Coventry University, United Kingdom.
37. Shaikh, S. A. Hongbing, O., Khan, K. and Ahmed, M. (2016). Determinants of Rice Productivity: An Analysis of Jaffarabad District- Balochistan (Pakistan). *European Scientific Journal* 12(13): 1857-7881
38. Song, Z., Chen, J. and Zhao, Y. (2018). 'Rice Domestication and the Yangtze River Civilization', Biodiverty Sciences**,** 26(4), pp. 346-356.