ASSESSMENT OF DIVERSIFICATION STRATEGIES ON LEVEL OF LIVING AMONG SOYBEAN FARMERS IN KADUNA STATE, NIGERIA.

M. A. Adam[1]., Associate Prof Dr. Y. U. Oladimeji[2]., Dr. S. A. Hussaini[2]., Dr. B. D. Magaji[2]., Associate Prof Dr. S. A. Makama[3]., & Dr. A. A. Sani[2]

[1]*AFEX Commodities Exchange Limited, Abuja, Nigeria & Postgraduate student*
Corresponding author: adam4ever37@gmail.com; https://orcid.org/0009-0001-0136-5525
[2]*Department of Agricultural Economics, Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria*
Corresponding author: yusuf.dimeji@yahoo.com; https://orcid.org/0000-0001-5987-3488
[3]*National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria, Nigeria*

Abstract:
On-farm diversification refers to the shift from primary agricultural produce to the diversifying economic outputs within the agricultural sector. Increasing the productivity of the agricultural sector has significant multiplier effects in stimulating other sectors of the rural economy. The study was designed to assess the effect of on-farm diversification strategies on output and level of living among soybean-based cropping farmers in Kaduna State, Nigeria. Primary and secondary data were collected from 336 farmers with the aid of structured questionnaire. The livelihood diversification index and Multinomial Logit statistics were used to achieve the study's objectives. Most of the rural households (69.6%) diversified their livelihoods into several activities and earned significant amount of income from multiple sources. On-farm income was the highest income sources contributing 73.4% of the total mean share of the income of the farmers with a significant difference (p < 0.001, χ2 = 31.98) between the on-farm, off-farm, and non-farm earnings. The results of the multinomial Logit model indicated the marginal effects of statistically significant variables on income diversification among soybean farmers, specifically in relation to the diversification categories of (i) soybean and other agricultural income (SA), (ii) soybean, other agricultural, and non-agricultural income (SAN), and (iii) soybean and non-agricultural incomes (SN). These effects were estimated while holding all other predictor variables in the model constant. Government policy needs to focus on access to arable land and extension support targeted at rural households to promote diversification to on-farm activities.
Keywords: income, livelihood diversification, soybean, Nigeria

1. INTRODUCTION

Lately, the global organization has directed its focus and endeavours towards sustainable progress in all spheres of life. Particularly, in the realm of agriculture as the pivotal foundation of rural livelihoods. Putting an end to destitution and hunger, attaining food security, and enhancing nutrition through sustainable agricultural production are essential components of achieving the sustainable development goals. Hence, Sustainable development requires progressing in a way that meets current needs while also ensuring future generations' ability to meet their own (WCED, 1987). Nonetheless, the 2022 report by the United Nations (UN) revealed a setback in

the long-standing efforts to eradicate poverty and hunger, primarily due to the convergence of the COVID-19 pandemic, climate change, and conflicts. Remarkably, it was estimated that 7.7% of the global population suffered from undernourishment in 2020, and this percentage was projected to remain the same by 2030 (WHO, 2021). Additionally, the 2022 global Multidimensional Poverty Index (MPI), created by the Oxford Poverty & Human Development Initiative (OPHI), (2022), identified 1.2 billion individuals (19.1%) as experiencing multidimensional poverty.

In Nigeria, approximately 47% of the populace reside in rural regions and rely on farming as a means of subsistence. According to the National Bureau of Statistics (NBS) report, a considerable proportion (72%) of impoverished individuals are rural farmers who experience a combination of socio-economic exclusion and the deterioration of their resources (NBS, 2022). As a result, desertification, drought, and diminishing agricultural yields serve as primary catalysts for poverty and hunger within these communities. Given these circumstances, poverty-reduction measures must include efforts to battle desertification and promote the adoption of sustainable land management methods that improve the well-being of impoverished rural populations.

In rural areas of Kaduna State, soybean is considered the most valuable protein source for enhancing the nutritional quality of traditional food (Kamara *et al.,* 2018). Soybean is rich in various phytochemicals, including phytic acid (1.0–2.2%), sterols (0.23–0.46%), and saponins (0.17–6.16%), which offer a broad range of potential health advantages (Pingxu *et al.,* 2022). Moreover, the cultivation of soybean has positively transformed the rural economy, leading to improved living conditions for soybean farmers, particularly women and children (Paroda, 1999).

However, due to the inherent risk and uncertainty associated with production, rural households find themselves compelled to devise a strategy to address the vulnerability of their agricultural production systems by pursuing livelihood diversification (Abdulrahman *et al.,* 2016). Although most rural households rely on diverse agricultural efforts such as animal rearing and crop production as their primary source of income, they also engage in a variety of non-agricultural activities to complement and increase their primary source of income (Oladimeji *et al*., 2015; Barrett *et al*., 2001; Babatunde and Qaim, 2010). According to their studies, only a minute

percentage of rural households engage in single activities, and diversifying into non-farm income-generating initiatives has been shown to improve food accessibility and nutritional result. While there is an abundance of literature on soybean production on one hand and livelihood diversification on the other hand by Sanginga et al. (2002), Ugbabe *et al.* (2017), Oladimeji *et al. (*2015), Sadiq *et al.* (2020), and Kamara *et al.* (2022), there is a notable gap in the analysis of economic diversification strategies specifically related to soybean farmers for sustainable livelihoods in Kaduna state. Consequently, this research aims to assess the proportion of livelihood diversification allocated to on-farm, off-farm, and non-farm income; examine the strategies employed by farming households to diversify their livelihoods and estimate socioeconomic factors influencing the diversification strategies adopted by farming households?

2.   RESEARCH METHODOLOGY

The geographical coordinates of Kaduna State span from 90° N to 12° N Latitude and from 6° E to 9° E Longitude, encompassing an approximate area of 68,000 square kilometres, which accounts for about 7% of Nigeria's total landmass; this region comprises 23 Local Government Areas (Kaduna State Government, 2012). The annual precipitation totals 1,272.5 mm, with a humidity level of 56.64%. Temperatures typically range from 15.1^{o}C to 35.18 ^{0}C daily. With an annual population growth rate of 3.2% by NBS (2016), the state's predicted population for 2023 was estimated to be around 9,969,156 people. Kaduna State was predominantly, an agricultural region, with crops like as soybean, rice, maize, cotton, peanuts, tobacco, beans, guinea corn, millet, ginger, cassava, yam, and potatoes being grown. Cattle, sheep, goats, pigs, and poultry husbandry are also important in the state's agricultural activities (Kaduna State Government, 2012). Furthermore, the state is home to numerous entities including as businesses, research institutes, higher education institutions, and universities.

Data collection utilized primary data. The data was gathered from farmers who were selected as samples and interviewed by enumerators with aids of Computer Assisted Personalized Interview (CAPI) method during the cropping season of 2019/2020. A three-stage sampling procedure was employed. Five Local Government Areas (LGAs), namely Makarfi, Ikara, Soba, Lere, and Giwa, were purposively considerable number of soybean farmers; four communities were chosen at random from each of the LGAs, for a total of twenty (20) villages. This choice was made based on the comparability of their production systems. Finally, using Taro Yamane's formula at a 95%

confidence level, a proportionate random sample technique was used to choose 336 farmers from a registered soybean farmer's cooperative.

The measurement of farmers' diversification in terms of their livelihood was achieved using the Livelihood Diversification Index (SID) adopted from Afodu et al. (2019). The formula for calculating SID is as follows:

$$SID = 1 - \sum_{i=1}^{n} P_i^2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

This study presents the SID model as:

$$SID = 1 - \sum_{i=1}^{8} \left[\left(\frac{fci}{thi}\right)^2 + \left(\frac{pji}{thi}\right)^2 + \left(\frac{livesi}{thi}\right)^2 + \left(\frac{pfpwi}{thi}\right)^2 + \left(\frac{lwi}{thi}\right)^2 + \left(\frac{sei}{thi}\right)^2 + \left(\frac{remi}{thi}\right)^2 \right. $$
$$\left. + \left(\frac{csi}{thi}\right)^2 + \left(\frac{fri}{thi}\right)^2 + \left(\frac{othersi}{thi}\right)^2 \right] \dots\dots\dots\dots\dots\dots\dots .2$$

Where: thi = total household income, fci = crops farming income, pji = private job income, $livesi$ = Livestock income, $pfpi$ = Processing of farm produce, lwi = labour wage, sei = self-employment income, fri = farm rent income, $remi$ = remittance income, csi = civil service income, and $othersi$ = other income sources. The classification of SID values concerning the level of livelihood diversification was adopted from studies of Oladimeji et al. (2015) and Sherf-Ul-Alam et al. (2017). The extent of income diversification and their range include: No diversification (≤0.01); Diversification on low level (0.01 – 0.25); Diversification at medium level (0.26 – 0.50); Diversification on low level (0.01 – 0.25); Diversification at high level (0.51 – 0.75) and Diversification at very high level (≥0.75).

The Multinomial Logit model was used to analyse the socioeconomic factors that influence diversification strategies among agricultural households in the study area. The model's explicit form is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + e_i \dots 3$$

Y = income diversification strategy (1= Soybean income only, 2= income from soybeans and other agricultural products 3= Soybean and non- agricultural incomes and 4= Soybean, other agricultural & non- agricultural incomes). X_1 = Sex of the farmer (dummy), X_2 = Age (years), X_3 = educational level (years of formal education), X_4 = Marital Status (dummy), X_5 = household

size (number), X_6 = Farming experience in years (years), X_7 = Co-operative membership in years (years), X_8 = Access to credit in Naira (naira), X_9 = Farm size (ha), B_0 = Constant, β_1 - β_{11} = regression coefficients and e = error term.

3. RESULTS AND DISCUSSION

3.1 Soybean-based Production Systems

The majority of the farmers (36.7%) were primarily involved in the combination of soybean/maize (SM), soybean/cowpea (SC) with 25.2% followed by soybean/sorghum (24.6%) production system (Table 1). Most soybean-based farmers practice crop combination due to the uncertainty of harvest (yield) that may arise from changing climatic conditions, as well as high input cost, particularly fertilizer. Selecting two different crop mixtures provides the added benefit of optimizing land resources. Legumes help to convert the nitrogen gas into its usable form like ammonia which can be used by the plants and other organisms thus reducing expenses on fertilizer.

Table 1. Distribution of respondents based on crop combination.

Soybean based cropping systems	*F*	%
Sole soybean	45	13.4
Soybean / sorghum	83	24.7
Soybean / maize	123	36.6
Soybean / cowpea	85	25.3

Source: Researchers' computation, 2021

3.2 Gender Distribution of Farming Household Heads

The result of the distribution of the Soybean farmers showed that, about (80.5%) male participated in soybean based cropping system. This could be attributed to the fact that men are mostly involved in crop production in the study area as women are mostly play a supportive role such as taking part in planting and harvesting and post-harvest handling of harvested crops.

3.3 Income Share of Livelihood Diversified Activities by the Farmers

Farm income which stems from farming activities, represents the largest portion, accounting for approximately 73.4% of the average total farmers' income in the study area (Table 2). On the other hand, off-farm income contributes a mere 4% to the overall income share of the farmers, while non-farm income constitutes roughly 23% of their total income share. In line with this study, Arifa *et al.* (2019), discovered that crop production accounted for the highest income

share among both tribal and non-tribal farmers in a separate study to assess the impact of agricultural modernization on the sustainable livelihood of tribal and non-tribal farmers in Bangladesh, with respective proportions of 25.08% and 23.69%.

Table 2. Diversification strategies and mean shares of income (level of living)

Income Sources	Variables	Mean Income Share		%MIS
Farm income		(₦)	($)	
	Crop farming	451,548.00	1,268.39	72.6
	Livestock	5,205.00	14.62	0.8
	Farm income	**456,753.00**	**1,283.01**	**73.4**
Off-farm income				
	Farm labour	10,360.00	29.10	1.7
	Processing of farm produce	3,409.00	9.58	0.5
	Farm rent/resources	10,620.00	29.83	1.7
	Off-farm income	**29,594.00**	**83.13**	**4.8**
Non-farm income				
	Self-employed business	42,427.27	119.18	6.8
	Private Organization Job	28,842.55	81.02	4.6
	Government job income	31,950.00	89.75	5.1
	Remittance	16,437.50	46.17	2.6
	Others	20,833.33	58.52	3.4
	Non-farm income	**140,490.65**	**394.64**	**22.6**
Household income		621,632.65	1,746.16	100

Source: Researchers' computation, 2021; Note $1USD = ₦356.00 At the time of the survey

3.4 Livelihood Diversification Strategies of the Soybean Based Crop Farmers

As depicted in Figure 1, approximately 70 percent of farming households engage in diversified livelihoods.
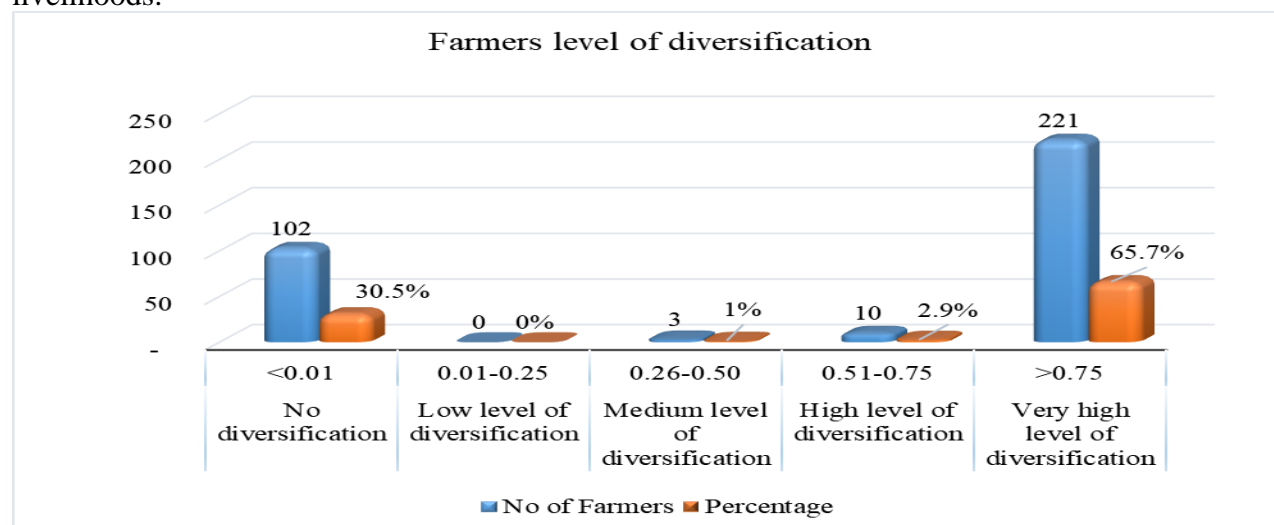
Figure 1. Farmers' livelihood diversification levels

Merely 30.5 percent of these households possess a Simpson index below 0.01, indicating their reliance on a solitary source of livelihood activity. Around 31 percent of households lack any form of diversification, while 1 percent display a moderate level of diversification. Additionally, 2.9 percent exhibit a high level of diversification, and the remaining 65.7 percent demonstrate an extremely high level. These findings suggest that a majority of households engage in medium to high levels of diversifying their means of making a living. These findings contrast the findings of Sherf-Ul-Alam *et al.* (2017), who used the SID approach to investigate income diversification among farmers in selected areas of Bangladesh's Sunamganj District. Their study revealed that the highest level of diversification among farmers in the region was medium, accounting for a total of 42.50 percent, while only 22 percent had no diversity at all.

3.5. Socio-Economic Factors Influencing Diversification Strategies of the Rural Farming Household Heads

Table 3 displays the findings of the Multinomial Logit analysis concerning the factors influencing the diversification of income among Soybean farmers in the designated region. The model demonstrated statistical significance, as indicated by the Wald chi-squared estimate probability, which was significant at the 1% threshold. Results were reported using marginal effects (ME) rather than the coefficients since ME shows the direction of change in income diversification and precisely predict the probability and magnitude of such shift in response to changes in socioeconomic and institutional factors.

Findings show that males are 0.978 units less likely than females to choose the soybean plus non-agricultural income sources (SN) diversification approach when all other predictor factors in the model were held constant. However, male is more likely than females to choose soybean only (-0.883), soybean and other agricultural income (-1.126) and soybean, other agriculture, and non-agricultural income (-1.454) units. This suggests that female soybean growers are statistically more likely to diversify by incorporating non-agricultural sources of income, particularly through self-employment activities like petty trading, which play a significant role in remote settings. The educational background of the household head had a positive and notable impact on SA (0.433), SN (0.406), and SAN (0.634). This implies that households with more educated family members may choose to engage in activities other than farming, by incorporating both external labour and on-farm labour at the same time. Existing literature

asserts that educational achievement, knowledge, and skills are the most influential factors affecting farm productivity, income, and labour mobility (Farooq *et al.*, 2021).

Table 3. Multinomial Logit Results for Factors Influencing Income Diversification

Variable	S	SA	SN	SAN
	Marginal effect (ME)	ME	ME	ME
Sex	-0.883**	-1.126**	0.978*	-1.454*
Marital Status	0.631**	0.522	0.678	-0.389
Education	-0.205	0.433**	0.406**	0.634*
Age	0.009	-0.014	0.008	0.065**
Household size	-0.006	-0.028	0.220***	-0.005
Farming experience	-0.000	0.044**	0.040**	-0.017
Cooperative	-0.023	-0.047*	-0.111***	-0.070
Credit	-7.11e-07	3.24e-06	-8.96e-06*	-3.25e-07
Constant	0.599	1.892	-1.412	-0.546
No. of observations	336			
Pseudo likelihood	-181.241			
Wald chi^2 (348)	156.912			
Log Prob > chi^2	0.0000			
Pseudo R^2	0.48			

Source: Researchers' computation, 2021

*Note: *** Significant at 1%; ** significant at 5%; * significant at 10% level; S denote soybean income only; SA= soybean & other agricultural incomes; SN = Soybean and non-agricultural incomes & SAN = Soybean, other agricultural & non-agricultural incomes*

There is a projected 6.5% increase in the likelihood of farming for every year that the household head's age rises opting for SAN activities, as opposed to relying solely on soybean as their source of livelihood. Therefore, with all other factors being equal, younger farmers have a larger propensity to engage in non-farm and off-farm activities as opposed to only cultivating crops or depending on the soybean for their living in line with study by Dinku (2018). The fact that soybean farmers have adopted an income diversification strategy is consistent with the hypothesis that as household sizes rise, so does the possibility of income diversification. The results show that the chance of the soybean farmer adopting SN diversification increases by 0.220 units (equal to 22%) with the addition of each new household member (P>0.01). This finding substantiates the claim made by Asfaw et al. (2015), in rural Malawi, which associates larger households with income diversification.

The results of farming experience suggest that compared to individuals who exclusively depend on soybean as their primary means of subsistence (baseline scenario), a one-year increment in the farming expertise of household leaders is likely to sway farmers' choices of livelihood options towards SA and SN by 0.044 units (4.4%) and 0.040 units (4.0%), respectively, both at a

5 percent probability level. Hence, it is plausible that households with extensive years of agricultural experience will potentially facilitate the cultivation of additional crops. This aligns with earlier empirical research conducted by Lancaster and Torres (2019).

4.0 CONCLUSION

Most of the households in the study practice crop combination in production as crucial elements of their livelihood approaches. Household livelihoods are formed through various combinations of these activities, although the most practiced production systems in the study area involve soybean, sorghum, maize, and cowpea. It is essential for policies to place a priority on having access to cultivable land, saving money, and extension help that is especially suited to rural households to enable favourable choices for livelihoods that encourage diversification in both farming and non-farming strategy. Considering that soybean production and its expansion tend to favour men, it is important to address gender-related issues and eliminate biases and discrimination within communities against women, thereby creating gender-sensitive opportunities that allow women to expand their sources of income.

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