



Research article

Drivers of diversification and pluriactivity among smallholder farmers—evidence from Nigeria

Paul Agu Igwe^{1*}, Mahfuzur Rahman¹, Kenny Odunukan¹, Nonso Ochinawata², Obiamaka P. Egbo³ and Chinedu Ochinawata²

¹ Lincoln International Business School, University of Lincoln, Lincoln, United Kingdom

² African Development Institute of Research Methodology, Plot 79, Arai River, Independence Layout, Enugu, Nigeria

³ Department of Banking and Finance, Faculty of Business Administration, University of Nigeria, Enugu Campus, Enugu, Nigeria

* **Correspondence:** Email: pigwe@lincoln.ac.uk; Tel: +441522835509.

Abstract: Diversification and pluriactivity have become a norm among farm business owners (FBOs) due to persistent low farm income. This study applies the resource-based theory to examine drivers of diversification and livelihood income-oriented towards a sustainable livelihood. Our framework develops hypotheses about the impact of internal and external resources on livelihood choices at the household level. We use a survey of 480 rural Nigerian farmers (agripreneurs), applying a Multivariate Tobit to test our framework. We find that education plays the most significant role in all types of employment options. The more FBOs are educated, the more the likelihood that they will choose non-farm or wage employment. This study revealed that while the agriculture sector's share of rural employment is declining, non-farm is on the increase. More so, there is a decline in farming among the young generation, marital status bias and gender influence in resource allocation. The socioeconomic (income and food security) and socio-cultural (employment and rural-urban migration) implications of rural sustainability linked to UN Development Goals have been highlighted and analysed in this article.

Keywords: agribusiness; diversification; pluriactivity; resource-based theory; sustainable livelihood framework

JEL Codes: Q12, Q13, Q20, R11, R20

1. Introduction

Historically, the economic development literature reveals that the growth path of most nations was accompanied by a process of agricultural development and transformation (Bezu & Barrett, 2012; Nagler & Naudé 2017). Like many developing regions, Sub-Saharan African (SSA) employment still depend on agriculture. On average, over half of the labour force, and even more in poorer countries and localities depend on agriculture (World Bank, 2018). However, the share of the labour force in agriculture is declining (as is normal in development), leading government and policymakers to focus on job creation outside agriculture (World Bank, 2018). Due to declining farm income, engagement in the informal sector or non-farm sector has been a route out of chronic poverty for many households. In Nigeria, for example, most farmers are only marginally improving yields and continue to use traditional processes that depend heavily on use tools like hoes and cutlasses that have not evolved for centuries (Ekekwe, 2017). In addition to traditional constraints, there is market failures and missing institutions to support rural development (Ola & Menapace, 2020).

Faced with several challenges, farming households engage in diversification or pluriactivity. Pluriactivity and portfolio entrepreneurship is commonly used to explain on-farm and off-farm diversification or multiple jobs holding by farm business owners FBOs (Radicic et al., 2017) which we refer to agripreneurs. For decades, SSA governments have used different policy instruments to improve rural agricultural productivity. However, most farmers in the region cultivate less than 2.0 hectares (Kuivanen et al., 2016). An outdated land tenure system constrains access to land (1.8 ha/farming household), including a very low level of irrigation development, limited adoption of technologies, poor access to credit, inadequate storage facilities and poor access to markets (FAO, 2020).

This study is based on the fundamentals of the United Nations (UN) Sustainable Development Goals aimed at achieving a better and more sustainable future for all. Specifically, Goal 2: Zero Hunger—emphasizes that the food and agriculture sector offer key development solutions and is central for hunger and poverty eradication. Goal 8: Decent Work and Economic Growth—highlights that Sustainable economic growth will require societies to create conditions that allow people to have quality jobs. Due to rural livelihoods challenges, rural communities are increasingly diversifying into non-farm activities (Neog & Sahoo, 2020) or engaging in off-farm employment (Fabusoro et al., 2010; Sarker et al., 2019, 2020). Diversification has been previously studied in many other contexts as pluriactivity and portfolio entrepreneurship referring to farmers having multiple income activities or job holdings (Morris et al., 2017; Rahut & Scharf, 2012). The current article applies the “Resource-based View” (RBV) theory to examine motives and the determinants of farm-focused “monoactivity” versus diversification. Despite the recent scholarly interest in the field of pluriactivity or agripreneurship (e.g., Radicic et al., 2017), research into behaviour and determinants in the SSA context are relatively few (Kuivanen et al., 2016).

This study examines the household as the unit of analysis. Radicic et al. (2017) argued that the first theoretical perspective derived from rural sociology treats the household as the unit of analysis such that resources of the whole family are judged as key influences on how pluriactive farm households allocate resources between farm and non-farm activities. In the current study, our

purpose is to appraise the key internal resources (age, gender, family size, education level, etc) and external resources (e.g. effect of farm size, the value of land, access to credit, access to infrastructure, etc.) (see, e.g., Gautam & Andersen, 2017). It has been argued that a more integrative understanding of individual with external perspectives is needed to fully advance entrepreneurship studies (Gedajlovic et al., 2013). More so, data on both individual and environmental factors are rarely available (Radicic et al., 2017). The examination of the internal and external resources for a less developed context is useful (Nagler & Naudé, 2017), hence, the focus of this study is on Nigeria (the largest economy in SSA).

It has been reported that there is limited literature on small and medium scale farms in SSA and previous studies tend to focus on the profitability of crop producers (Sanou et al., 2020). Also, limited attention is given to the heterogeneity of farms and viability with farm size (Sanou et al., 2020). For decades, rural households are diversifying their sources of income for various socioeconomic and sociocultural reasons (Atuoye et al., 2019). In its current trajectory, diversification of sources of income can lead to food security, income security and rural sustainable livelihood.

Against these backdrops, this article examines the determinants of diversification and pluriactivity among rural farm business owners (FBOs) in Nigeria. The remainder of the article is as follows. Next, we review the literature on pluriactivity and diversification, Resource-based theory, Livelihood and Capability Approach. This is followed by the methodology, hypotheses development, analysis and discussion. Finally, the article concludes with contributions and implications.

2. Literature review

2.1. Pluriactivity and diversification

In the rural sociology literature, pluriactivity is an off-farm economic activity engaged by the farmer and other household members, typically for risk-reduction and to supplement farm income. Sometimes, it might be because of lifestyle choices or wider non-economic goals (Ochieng et al., 2019; Dessart et al., 2019). However, pluriactivity may not be entrepreneurial, for example when FBOs engage in off-farm salaried activities. Some farmers try to mitigate associated risks including floods, droughts, crop failure (Dagunga et al., 2018). Arguably, this sector will be highly informal and emergent (Bezu & Barrett, 2012; Haggblade et al., 2010). By informal, we refer to legal activities that are unrecorded, unprotected, and unregulated by the public authorities. While some of these attempts have a positive impact on income generation in the short run, unplanned diversification can affect associated stakeholders in the long run (Akinrinde et al., 2018).

Radicic et al. (2017) identifies three distinct motivations behind pluriactivity—(i) as an exit strategy, (ii) as a coping strategy during downturns in agricultural activities and profits, and (iii) as a deliberate family strategy to increase wealth. In this study we regard FBOs as “agripreneurs” since being an entrepreneur means spotting opportunities and creating value in marketplaces. Morris et al. (2017) posit that the adoption of technology in search of diversified farm business opportunities appears to be consistent with broader conceptions of entrepreneurship. These attributes have been applied by some studies representing the farmer as an agent of innovation focusing on the entrepreneurial skills of farmers (see, e.g. Morgan et al., 2010). It is believed that FBOs engage in portfolio activities as a self-insurance mechanism to increase or stabilise household incomes (Haggblade et al., 2010). The term pluriactivity

could be interpreted in three broad ways: diversification within the farm gate, within the farm business and beyond the farm gate (Radicic et al., 2017).

Arguably, reliance on off-farm income-generating activity (Rahut & Scharf, 2012), or pluriactivity, has for some time been a strategy adopted by FBOs to absorb economic shocks and protect rural society (Morris et al., 2017). Three rural livelihood factors are mentioned as determining the nature and extent of diversification are seasonality, risk and vulnerability (Igwe et al., 2019; Loison, 2015). Morris et al. (2017) observe that one of the most significant factors in the rural non-farm economy (RNF) is resource availability (labour, land and capital). To explore the implications of diversification practices of rural FBOs in developing context, we examine the Nigerian rural context?

Some characteristics of Nigerian rural farm economy include limited market access, inadequate credit, limited access to information and poor infrastructure (World Bank, 2013; Rueda et al., 2018). To overcome these challenges, people come together to form a social group. Membership of social group and collective action leads to improvements in the supply of input, improved access to information and resources. However, farmers' attitude towards the social group is positively influenced by being male, having more assets, and operating a larger farm (Wardhana et al., 2020).

2.2. Resource-Based View (RBV)

The growth of entrepreneurial ventures results from the interaction between entrepreneurs' internal resources and capabilities and constraints (Pindado & Sánchez, 2018). The resources available to entrepreneurs include natural, human, financial, physical capital, etc. These resources are converted into capabilities. Therefore, successful entrepreneurs are those that create the most value from their resources available to them. Studies often apply RBV to analyse new venture creation or growth orientation within the agricultural sector (e.g. Pindado & Sánchez, 2018; Kraaijenbrink et al., 2010; Sarker et al., 2020). RBV defines a business as a;

“a unique collection of resources and capabilities, and those that are valuable, rare and inimitable, together with the suitability of the firm's organisation to exploit these tangible and intangible assets that give the firm competitive advantage and consequently greater financial reward” (Pindado & Sánchez, 2018).

Chambers and Conway (1992) posits that a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living (cited in Morse, McNamara & Acholo, 2009). There are five major capabilities, assets and activities required for rural livelihood: Natural Capital, Social Capital, Human Capital, Physical Capital and Economic/Financial Capital. As defined by Morse et al. (2009), Natural Capital refers to natural resource stocks and environmental services (Sarker et al., 2020; Sarker et al., 2019). Social Capital refers to social resources (networks, social claims, social relations, affiliations and associations). Human Capital includes education, skills, knowledge and labour. Physical Capital includes infrastructure, equipment and technologies. Finally, Financial Capital refers to capital-base (credit/debit, cash, etc).

The Capability Approach was first articulated by the Indian economist and philosopher Amartya Sen in the 1980s (Sen, 1985). It is defined by its choice of focus upon the moral significance of individuals' capability of achieving the kind of lives they have reason to value. It focuses directly on the quality of life that individuals can achieve. Explaining Sen (1995) personal, social and environmental conversion factors, Kimmitt et al. (2019) draw on three distinctions. First, they

postulate that for personal conversion factors, if an individual is restricted by some internal factors (e.g. emotions, satisfaction physical condition, reading skills, intelligence and so forth) then what can be achieved will be limited in scope and have limited help in enabling a functioning. Second, they maintain that social conversion factors reflect the societal elements which may be combined with personal conversion factors to inhibit or lead to achieved functioning (such as discriminating practices, gender roles, societal hierarchies, power relations, etc). Third, environmental conversion factors pertain to the elements of the environment (e.g. geographic location, climate), which individuals may be able to convert into an individual functioning (Kimmitt et al., 2019).

Although popular since its development, the RBV has been extensively criticized. Kraaijenbrink et al. (2010) provide RBV critiques that fall into several categories: it has no managerial implications, its applicability is too limited, and sustained competitive advantage (SCA) is not achievable. Among the internal resources of the RBV theoretical approach, age is an important factor generally found to influence pluriactivity or portfolio activities with very young entrepreneurs (less than 21 years) and median age more likely to engage in diversified activities than older counterparts (Radicic et al., 2017). Studies investigating the effects of gender in isolation suggest that women start businesses for somewhat different reasons than their male counterparts (Stephan et al., 2015). Education and technical training appear to have a positive effect on farmer agripreneurship, growth ambitions and poverty reduction (Gautam & Andersen, 2017; Naminse & Zhuang, 2018).

Family size and demography are major elements that play key roles in pluriactivity, since, undertaking additional business activities through different family members can mitigate resources or market constraints within the agricultural sector (Radicic et al., 2017). Also, access to information and social capability has the greatest influence on farmer agripreneurship growth (Naminse & Zhuang, 2018). However, age, location, gender, household income, and education influence the relative importance of various segments of smallholders' place on these constraints (Ola & Menapace, 2020). The external resources and capabilities within the RBV of the rural agricultural sector and informal non-farm entrepreneurship include farm size, the value of land, access to capital/credit, access to services and information and access to infrastructure such as electricity. Using a cross-sectional household data from six countries (Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda), Deininger et al. (2017) found that large differences in land endowments and productivity create the potential for the land market to equalize endowments and contribute to higher levels of productivity.

Another factor that affects rural productivity is the dysfunctional or imperfect factor markets, especially for agricultural land. Therefore, farm size is expected to be positively associated with portfolio agripreneurship as small farms indicate survival strategies, but for large farmers, portfolios are less likely because the farm is an efficient marketing unit and diversification is less necessary (Radicic et al., 2017). In Ethiopia, the land certification has positive impacts on investment and land market participation and improving producers' access to information by computerizing land records helped to increase the number of registered transactions and credit access (Deininger et al., 2017). Above all, land sales may allow households who want to move into the non-agricultural economy to mobilize the equity (Deininger et al., 2017). In their study of rural employment transitions in Ethiopia between farming and nonfarm employment, Bezu and Barrett (2012) reveal that initial asset holdings and access to saving and credit are important factors for the transition into high-return rural non-farm employment. Increases in adult labour, access to credit and saving options were also positively correlated with transitions from farming or low-return activities to high-return non-farm employment (Bezu & Barrett, 2012).

3. Data and methods

This study follows a long tradition by adopting a broad definition of rural locations as encompassing both dispersed rural settlements, as well as the functionally linked rural towns where many agro-processing, ancillary services and commercial activities congregate to service surrounding agricultural settlements (Haggblade et al., 2010). Also, the research method is based on a household survey that captures individual information about FBOs, family members employment status, household income and external factors.

3.1. Research design and sampling

A printed questionnaire was distributed to farmers whose addresses were on the State Ministry of Agriculture Directory of Farmers in South-eastern states of Nigeria. This region is known for commercialization of agriculture, small business enterprises and artisan activities (Igwe et al., 2019). In the current study, the whole population of farmers is available to choose from which allows us to compare farmers who diversified into non-farm enterprises and/or engaged in on-farm or off-farm wage employment in addition to farming. The Five South-eastern States comprises of a population of approximately 32 million (CIA World Factbook, 2016). The list of each state comprised more than 100,000 lists of farmers (making a total of more than 300,000 population). The FBOs were purposefully selected from the list to ensure representativeness across geographical zones, distribution of farm sizes, land ownership, gender, etc. Considering the effectiveness in developing countries, this study applied cluster sampling with area technique (Rahman et al., 2020).

First, each State was divided into three geographical zones making a total of Nine research geographical zones (9, RGZ). Each of the 9 RGZ was further sub-divided into three research units ($3 \times 9 = 27$ research areas). A total of 100 FBOs were randomly selected from each of 27 research areas making 2700 selected FBOs. Of the 2700 questionnaires that were distributed, 480 completed surveys were achieved (17.8% completion rate). All incomplete forms were discarded.

3.2. Data collection, validity and ethical procedures

Before the main survey, the questionnaire was designed and tested through a pilot survey of 20 FBOs randomly selected. The aim of the pilot survey and focus group was to test the validity and understanding of the research questions by the respondents. The pilot survey was followed by a focus group of seven participants to obtain feedback about the clarity of the questions, the use of appropriate terminology, and the possible omission of critical rural factors. Also, feedback on the questionnaire was sought during the focus group which led to minor revision before the main survey. The questionnaire was designed to collect both quantitative and qualitative data. All respondents were engaged in farming (i.e. crop and livestock activities) and non-farm enterprise or wage employment.

The questionnaire was delivered by hand to households through six research assistants employed for the data collection, and a date was fixed for collection of the completed questionnaires. The questionnaire cover page informed respondents that participation was voluntary. Also, the cover page explained the aims and objectives of the research and respondents were promised anonymity. This method was chosen to eliminate the barriers associated with collecting data in Nigeria due to

lack of postal facilities, email and business contact addresses. Another benefit is that the method ensured a high response rate. The data collection lasted six months.

The results from primary data were triangulated with secondary data from the Nigerian National Bureau of Statistics (NBS). NBS, Federal Ministry of Agriculture and Rural Development (FMA&RD) conducts Farm Business Survey and General Household Survey (GHS) every ten years as recommended by the Food and Agriculture Organization (FAO). The NBS-GHS survey (2010/11) was a national cross-sectional survey of households. After the data analysis and interpretation, we organised another focus group of 10 FBOs. During the focus group, discussion about the data results, demographic makeup, socio-cultural structure, farming system/activities and land tenure system and the implications of the results were discussed (see, e.g. Kuivanen et al., 2016).

3.3. Test of hypotheses and conceptual framework

To test the hypotheses, we apply econometric methods—Multivariate Tobit regression (e.g. Kim et al., 2006; Jansen et al., 2006). To understand the motives and determinants of diversification in the developing world context, it is necessary to examine the influence of individual factors on the entrepreneurial decision, especially impact of age, gender, marital status, level of education, training, family size and membership of a social group (see, e.g. Bezu & Barrett, 2012). This leads to the development of the first hypotheses:

H1: *Entrepreneurial pluriactivity and diversification decisions will be positively and significantly associated with individual characteristics of FBOs.*

More so, FBOs ability or capacities to diversify, engage in pluriactivity or portfolio activities will depend on external factors and resources accessible to the households (Gautam & Andersen, 2017). These factors become determinants of household income as previously reported by many empirical studies (Bezu & Barrett, 2012; Morris et al., 2017). This leads to the development of the second hypotheses:

H2: *Entrepreneurial pluriactivity and diversification decisions will be positively and significantly associated with resources available to FBOs.*

Based on the two hypotheses, a conceptual framework is designed and pictured in Figure 1.

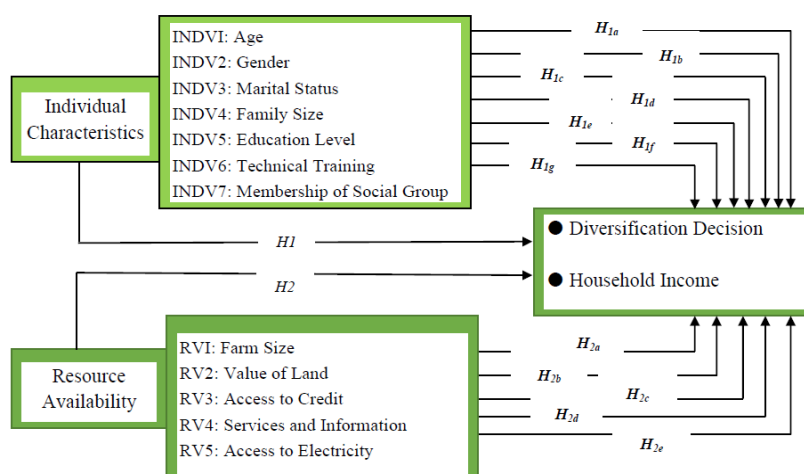


Figure 1. Conceptual model of the study.

4. Descriptive statistics

4.1. Results from secondary data

Agriculture is a major driver of economic growth in Nigeria with about 70 per cent of the rural population involved in agricultural production and contributing about 40 per cent to the GDP (NBS, 2010/11). Four main farm activities captured in the NBS-GHS (2010/11) include—crops, livestock, poultry and fishery. The data captured 36,573,214 farming enterprise which when disaggregated by gender showed that enterprises operated by a male were 31,090,789 and female 5,482,425 (Table 1).

Table 1. Nigerian national distribution of farming activities by gender.

Activity	Male	Female	Total
Crops	15,629,709	2,546,373	18,176,082
Livestock	10,367,831	1,941,801	12,309,631
Poultry	4,196,945	866,126	6,393,094
Fishery	896,304	128,125	1,024,428
Total	31,090,789	5,482,425	36,573,214

Note: Source: NBS (2010/2011).

Men dominate the population of working proprietors (77% of the total population) and women (23%). The distribution of holdings by land size (hectare) of tenure type were as follows: Owner-like possession (26,877,847 ha, representing about 84% of total holding); family land (3,393,597 ha); rented/royalty (1,326,713 ha); squatter (322,283 ha) and others (111,380 ha). The average sum of capital for crop farming was 570,063 million Naira. Of the total amount, the biggest share of 513,577 million Naira (90.09%) came from private funds (personal savings), followed by sources from friends/relatives 27,475 million Naira (4.82%), traditional contribution 15,861 million Naira (2.78%) and local money lenders 5,291 million Naira (0.93 per cent).

4.2. Results from primary data

4.2.1. Individual characteristics

The average age of FBOs was 56.6 years with a range between 32 and 72 years. The FBOs were male-dominated (91.7%) and women (8.3%). This is not unusual given that results of the Nigerian National Agricultural Survey (NBS, 2010/2011) revealed male dominance of agricultural activity in the rural agrarian communities. More than one-third (41.26%) do not have any educational qualification (Table 2). While, less than half of the business owners (47.5%) received vocational training in specific areas such as technical works and general trading apprenticeships, while most were self-trained (52.5%). The percentage of FBOs that combined farm and non-farm business as the main employment was highest at 59.6 per cent (Table 2). The majority (68%) of the FBOs were engaged in informal businesses since the owners reported that the businesses are not registered with the government and do not pay business taxes.

Table 2. Individual characteristics of farm business owners.

Variables	Min.	Max.	Freq.	Per cent	Mean	SD
FBOs' Age (All data)	32	72	480	100	56.55	8.976
• <i>Age range</i>	30	50	254	52.9		
• <i>Age range</i>	51	72	226	47.1		
Gender of FBO (of which are men)			440	91.7		
FBOs (married)			442	92.1		
FBOs Education (years)	0	16			6.90	4.49
• <i>No education</i>			94	19.6		
• <i>Incomplete Primary school</i>	1	5	104	21.66		
• <i>Completed primary education only</i>	6	7	102	21.25		
• <i>Uncompleted Secondary</i>	8	12	92	19.16		
• <i>Diploma or NCE</i>	13	14	84	17.5		
• <i>Degree/postgraduate</i>	15	16	4	0.83		
Technical/Vocational Training			228	47.5		
Major Occupation/Employment						
• <i>Farm business only</i>			114	23.8		
• <i>Farm & nonfarm activity</i>			286	59.58		
• <i>Farming & salary work</i>			80	16.66		
Household size	4	25			10.35	3.865
Household members working in the family business	1	6			1.90	1.027
Membership of Social Group			432	90.0		

4.2.2. Resource available to FBOs

The questionnaire captured the household's income and employment in the past 5 years (Table 3). In the case where respondents have more than one sources of income, they were asked to indicate which of the occupation which they usually worked the most hours or considered as main employment. Household income was calculated annually that include farm and non-farm income activities, while wage employment consists of all salaried work (in private and public services). Income from salaried work has the highest mean income of 95,258.00 (although only 24% of the sample engaged in the activity), followed by crop income (77,928.00) and nonfarm income (75,751.00) as shown in Table 3. About 63 per cent of the FBOs never applied for loans from formal credit agencies (Table 3).

Majority of the population in the study region engage in farming while a few are white-collar workers and mixed cropping is practised over the region. Traditional agricultural practices are usually restricted to small farmers and it involves dogged work and low profit and young people do not readily take to farming (Ndaeyo et al., 2001). Common crops cultivated include yam, cocoyam, cassava, maize, melon, and vegetables and palm oil and kernel that supports domestic industries which are supplemented by indigenous crafts (Ndaeyo et al., 2001).

Table 3. Resource availability.

Variables	Min.	Max.	Freq.	Per cent	Mean	SD
Size of farmland in ha (current)	1.0	5.0			2.446	0.7571
Size of farmland (5 years ago)	1.0	8.0			2.808	1.1652
Annual Income from crops (₹)	4000.00	350000.00	478	99.58	77928.87	57782.27
Annual Livestock Income (₹)	1000.00	150000.00	448	93.33	40901.79	30701.99
Annual Income from nonfarm business excl. salaried work (₹)	5000.00	300000.00	450	93.75	75751.11	50894.89
Annual Income from salaried work or off-farm labour (₹)	5000.00	240000.00	116	24.166	95258.62	34305.82
Total Household Income (₹)	18000.00	685000.00	480	100	210566.67	130004.70
No Access to Services & Information			318	66.25		
Access to Electricity			183	38.3		
Ever applied for a loan (No)			302	62.9		

4.3. Econometric analysis and test of hypotheses

Our analysis followed the two-stage modelling procedure recommended by Edelman et al. (2010). In the first process, the measurement model was estimated using a confirmatory factor analysis to test whether the constructs exhibited sufficient reliability and validity. The second process identified the structural model(s) that best fit the data and examined the hypothesised relationships between the constructs. From the data gathered through the farm household survey, 12 variables describing individual characteristics and the external resource available to FBOs were selected (Table 4). The choice of variables was informed by findings from previous studies, research objectives and data availability (Kuivanen et al., 2016; Selden & Fletcher, 2015).

4.3.1. Validity and reliability of construct measures

Applying linear random utility modelling (based on dependent and independent variables), we test the two hypotheses (H1 and H2) by employing Multivariate Tobit regression analysis. Both nominal and continuous measures are utilised in this study. To evaluate the measurement model fit, we performed a series of confirmatory factor analysis (e.g. Partanen et al., 2017). We checked the data for violations of the normality assumption, for missing data and outliers. We ran single variable and F-test analysis with different categories of our dataset (e.g. small, medium & large) before the multivariate and multinomial analysis. We found strong support for the reliability and internal validity of our measures. The standardised factor loadings were all above 0.59 (recommended minimum in the social sciences is usually 0.40) (Edelman et al., 2010) and a Cronbach's alpha of 0.74.

Table 4. Definition, measurement and summary statistics of variables.

Variables	Definition	Measurement
Dependent Variables		
<i>Farming Only</i>	Respondents who chose farming enterprise only	Farming Enterprise = 1, Others = 0
<i>Farming with Nonfarm only</i>	Respondents who chose farming and Nonfarm enterprise only	Farming with Nonfarm Enterprise = 1, Others = 0
<i>Farming with Wage Employment</i>	Respondents who chose farming and Wage enterprise only	Farming with Wage Employment = 1, Others = 0
Independent Variables		
<i>Gender</i>	Sex of business owners	Male = 1, Female = 0
<i>Age</i>	Age in Years	Years
<i>Marital Status</i>	If FBOs are married or not	Married = 1, Others = 0
<i>Education</i>	Years spent in formal education	Years
<i>Farm Size</i>	Area of land cultivated (Ha)	Hectares
<i>Family size</i>	Number of persons living together	Number (count)
<i>Technical Education</i>	Vocational & technical training	Yes = 1, No = 0
<i>Membership of Social Group</i>	Belonging to a cooperative, social club, business club, etc.	Yes = 1, No = 0
<i>Access to Service & information</i>	Contact with extension agents, business advisors, etc.	Yes = 1, No = 0
<i>Land value</i>	Value or worth of land	Naira (₦)
<i>Access to Electricity</i>	Business access to electricity	Yes = 1, No = 0
<i>Access to Credit</i>	Business access to formal credit or loan facilities	Yes = 1, No = 0

The previous modelling on-farm business analysis is skewed towards using binary choice, single equation Probit and Logit to model discrete decisions (Abdulai & CroleRees, 2001). These are inappropriate to handle simultaneous and joint choices which are typical of the household decision-making process (Rahman & Artker, 2014). Multivariate Tobit and Probit analysis are generally applied to gauge decisions involving interdependent and non-exclusive choices. Several studies acknowledged the limitations of bivariate models to handle tests involving interdependent decisions. Therefore, previous studies used Multivariate probit to model multiple or interlinked choices (Pindado & Sánchez, 2018). The dependent variables are based on whether households earned income from one or combinations of the income options.

Multivariate models are generally applied to gauge decisions involving interdependent and non-exclusive choices. Rahman and Akter (2014) acknowledging the limitation of bivariate models to handle decisions involving interdependent decisions. Suppose that $V_j - V_p$, represent a household's perceived utility for enterprise choices $j - p$ respectively and suppose also that $B_j - B_p$ are vectors of explanatory variables that influence the perceived desirability of activities $j - p$. Following the work of Pindado and Sánchez (2018) the linear regression model for an agripreneur could be specified as;

$$\begin{aligned}
P(Y = 1 / X) &= P(U_{ij} > U_{ip}) \\
&= P(\beta_j'X_j + \varepsilon_j - \beta_k'X_i - \varepsilon_p > 0 / X) \\
&= P(\beta_j'X_i - \beta_p'X_i + \varepsilon_j - \varepsilon_p > 0 / X) \\
&= P(\beta^*X_i + \varepsilon^* > 0 / X = F(\beta^*X_i)
\end{aligned} \tag{1}$$

where P is a probability function, V_{ij} , V_{ip} and X_{ij} are as defined above, $\varepsilon^* = \varepsilon_j - \varepsilon_p$ is a random disturbance term, $\beta^* = \beta_j' - \beta_p'$ is a vector of unknown parameters which can be interpreted as the net influence of the vector of independent variables influencing choice, and $F(\beta^*X_i)$ is the cumulative distribution function of ε^* evaluated at β^*X_i . The exact distribution of F depends on the distribution of the random disturbance term ε^* .

Let H denote set of independent variables;

$H_1 = \text{Age of FBOs (years)}$

$H_2 = \text{Gender of FBOs (Male = 1, Female = 0)}$

$H_3 = \text{Marital Status (Married = 1, Others = 0)}$

$H_4 = \text{Years of Schooling (years)}$

$H_5 = \text{Technical Education (Yes = 1, No = 0)}$

$H_6 = \text{Family Size (Number)}$

$H_7 = \text{Farm Size (Hectares)}$

$H_8 = \text{Value of Land (Naira)}$

$H_9 = \text{Access to Credit (Yes = 1, No = 0)}$

$H_{10} = \text{Membership of Social Group (Yes = 1, No = 0)}$

$H_{11} = \text{Access to Service Providers/Information (Yes = 1, No = 0)}$

$H_{12} = \text{Access to Electricity (Yes = 1, No = 0)}$

4.3.2. Multivariate model

The results of the multivariate analysis (i.e. variable correlations, enterprise types and income types) are illustrated in Table 5. The multivariate Tobit model accounts for the multiple but joint and/or interdependent choices made by the FBOs in the study area. Incomes from the farm, non-farm and wage enterprise engagements were used as the dependent variables. The result of the analysis showed a model diagnostic of log-likelihood of -7536.52 and Wald χ^2 of 1473.42 measures which explain the significance and suitability of the model and the variables selected for analysis (Table 5).

Table 5. Determinants of entrepreneurial choices by FBOs: a multivariate tobit analysis.

Variables	Farming Enterprise		Nonfarm Enterprise		Wage Employment	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Constant	-67.9811***	15.6216	78.8529***	14.3653	2.5117	11.4308
Age of FBOs	-0.0169	0.3534	-0.5897	0.3251	-0.8137***	0.2586
Gender of FBOs	16.8476**	8.1625	10.7042	7.5061	-2.2889	5.9728
Marital Status of FBOs	16.1125*	8.3756	4.1052	7.7021	-4.3429	6.1287
Year of Schooling	4.3869***	0.4831	6.7279***	4.4425	6.3114***	0.3535
Technical Education	-4.5483	4.4929	19.9807***	4.1316	8.2752**	3.2876
Household size	4.2043***	0.7954	0.3679	0.7315	0.8475	0.5821
Farm size	9.5099***	3.6003	-10.1684***	3.3108	-2.2348	2.6345
Value of Land	0.0002***	0.00002	0.00003	0.00002	0.00003	0.00002
Access to credit	4.2629	4.4765	0.6328	4.1165	1.3704	3.2756
Membership of Social Group	-8.2333	7.0227	9,3519	6.4579	-0.1665	5.1387
Access to Services & Information	1.1648	4.3404	-1.9702	3.9914	5.9698*	3.1760
Access to Electricity	11.6685***	4.3913	3.7587	4.0381	10.4171***	3.2132

Notes: Log likelihood -7536.52, Wald Chi2 = 1473.42, Prob. Chi2 = 0.000

*Significant at 10 percent level (0.10), ** at 5 percent level (0.05) and *** at 1 percent level (0.01)

Source: Computed from survey data.

5. Results

The results of the multivariate analysis revealed the relationship between livelihood diversification choices, employment choices and income determinants. The multivariate result reveals that the age of FBOs has a negative significant effect on the three income activities (Table 5). The effect of age is insignificant for farming and non-farming enterprise. This indicates that there are enough variations in terms of age in both sectors (i.e. people of all ages work in farming and non-farm enterprises). However, it was highest at 1 per cent level with wage employment which means that younger FBOs show more interest in wage employment than farming.

In the study area, farming is dominated by men who are the landowners and decision-makers. From the descriptive statistics, 91.7 per cent of the sample are men. Gender of FBOs has a positive effect on farming enterprise at 5 per cent level meaning male have more interested in farming enterprise than women. Gender of FBOs is insignificant with nonfarm and wage employment. During the focus group, it was revealed that tradition and culture assign land ownership and transfer to men mainly leaving women to engage in farming as support workers or on-farm labourers.

About 92 per cent of the sample population are married. Although the marital status of FBOs is positively associated with farming enterprise at 10 per cent level, there is no impact on non-farm or wage employment. Marital status is associated with land ownership as tradition confers manhood and land ownerships to men after marriage. Also, in the study region marital status is associated with family responsibilities, leadership and decision making which are predominately men positioned. During the focus group, some participants reveal that for non-farm employment and wage employment—people first get a job due to lack of social security system before they get married.

Year of schooling (formal education) is the only variable that is significant at the 1 per cent level for the three forms of income diversification. This indicates the importance of basic education towards livelihood choices. About 58.74 per cent of FBOs attained primary education or more. This appears high figure given the rate of low education in SSA. One of the reasons for the high years of schooling is that primary education is free and compulsory in the study region, hence most of the population has primary education. During the focus group, some participants maintain that educational attainment negatively affects young farmers' involvedness in the farm activities and may directly or indirectly affect young people's motivation to be farmers. Technical education is positively related to non-farm enterprise (at 1% level) and wage employment (at 5% level) but not significant for farming enterprise. This means that FBOs that have technical education are more likely to engage in non-farm and wage employment than farming. During the focus group, it was revealed that young people pursue technical education as a means to avoid farming as a livelihood but as an opportunity to migrate or seek wage employment in the urban sector.

Household size is significantly associated with farming enterprise at 1 per cent level but not related to non-farm enterprise or wage employment. Households require labour to work on the farm and the labour mostly comes from family labour due to scarcity of labour in rural areas as a result of rural-urban migration. During the focus group, it was revealed that large farm size is a justification for maintaining large families to increase productivity. Also, traditionally, ownership of large farms is a status that demand farmers to have a large family size such as the marriage of more than one wife and having more children who are expected to contribute to farm labour. The new farming system leads to a diversification of tasks, and hence to an increased demand for labour and tendency to maintain a large family size (Kouamé & Schellekens, 2002).

While the size of farms has a significant positive impact on farming, it has a significant negative impact on the non-farm enterprise. There is no such relationship for wage employment. Value of the land is significant at the 1 per cent level for farming, insignificant for non-farm and wage employment. Starting and increasing farm production requires access to land. However, when the value of the land for other commercial purposes increases, landowners must decide whether to sell or keep the land for the less profitable farming system. During the focus group, some participant explained that the former has been the case as many farmers are selling off their land with higher commercial value than keep it for farming, hence, the downwards decrease in the past years on agricultural land use.

Although membership of a social group has an insignificant negative relationship with farming enterprise and wage employment, there is an insignificant but positive relationship with the non-farm enterprise. Lack of social security and agricultural support schemes leaves households and families highly insecure, especially in times of shocks and stress (Getu & Devereux, 2013). As explained by some members of the focus group, large labour is needed in the traditional farming system, given the

labour-intensiveness of the farming practices, hence, many forms or join a social club to assist each other in the provision of labour and resources.

Access to credit is an insignificant but positive association with farming, nonfarm enterprise and wage employment. During the focus group, some participants explained that in rural areas of Nigeria, FBOs source their capital mainly from personal savings. They obtain credit mainly from informal sources or lenders. Participants of the focus group explained that agricultural loans and financing require evidence of land ownership as collateral but many of FBOs do not certificate of ownership since their land cannot be accepted as collateral. Hence, most of the smallholders obtain credit from informal lenders, relatives, input suppliers, and fellow farmers. During the focus group, some participant states that young people lack the initial start-up capital to go into farming due to the high cost of farmland and tenure system. More so, young people are educated in comparison to the older generation and are more likely to migrate in search of self-employment or wage employment.

The result of the access to services and information revealed an insignificant relationship with farming and nonfarm enterprise but positively significant for wage employment. Before the advent of mobile technology, there is information asymmetric in Nigeria like other developing countries such that information is not equally accessible and available to everyone. Digitisation is changing the game for agriculture and other rural activities in many SSA communities. During the focus group, some participants maintain that digitisation is enabling information gathering via text mobile phones and through social media. Many agencies and institutions use smartphone applications to link farmers to multimedia advisory content, farm inputs, and buyers. According to Ekekwe (2017), a Kenyan enterprise connects unbanked and underserved smallholder farmers to credit while helping financial institutions cost-effectively increase their agricultural loan portfolios. Access to electricity has a positive significant effect on farming enterprise and wage employment at 1 per cent but there is no such relationship with the nonfarm enterprise. During the focus group, some participants explained that nonfarm are mainly trading of farming and urban goods which require transportation but not electricity dependent.

6. Discussion

This study tested the relationships between individual characteristics, external resources, diversification capability and income within the sustainable livelihood framework. This is concerning the achievement of Goal 2 (Zero Hunger) and Goal 8 (Decent Work and Economic Growth) of the UN Development Goals. Like previous studies, this study reveals that diversification of livelihoods has become a common strategy for coping with economic and environmental shocks and instrumental in poverty reduction and rural sustainability (see, e.g. Gautam & Andersen, 2016; Rahut & Scharf, 2012; Radicic et al., 2017). Indeed, rural communities in developing countries like Nigeria go beyond agriculture and farming to a range of off-farm activities including rural employment. Based on multivariate analysis, this study tested the effect of variables such as the age of FBOs, gender, marital status, years of schooling, technical education, family size, farm size, the value of land, access to credit, membership of a social group, access to service providers/information and access to infrastructure (electricity) on livelihood diversification and household income. These are critical variables that influence socio-economic (income inequality and food insecurity) and sociocultural (employment and rural-urban migration) issues of rural sustainability.

Majority of the rural population live in rural areas and depend on agriculture for employment, source of income and food. However, agriculture cannot meet the needs of households, leading diversification and pluriactivity in response to livelihood sustainability. Also, the number of young farmers has been on the decrease due to educational, technological, social, and economic changes (Ekekwe, 2017). As explained earlier, traditional farming practices depend heavily on the use of crude tools and traditional methods (Ekekwe, 2017). The inefficiencies in the existing farming practices (Ndaeyo et al., 2001) might be responsible for the decreasing number of younger farmers. “For young people, agriculture is often seen as outdated, unprofitable and hard work” (Carr, 2016).

Land is a major productivity factor in rural livelihood sustainability. Traditional land tenure in Nigeria is such that at the death of the head of the family, his plots of land are shared among his male children (Ndaeyo et al., 2001). Also, tradition, attitude and values assign farming roles to men than women. However, women are more engaged in non-farm activities such as trading and agro-processing, on-farm and off-farm paid employment than salaried employment—thus the negative relationship with wage employment. Also, SSA women are disadvantaged in markets for resources when compared to men (Uzuegbunam & Uzuegbunam, 2018). They are affected by relative poverty and exclusions in decision making (Wambua et al., 2018).

Culture and social values within rural communities lead to inequality in access to resources. The traditional societies tend to limit unmarried people entitlement to the family property in most parts of Nigeria (Ezeakor, 2011) and unmarried persons lack social recognition and respect (Jackson, 2003). The highly patriarchal orientation in rural settings tends to give married individuals over unmarried productive and reproductive abilities. In this way, unmarried men and women become subjected to a second class and are denied some entitlement to rural assets like land and livestock, which constitute essentials of their livelihood (Nwokoro & Chima, 2017). These conditions can affect the ability to secure wage employment or own a farm.

Despite tremendous developmental progress, Africa’s education and human capital deficit still loom. Previous studies have reported the effects of education on the probability of being poor to be a very strong relationship (Igwe et al., 2018). On the positive side, education allows people to adapt more easily to both social and technical changes in the economy and changes in the demand for labour (Igwe et al., 2018). Also, education is often the most important foundation for people to pursue new business opportunities, seek higher employment and/or migrate (World Bank, 2008).

Access to land, the value of land and the land tenure system affect rural livelihood. The amount of land (resources) available to a farmer can influence the number of enterprises engaged in and/or combined (Ndaeyo et al., 2001). Also, rural livelihood depends on the availability of social protection and relationships. Pests, diseases and harvest losses have complicated the low farming income available, subjecting the farmers to a social protection crisis. Hence, social clubs have become interventionist scheme (Getu & Devereux, 2013). Through strong cooperatives, the knowledge held by buyers about what constitutes a high-quality can be transferred to farmers (Rueda et al., 2018). Previous studies showed that gender, educational level, farm size and availability of collateral have a positive effect on farmers’ access to credit (Chandio et al., 2017).

The relationship between infrastructure and economic growth has long been a major focus of development literature (Khander & Koolwall 2010). These studies provide evidence that under the right conditions, access to infrastructure plays a major role in increasing productivity and poverty reduction in rural areas. To increase diversification opportunities, productivity and profitability will require improvement and investment in public infrastructures such as roads, electricity,

transportation and water. For instance, in Bangladesh, a 1 per cent increase in households with access to electricity and paved roads in the villages led to 0.8% increase and 33% in total per capita income respectively (Onyeiwu & Liu, 2011).

7. Conclusion, contributions and implications

7.1. Theoretical and practical contributions

This study provided reliable and robust data to test and confirm the hypotheses H1 and H2. It found that individual characteristics are strongly related to the capability to diversify livelihood sources. However, diversification decisions will be positively and significantly associated with resources available to FBOs (regarded as agripreneurs). Rural population pursue livelihood sustainability through employment and income diversification or pluriactivity. For these people, diversification of economic activity (for example, starting a small business) is not an optional decision, but a necessity. These activities usually vary with the season, with farming in the raining season and non-farm activities in the dry season due to lack of irrigation and other factors.

As revealed in this study, non-farm income has become a major component of household income and a major employment opportunity for many landless, small and medium-scale farmers in pursuit of main income, supplementary income, extra income, respectively. However, it is important to note that despite the rising prevalence of non-farm activities among rural households, agriculture still has an important role to play in the development of the rural economy, especially food security, income and savings. Therefore, productivity increases in the agriculture sector not only benefit poor households, but it can also potentially enable many small and medium scale farmers to raise capital to reinvest in farming or diversify into other non-farm investment and in most cases secure food and employment for household members.

As explained previously, the rural sector faces several challenges which produce a higher rate of poverty, inequality and food insecurity. There is a lack of skilled manpower, low level of education, lack of access to finance, market information, lack of social security support, lack of access to improved varieties and lack of infrastructure. Enhancing access to agricultural financing will enable a vibrant and competitive rural agricultural market. Majority of rural people depend on informal lenders in Nigeria despite the presence and availability of several commercial and investment banks. In this context, formal financial services (e.g., loan, flexible credit and insurance scheme) are required to boost rural economic activities. Although diversification of income activities has been adopted by farmers in every farming communities globally good policy support is necessary to promote rural livelihood sustainability. Decisions by policymakers will aggregate to changes in the ecology of rural landscapes, but the influence of food supply and agribusinesses on rural landscape sustainability also requires scrutiny.

7.2. Implications

Diversification or pluriactivity among rural farmers is widespread and only a few farmers work on the farm as the only source of income. However, these decisions are also nested in FBOs individual characteristics and the nature and extent of resource available to them. Regarding sustainable practices, a common core running through several decades of research is that essentially

farmers will adopt such practices if they expect these to help them achieve their objectives (Dessart et al., 2019). What is required is “inclusive” transformation of the region’s agri-food system, one that focuses on linking many more smallholders to high-value markets and adds value and employment along value chains through the growth of small and medium enterprises (SMEs) (AGRA, 2017). This integration would bridge the huge gap between smallholders and large farmers and help prevent young farmers from leaving the farm.

Diversification motives or pluriactivity has been studied in the developed world, leading to several alternatives and, in part, conflicting perspectives (Morris et al., 2017; Radicic et al., 2017; Rahut & Scharf, 2012). Despite the exploration of the concept in developed world contexts, research in the SSA rural setting remains relatively under-explored; thus, our article makes a significant contribution in this field. In the context of Nigerian rural livelihood studies, the choice between to diversify or not could, therefore, be interpreted as an income stability management and survival strategy. Our findings regarding informality, size of firms, downward decreasing of farmland, young people leaving the farms and low levels of household income have policy implications for target programmes directed towards promoting rural development and poverty alleviation. A new generation of farmers and agribusinesses is needed for the future particularly, in many developing countries where there are significant levels of migration of young people from rural to urban areas (Carr, 2016).

7.3. *Limitations and future studies*

As with all empirical research, our study has several limitations. First, it relied on survey data, thereby, missed the opportunity and benefits of qualitative research that provides the participant’s perspectives and a voice to narrate their experiences. Second, it relied on data from 480 FBOs, which makes it difficult to generalise the findings despite the benefits of the research methods adopted. Besides the questions explored in this study, there are a variety of exciting opportunities for future research using a longitudinal design. Specifically, future studies could perform longitudinal studies to follow diversification for over 10 years. This will provide an opportunity to respond to calls for more longitudinal research.

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Conflict of interest

The authors declare no conflict of interest.

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