

Multidimensional Poverty Status Correlates of Rural Households in Kaduna State of Nigeria

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محددات حالة الفقر متعدد الأبعاد للأسر الريفية في ولاية كادونا بنيجيريا

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Abstract

After Alkire's work on multidimensional poverty, literature exhibits a paradigm shift in the methodological approach to investigating poverty in a society. A shift from only an income-economic approach to a social approach that encapsulates a wider livelihood dimension—education, health, and standard of living—has taken the lead in the literature on poverty. Consequently, given this methodological gap in the study area, this research on the multidimensional poverty status of rural households was undertaken to serve as a one-stop solution to the engine growth of the rural economy. Using a multi-stage sampling technique, a total of 120 households were selected, and information elicitation was done by using a well-structured questionnaire complemented with an interview schedule in the year 2022. Besides, the collected information was synthesized with the aid of both descriptive and inferential statistics. Empirically, the study area is populated by an economically viable and healthy labor force, literate, agrarian and technologically exposed, globally integrated, and has a viable social capital pool. However, the rural population is characterized by a vulnerable household size, credit paucity, gender stereotypes, and cultivation of uneconomic holdings. Furthermore, multidimensional poverty is rife in the study area, and the rural populace suffered deprivation in at least two dimensions. The vulnerability to poverty is due to unsustainable large household size and lackluster livelihood enhancement innovative measures. Moreover, an advisory service is the major driving force that regulates the intensity of multidimensional poverty in the study area. Nevertheless, self-help, social, religious, and medical measures were the poverty coping strategies adopted in the study area. Therefore, the study calls for gender mainstreaming to arrest the vicious cycle of poverty among the womenfolk and the provision of augmenting assets to enable these rural poor to overcome distress sales due to the uneconomic scale of operation.

Keywords: Poverty, multidimensional, livelihood, households, rural area, Nigeria

Introduction

The experience of poverty, in accordance with Sadiq (2015a) and Sadiq et al. (2018a), extends beyond not having enough money—lack of income. As a result, there is a lack of knowledge, a loss of influence, and little to no control over fundamental life choices. Poverty occurs from the lack of necessary assets and possibilities to which every person is entitled, in addition to when a set of fundamental necessities is not provided (Sadiq, 2015b; Sadiq et al., 2018b). Globally, over several governments and populations, poverty has remained the long-time standing reproach (Smits, 2022). In 2019, the National Bureau of Statistics, the World Bank, and the International Labour Organization claimed that this reprehensible situation is to blame for the high rate of illiteracy that exists among people worldwide, particularly women (Ndimele, 2022). Due to its complexity, it has grown difficult to resolve and has proven harmful to both human life and the natural world (Aluko and Mbada, 2020; Bello et al., 2022).

Approximately 413.3 million people lived in extreme poverty on the African continent in 2015 (Osabohiene et al., 2021), with Sub-Saharan Africa having the greatest rate of hunger-related deaths. Sub-Saharan Africa's (SSA) pervasive poverty contributes to the region's underdeveloped infrastructure. According to Muhammad and Sidique (2019), Osabohien et al. (2021), and other sources, the population's higher growth rate has led to rising unemployment, particularly among young people, which is thought to be one of the main reasons for poverty among Africans, particularly Nigerians. Furthermore, because of the worsening effects of poverty and hunger, the majority of the population is now without hope. More than 70% of the disposable earnings of poor households are used to meet food needs, but at least 31.5% of children under the age of five are underweight (Roser and Ritchie, 2023; Sulaimon, 2022).

The vast agricultural richness of Nigeria offers tremendous potential for growth for the broader economy and the rural sector. Rising poverty is still a significant problem in the nation despite its abundant natural resources (Sadiq et al., 2018c; Oyewunmi and Obayelu, 2023). Despite having a wealth of natural resources and human capital, Nigeria's staggering poverty rate has earned it the moniker "the poverty capital of the world," with approximately 100 million of its citizens living in conditions of extreme destitution (Jaiyeola and Bayat, 2020a & b; Adeyonu et al., 2022). The fact that a significant portion of the country's population lives in destitution in a nation with plenty of natural resources, a robust oil industry, and a growing agricultural sector is highly upsetting (Sadiq et al., 2018d; Abubakar, 2022).

Rural individuals are more likely than urban ones to experience poverty and remain there longer (Kyzyma, 2018; Ashagidigbi et al., 2020; Gambo et al., 2022). Rural residents continue to experience extreme poverty and deep deprivation, which is frequently made worse by violent conflicts & high risk of catastrophes (Cuaresma et al., 2018; Aminu et al., 2022). Women, in particular, continue to suffer the most from this situation. According to reports, the proportion of Nigerians experiencing hunger has increased from around 29% as of 2000 to a staggering 33% in 2010, suggesting that this increase may be the cause of the failure to meet the 2015 target of 14.5% of the population falling below the hunger level. According to Sadiq et al. (2018b), 40% of households across the nation's geopolitical regions are food insecure. In 2022, it cascaded to seventy percent (Ndimele, 2022; Oyewunmi and Obayelu, 2023), thus concomitantly blurring the possibility of halving poverty by 2030 as envisaged by SDGs. It should be mentioned that the population of India is seven times more than that of Nigeria (Farrell and Nijkamp, 2019). According to Khan and Cheri (2016), among Nigeria's six geopolitical zones, the northeastern area has the highest death rate, the largest percentage of males without a high school certificate, and second to the northwest with the highest percentage of females without educational attainment.

Additionally, poor health and low education contribute to the cycle of poverty, according to Sadiq (2015 a & b) and Sadiq and Sani (2022). When cheaper, more delectable items are imported, local farmers also lack motivation to produce locally grown food. As a result, local farmers are forced to lower their prices, thus lowering their income. The result is a drop in farm production the next year, which keeps the poverty cycle in motion. Age, sex, education, health, asset ownership, and other household variables are heavily weighted in the available research on the factors determining poverty. These are regarded as opportunities and capacities for a certain household or, to put it another way, to seize the human and material capital that establishes how vulnerable a normal household might be. According to the aforementioned, understanding the factors contributing to rural poverty is essential for establishing policies that aim at reducing it and understanding its causes.

According to a study on the impact of human capital and capacities on rural destitution in Nigeria, there are considerable geographic disparities in the likelihood that a household will become impoverished (Sadiq et al., 2024). This was revealed by the impact of local factors on rural poverty (Sadiq et al., 2024). Whether a rural household is working on a farm or not, human capital has a lower impact on the likelihood of being poor. Considering how long a remote area of Kaduna State has existed, additional infrastructure development is anticipated. However, the area's poor infrastructure is a major concern for economic growth, as it affects productivity and lowers farm households' potential for realizing their potential, which results in poor agricultural productivity, low levels of income, a decline in living standard, and an elevated prevalence of poverty among rural residents.

In Nigeria, the majority of agricultural production occurs in rural areas where, ironically, poverty is most prevalent and severe. This study is designed to investigate the pattern and drivers of poverty among farming families in Kaduna State, in the North Western area of Nigeria. Poverty is a significant restraining factor for farming households. To the best of our knowledge, the literature review revealed little to no documented evidence of a multidimensional approach to poverty in the study area, despite convincing arguments that poverty is multifaceted as opposed to unidimensional, which is the main motivation behind the conceptualization of this research. In summary, the literature evaluation on poverty in the studied area has knowledge, empirical, methodological, and population research gaps. Therefore, this study aims at closing the knowledge gap with persuasive facts and data.

In lieu of the foregoing, this research addresses the challenge of multidimensional poverty—a social matrix in the study area. The broad objective of the research centered on the multidimensional poverty correlates of rural households in Nigeria's Kaduna State. The specific objectives were to describe the socio-economic characteristics of the households in the study area, determine the multidimensional poverty status of the households in the study area, determine the factors responsible for households' vulnerability to multidimensional poverty, determine the driving force of households' multidimensional poverty correlates; and determine the poverty coping strategies adopted by households in the study area.

Literature Review

Multidimensional poverty extends beyond income-based measures, encompassing deprivations across education, health, and living standards. In rural Nigeria, poverty correlates with socio-economic, demographic, and institutional factors, underscoring the need for localized interventions.

A study by Bakker (2023) on population pressure revealed its significant correlation with multidimensional poverty in Nigeria, particularly in sub-regions with high fertility rates. The study highlighted that population growth exacerbates resource constraints, worsening poverty indicators such as housing and education quality. Popoola (2023) analyzed how cooperative identity influences poverty alleviation efforts among rural poultry farmers. Results showed that income diversification

through cooperatives mitigates poverty by enhancing access to credit and improving production. Gender disparities and access to education were also critical correlates.

Adebunmi et al. (2023) studied the relationship between social networks, farm income, and poverty in Osun State, Nigeria. The study highlighted that strong social ties facilitate access to resources and information, significantly reducing poverty levels among rural farmers. Findings emphasize the need to foster cooperative frameworks and community-based support systems.

Titulaer (2024) examined gendered empowerment in Northern Nigerian smallholder households. The study showed that poverty levels and empowerment gaps are strongly influenced by household composition, particularly in gender dynamics, suggesting targeted programs for women's empowerment as a strategy to reduce poverty. Ibrahim et al. (2023) assessed government policy interventions in addressing educational inequalities and their impact on multidimensional poverty. Their findings revealed that effective educational policies significantly reduce poverty indices, reinforcing education as a critical factor in poverty alleviation.

Ajayi et al. (2024) analyzed child poverty determinants in rural Nigeria. The study used a multidimensional approach to highlight the significant role of healthcare, nutrition, and education in shaping child welfare outcomes. Olawuyi et al. (2024) explored indigenous knowledge practices in rural Nigeria and their contribution to food security and poverty reduction. Results emphasized that traditional knowledge systems, coupled with modern interventions, play a significant role in mitigating rural poverty. Several studies identified education, household size, and gender as pivotal correlates of poverty. Rural households with higher educational attainment exhibit better outcomes across multidimensional poverty indices. Conversely, larger household sizes increase the likelihood of poverty due to resource dilution. Evidence from rural Nigerian households shows that government and community-led social safety nets significantly reduce multidimensional poverty. Programs targeting healthcare access and women's empowerment yield marked improvements in living standards.

Theoretical Framework

The theoretical framework for studying the multidimensional poverty status of rural households in Kaduna State, Nigeria, can be built on the **Capability Approach** by Amartya Sen, which emphasizes the evaluation of poverty in terms of capabilities rather than income alone. This approach underpins the idea that poverty is a deprivation of basic freedoms and capabilities necessary for individuals to lead a fulfilling life.

Key Theoretical Underpinnings

1. Capability Approach (Sen, 1980)

- It argues that poverty should be analyzed beyond income or consumption.
- This approach focuses on people's actual freedoms or capabilities to function effectively in society.
- It highlights dimensions such as education, health, living standards, and access to essential resources.

2. Multidimensional Poverty Index (MPI) Framework (Alkire & Foster, 2011)

- It builds on the Capability Approach and operationalizes poverty measurement through multiple indicators.
- The indicators include health, education, and living standards, with sub-measures like child mortality, years of schooling, and sanitation.
- It helps to capture deprivations more comprehensively.

3. Sustainable Livelihoods Framework (Chambers & Conway, 1992)

- It highlights how households draw upon multiple assets (human, social, natural, financial, and physical capital) to build sustainable livelihoods.
- It focuses on the vulnerability context (e.g., shocks, trends, and seasonality) that influences poverty.

4. Social Exclusion Theory (Silver, 1994)

- This theory suggests that poverty is perpetuated by systemic inequalities that exclude individuals or groups from participating fully in social, economic, and political life.
- It is particularly relevant in rural Kaduna, where geographic and cultural factors may limit access to opportunities.

These theories collectively guide an understanding of how different factors interconnect to affect poverty status and suggest the need to consider diverse indicators of deprivation.

Conceptual Framework

The conceptual framework for this study integrates multiple dimensions of poverty and their correlates. It visualizes poverty as a multidimensional phenomenon influenced by socio-economic, demographic, and geographic factors, as outlined below:

Components of the Framework

1. Independent Variables (Correlates of Poverty)

- **Socio-Economic Factors**
 - Household income, education levels, occupation, access to credit, and ownership of productive assets.
- **Demographic Characteristics**
 - Household size, gender of the household head, and dependency ratio.
- **Geographic and Environmental Factors**
 - Proximity to infrastructure (schools, health facilities, markets) and quality of housing.

2. Dependent Variable

- **Multidimensional Poverty Status**
 - It is measured using dimensions such as health, education, and living standards.
 - Each dimension includes specific indicators like child mortality, malnutrition, years of schooling, and access to basic services.

3. Intervening Variables

- **Policy and Institutional Factors**
 - The role of government programs, non-governmental organizations, and community support structures.
- **Cultural Practices**
 - The traditions and norms that influence access to education, healthcare, and economic opportunities.

Diagram of the Conceptual Framework

A simple representation would involve:

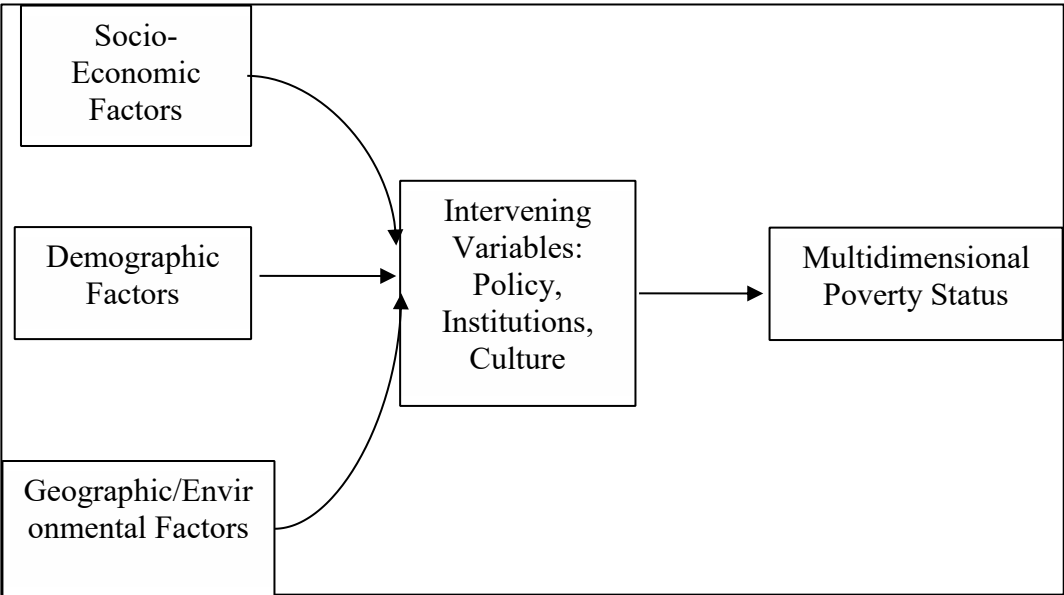
- **Arrows** point from independent variables (socio-economic, demographic, geographic) to the dependent variable (multidimensional poverty status).

- Intervening variables positioned between independent variables and the dependent variable, indicating their mediating effects.

Application

This combined framework helps analyze the drivers of poverty in Kaduna State and provides actionable insights for policymakers (Figure 1). For instance, interventions addressing socio-economic inequalities (e.g., access to education or credit) and demographic pressures (e.g., high dependency ratios) can be prioritized to alleviate multidimensional poverty effectively.

Figure 1
Conceptual Framework



Source: Authors’ own drawing.

Research Methodology

The state is situated in the high plains of northern Nigeria. Besides, in Nigeria's north, it is located in the Northwest geopolitical zone. The Kaduna state can be found between latitude 38°58" N & 25°36" equatorial north and longitude 22°14"E and 7°32'00" equatorial east. The state is situated alongside the Kaduna River, an important Niger River tributary. The state is traversed by the Kaduna River, a branch of the Niger River. It originates on the Jos Plateau in Vom, 18 miles (29 kilometers) southwest of Jos town, and flows northwest until a bend 22 miles (35 kilometers) northeast of Kaduna town. Prior to finishing its 340-mile (550-kilometer) discharge to the Niger River at Mureji (opposite Pategi), it takes a southwesterly and southerly route. Although its lower half has carved out some gorges, including the 2-mile (3-kilometer) granite ravine at Shiroro, above its entrance into the expansive Niger floodplains, the majority of its route is in broad savanna woodland. Short, dispersed trees, shrubs, and grasses make up the Sudan Savannah type of vegetation cover. Although there is a sizable amount of clay present, the soil is primarily loamy to sandy. There are seven states that border the state.

The state ranks third in population, with approximately 9,231,390 residents and an annual growth rate of 3%. It is also fourth in terms of total land area, covering 46,053 km². As of 2021, the state's per capita GDP was USD 2,905, and its GDP at purchasing power parity (PPP) stood at USD 27.88 billion. The Human Development Index (HDI) for the state was recorded at 0.511, according to

KDSG. Notable geological features include rocks found in Kogoro Hill and Zaria. During the rainy season, many communities face seasonal flooding risks. The climate of Kaduna is characterized by two distinct seasons: a hot, partly cloudy dry season and a hot, muggy, and gloomy wet season. Throughout the year, the temperature typically ranges between 55°F and 95°F, rarely falling below 50°F or exceeding 102°F.

Using a multi-stage sampling technique, a total of 120 rural households constituted the sample size for the study. Conveniently, given the characteristic similarity of the rural areas in the state, one local government area, viz. Kachia was selected. Subsequently, in view of population density and agrarian activities, six (6) out of twelve (12) wards/taluks were purposively chosen. The chosen wards/taluks were Gumel, Kachia, Awon, Ankwa, Sabon-Sarki, and Kurmin-Musa. Afterward, two (2) villages were randomly chosen from each of the selected wards/taluks. Thereafter, from each of the selected villages, ten (10) households were randomly chosen in a freelance manner, giving a total of 120 households. Furthermore, a well-structured questionnaire complemented with an interview schedule was the instrument used for data elicitation, and the data were collected during the year 2022. Analytically, in descending order, the study objectives were achieved using descriptive statistics, Alkire's multidimensional poverty index, Heckman's model, decision tree regression, and exploratory factor analysis.

Model specification

1. **Multidimensional Poverty Index (MPI).** The MPI is a composite indicator of poverty that accounts for both the distribution of deprived areas and their prevalence (Table 1). The various indexes involved in MPI measurement are presented below (Sadiq and Sani, 2022):

Multidimensional headcount ratio (H): It is the proportion of persons who have been classified as multidimensionally poor, i.e., those who fall below the poverty line, and is expressed as:

$$H = \frac{q(k)}{n} \dots\dots\dots (1)$$

The number (or headcount) of multidimensionally poor persons according to parameter k is $q(k)$.

$$(q(k) = \sum_{i=1}^n p_k(x_i, z)) \dots\dots\dots (2)$$

The average deprivation share across the poor is defined as the intensity of poverty (A), often known as the breadth of poverty. This is presented as:

$$A = \sum_{i=1}^q c_i(k)/q(k) \dots\dots\dots (3)$$

The percentage of the d indicators in which the average multidimensionally poor person is deprived is the intensity of poverty.

The measure is the so-called adjusted headcount ratio when $\alpha = 0$. refers to the headcount ratio of multidimensional poverty H, poverty incidence, multiplied by poverty intensity A:

$$M_0 = HA \dots\dots\dots (11)$$

When $\alpha = 1$, the measure M_1 , adjusted poverty gap, defined as the weighted average of indicator-specific poverty gaps is used. M_1 can be calculated as the product of H, A, and the average poverty gap among the poor G.

$$M_1 = HAG \dots\dots\dots (4)$$

$$G = \sum_{i=1}^n \sum_{j=1}^d g_{ij}^1(k) / \sum_{i=1}^n \sum_{j=1}^d g_{ij}^0(k) \dots\dots\dots (5)$$

Finally, the adjusted squared poverty gap is calculated as the weighted average of the indicator-specific squared poverty gaps. It can be calculated as the product of H, A, and the average squared poverty gap among the poor S, i.e., the severity of poverty.

$$M_2 = HAS \dots\dots\dots(6)$$

$$S = \sum_{i=1}^n \sum_{j=1}^d g_{ij}^2(k) / \sum_{i=1}^n \sum_{j=1}^d g_{ij}^0(k) \dots\dots\dots(7)$$

Seth and Alkire (2014) as reported by Sadiq and Sani (2022) suggested an additively decomposable inequality measure that is a positive multiple of "variance" and has within-group and between-group components. The inequality measure I^q employs the vector of deprivation scores of the q impoverished people $c_i(k)$ to quantify inequality among the poor at the national or sub-national level.

$$I^q = \frac{\tilde{\beta}}{q} \sum_{i=1}^q [c_i(k) - A]^2 \dots\dots\dots(8)$$

To calculate the measure of inequality, the difference between each poor person's deprivation score and average intensity is squared, then the squared distances are added together and multiplied by a constant $\tilde{\beta}$. We set $\tilde{\beta} = 1/25$ since the poor's deprivation ratings vary from 1/5 to 1. This is the greatest permissible number for the inequality gauge, guaranteeing that the inequality gauge is constrained between zero and one, given the spectrum of deprivation scores. Nevertheless, a lower degree of poverty or a decline in poverty does not necessarily mean that every region or demographic category has experienced an equal reduction in poverty (Sadiq and Sani, 2022).

Table 1
Dimensions and Indicators of Multidimensional Poverty Construct

Dimension	Indicator	Deprivation cut-off	Weight
Education	Year of schooling	No one has completed five years of schooling	1/12
	Child school enrolment	No school-age child (1-6 years) is attending school	1/12
Health	Health care services	No access to health care service	1/18
	Morbidity	Suffers illness	1/18
	Child mortality	Any case of a child within the age of 1-5 that is dead	1/18
Living standard	Electricity	No access to electricity	1/24
	Drinking water	No access to safe drinking water	1/24
	Light asset	Didn't own more than one of the following assets: radio, television, telephone, bicycle, scooter or refrigerator	1/24
	Heavy asset	Didn't own a car or truck	1/24
Environment	Sanitation	Household has no access to a good toilet or improvement but shares with other household	1/18
	Housing	House floor made with mud, dung, clay	1/18
	Cooking fuel	Use firewood, dung, and charcoal as fuel	1/18
Social connection	Autonomy	Household decision-making on the use of income is not participatory	1/12

	Social capital	Member of household is not a member of cooperative	1/12
Empowerment	Social challenge	The problem of domestic violence	1/24
	Political instability	The problem of social/political unrest	1/24
	Self-defense	The problem of personal security	1/24
	Social safety net	Didn't trust government social investment program (E.g., farmers/traders' monie)	1/24

Source: Sadiq and Sani, 2022.

2. **Heckman's model:** The model is composed of two dependent variables - decision (equation 10) and outcome (equation 11) variables (Sadiq *et al.*, 2021; Sadiq and Sani, 2023). As a result, the model was chosen because it has the ability to adjust for sample selection bias. As presented by Sadiq *et al.* (2021), the model is as follow:

$$Y_i = f(X_1, X_2, X_3 \dots \dots \dots X_n) \dots \dots \dots (9)$$

$$Y_{it} = \beta_0 + \beta X_{it} + \varepsilon_i \dots \dots \dots (10)$$

$$Y_i^* = \alpha + X\beta + \gamma IMR + \varepsilon_i \dots \dots \dots (11)$$

$$Y_i^* = \alpha + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + \dots + X_n\beta_n + \gamma IMR + \varepsilon_i \dots \dots \dots (12)$$

Where, Y_{it} = MPI status (non-poor =0, poor = 1); Y_i^* = latent observation of i^{th} household (index); $X_1 - X_n$ = Explanatory variables; IMR= Inverse Mill's ratio; β_0 = Intercept; β_{1-n} = regression coefficients; γ = Lambda; and, ε_t = Stochastic. Predictor variables- age (years); gender (male =1, otherwise = 0); marital status (married =1, otherwise=0); education (years); farming experience (years); farm size (hectare); annual income (₦); extension contact (yes= 1, otherwise =0); membership of association (yes=1, otherwise=0); sickness (yes =1, otherwise = 0); household size (HHS) (numbers); co-operative membership (yes= 1, otherwise = 0); credit access (yes =1, otherwise =0); and, mobile phone (yes =1, otherwise =0).

Results and Discussion

Socio-Economic Characteristics of Rural Households

A perusal of Table 2 shows that the study area is populated by an economically active labor force (42 years), thus a stimulus that should enable them to strive for a sustainable livelihood. Given that the majority of the households have education beyond the first school leaving certificate (10 years) coupled with adequate farming experience (30.8 years), the rural households are expected to be rational in taking up sustainable livelihood enterprises that should ease them from the vicious cycle of poverty. Moreover, the study area has a healthy labor force, as evidenced by the majority (73.3%) who reported no cases of ill health during the last production season. In other words, there is less of a challenge of morbidity as empirically established in the study area. This is a testimony that government and non-governmental efforts in containing killer diseases—malaria, typhoid, cholera, and meningitis—have yielded positive results, thus enhancing labor productivity.

However, most households maintained a large household size, with the tendency of a household to be vulnerable to poverty, except if it is composed of able-bodied men with income remittance. Besides, in the absence of augmenting assets—livestock rearing, light machinery equipment, and agro-enterprise—hardly the tiny and uneconomic holdings (2.23 hectares) maintained by most of the households contain poverty in the study. Further, gender is skewed towards the male, given that the gender stereotype phenomenon will not permit a woman to take the position of a primary household

when she has a living husband. Therefore, given the cultural affinity for gender stereotypes, women's households are likely to be constrained with access to productive assets, thus easing their vulnerability to the vicious cycle of poverty. Though credit facilities are very poor (78.3%) in the study, the households have the opportunity to explore the social capital as an economic buffer against poverty due to the engagement of the majority (73.3%) in cooperative organizations. Also, most of the households have the opportunity for innovative technological and marketing tools that will buffer their livelihood given the adequate extension/advisory services among the majority (66.7%). Nevertheless, the majority of households have family responsibilities to cater to; the majority are globally integrated with mobile phone devices; the majority relies on personal savings as an income source; and, the majority take to farming and off-farm as major and minor occupations, respectively.

Table 2*Socio-economic profile of rural households*

Item	Frequency	Percent	Item	Frequency	Percent
Age			Credit access		
<=29	16	13.3	No	94	78.3
30-39	35	29.2	Yes	26	21.7
40-49	39	32.5	Total	120	100
50-59	21	17.5	Cooperative member.		
60-69	5	4.2	No	32	26.7
70-79	4	3.3	Yes	88	73.3
Total	120 (42.11)	100 [11.54]	Total	120	100
Education			Extension contacts		
Primary	18	15	No	40	33.3
Secondary	72	60	Yes	80	66.7
Tertiary	20	16.7	Total	120	100
Non-Formal	10	8.3	Marital status		
Total	120 (10.43)	100 [3.96]	Single	14	11.7
Farming experience			Married	91	75.8
<=9	1	0.8	Widowed	14	11.7
10-19	17	14.2	Widowed	1	0.8
20-29	40	33.3	Total	120	100
30-39	35	29.2	Mobile phone		
40-49	16	13.3	No	2	1.7
50-59	9	7.5	Yes	118	98.3
60-69	2	1.7	Total	120	100
Total	120 (30.83)	100 [11.69]	Income source		
Sickness			Friends & Co-op.	5	4.2
No	88	73.3	Inheritance	41	34.2
Yes	32	26.7	Personal saving	74	61.7
Total	120	100	Total	120	100
Household size			Major occupation		
1-3	7	5.8	Civil servant	7	5.8
4-6	52	43.3	Fishing	1	0.8
>=7	61	50.8	Farming	107	89.2

Total	120 (6.67)	100 [2.20]	Trading	5	4.2
Farm size			Total	120	100
Marginal	3	2.5	Minor occupation		
Small	58	48.3	Civil servant	1	0.8
Medium	38	31.7	Fishing	1	0.8
Large	21	17.5	Farming	45	37.5
Total	120 (2.22)	100 [3.38]	Trading	42	35
Gender			Causal work	31	25.8
Female	24	20	Total	120	100
Male	96	80			
Total	120	100			

Source: Field survey, 2022.

Note: values in () and [] are mean and standard deviation, respectively.

Multidimensional Poverty Status of Households

The empirical evidence of multidimensional poverty in the study area showed that at the threshold poverty point of 33%—deprived of two poverty dimensions out of six dimensions—74.88% of the studied population are multidimensional poor (Table 3a and Figure 2a). Further, at the severe poverty level of 50%—deprived of three dimensions out of the six dimensions—a total of 41.63% of the study population are multidimensionally poor. Moreover, at both the threshold and severe poverty levels, the poor, on average, are being deprived of at least three dimensions, as justified by the poverty intensity percentages of 53.02% and 60.36%, respectively. Besides, 39.70% and 25.12%, respectively, are severely poor at the poverty threshold and severity points as indicated by the index of adjusted poverty. In other words, the share proportions of the total potential deprivation suffered by the poor in society are 39.70 and 25.12% at the poverty threshold and severity levels, respectively.

Furthermore, at the poverty threshold and severity points, respectively, the index of the adjusted poverty gap shows that 35.18% and 16.50% of the poor are sensitive to both the number of deprivations they faced and the depth of the deprivation. Thus, if a person becomes more deprived in a particular indicator, the adjusted poverty gap will increase. Contrarily, if the shortfall from the deprivation cut-off in any of the indicators is reduced, then poverty plummets even if the person remains poor. In addition, at the poverty threshold and severity levels, respectively, the index of adjusted poverty severity reveals that 17.37% and 6.79% of the poor are sensitive to the number of deprivations they experience, deprivation depth, and deprivation inequality among them. Moreover, contribution-wise (Table 3b; Figures 2b & c), at lower and higher poverty levels, respectively, it was observed that the poor suffered more deprivation in the environment, vis-à-vis 32.49% and 37.54%, then followed by empowerment—21.94% and 22.26% (Figure 2c). However, deprivation in education has the least contribution to multidimensional poverty at both lower and higher poverty levels vis-à-vis 5.82% and 2.42%, respectively. Therefore, it can be inferred that the majority of the households in the study area are experiencing multidimensional poverty and are at least deprived in not less than three livelihood dimensions. Nevertheless, environmental empowerment and standard of living dimensions need proactive intervention so as to minimize the corrosive effect of poverty in the study area.

Succinctly, the findings highlight those targeted interventions in environmental sustainability, empowerment, and standard of living are critical to addressing the multidimensional poverty in the study area, as these dimensions contribute most significantly to deprivation. Additionally, the sensitivity of the adjusted poverty gap and severity indices to the depth and inequality of deprivation underscores the importance of tailored policies to reduce deprivation intensities. Lastly, the minimal

contribution of education to multidimensional poverty suggests that existing educational initiatives may be relatively effective, but complementary measures in other areas are urgently needed.

Table 3a

Multidimensional poverty index of rural households

Index	k= 0.33 (2D)	k= 0.50(3D)
Head count	0.74875	0.41625
Adjusted	0.530152	0.603579
Gap	0.886251	0.656785
Severity	0.437612	0.27029
MPI(M ₀)	0.396951	0.25124
MPG (M ₁)	0.351799	0.16501
MPS(M ₂)	0.173711	0.067908
Inequality	0.00045	0.00024

Source: Field survey, 2022.

Table 3b

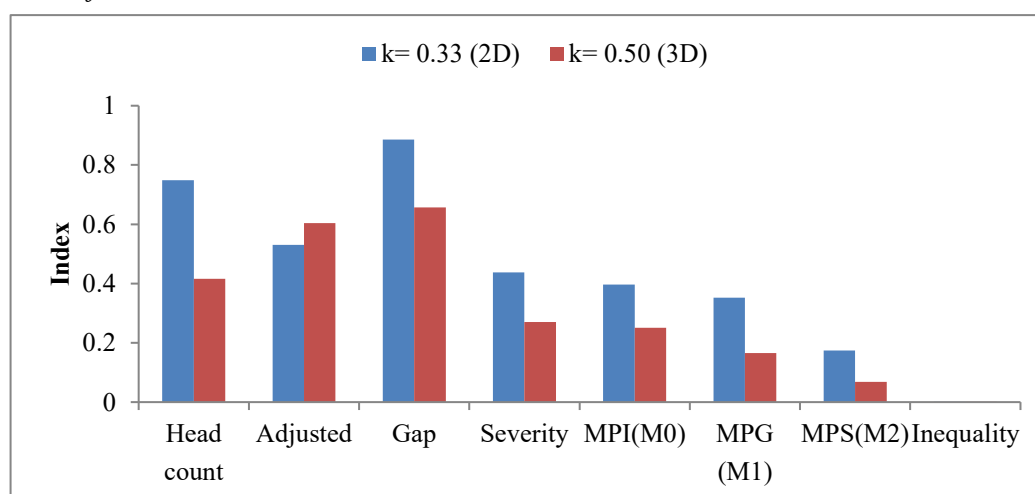
MPI's dimensions contributions

Dimension	Index contribution to MP		Percent contribution to MP	
	k= 0.33 (2D)	k= 0.50(3D)	k= 0.33 (2D)	k= 0.50(3D)
Education (EDU)	0.031563	0.027083	7.951225	10.77988
Health (HLT)	0.037222	0.026667	9.377023	10.61404
Living standard (LS)	0.070042	0.042125	17.6449	16.76686
Environment (ENV)	0.112917	0.066771	28.44597	26.57656
Social connection (SC)	0.058646	0.036563	14.77406	14.55284
Empowerment (EMP)	0.086563	0.052031	21.80683	20.70981
Total	0.396951	0.25124	100	100

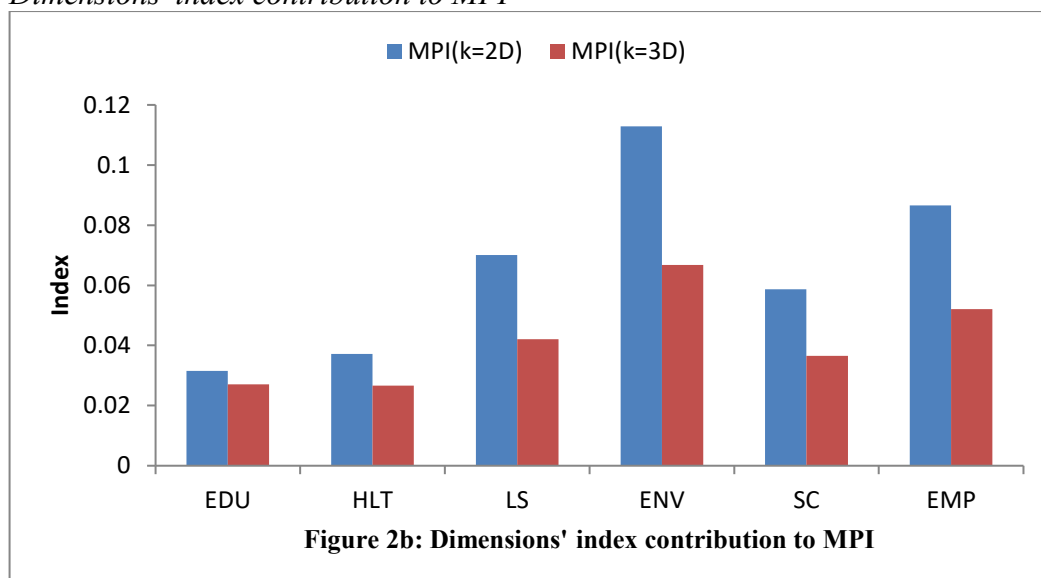
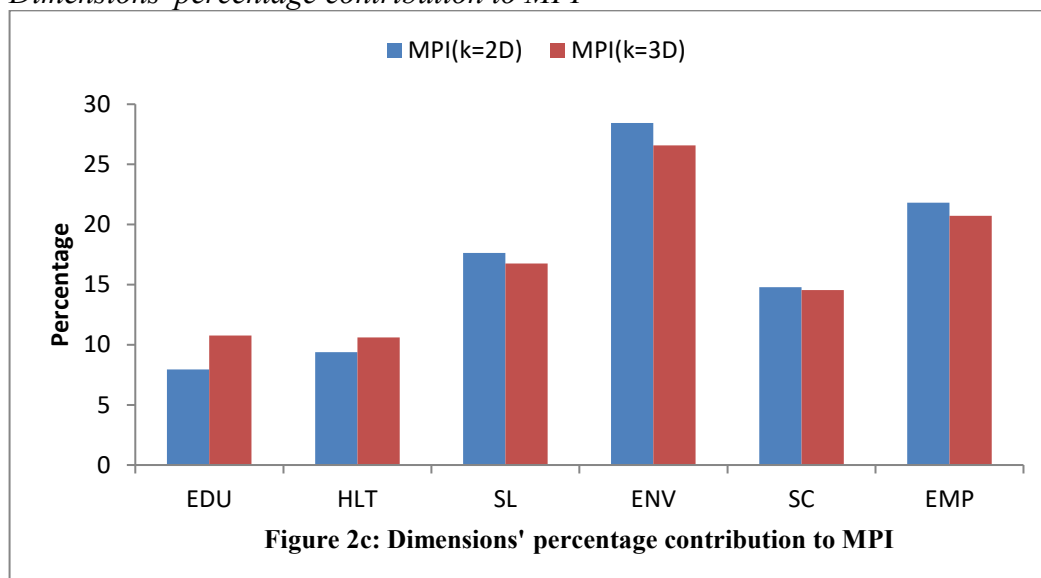
Source: Field survey, 2022.

Figure 2a

MPI of rural households



Source: Field survey, 2022.

Figure 2b*Dimensions' index contribution to MPI**Source:* Field survey, 2022.**Figure 2c***Dimensions' percentage contribution to MPI**Source:* Field survey, 2022.

Determinants of Multidimensional Poverty Intensity

Using the maximum likelihood Heckit, the covariates that influenced multidimensional poverty (MP) in the study area were determined (Table 4). The Wald χ^2 being within the plausible margin of 10% probability level indicates that the chosen model is the best fit for the specified equation. Besides, the equations are independent, as evidenced by the plausibility of the LR χ^2 at a 10% degree of freedom. More so, the non-significance of Mill's inverse ratio at a 10% error gap entails that there is no problem of sample selection bias in the use of the non-zero MP index. Thus, the outcome model is important in discerning the covariates that determine the intensity of the MP. Nevertheless, the covariates in the outcome model have no case of interdependence, as evident by their respective variance inflation factors (VIF) that are within the plausible threshold value of 10.0.

Thus, holding on to the above diagnostic tests, it can be adjudged that the captured parameters can be used for prediction with accuracy, certainty, and consistency.

The empirical evidence showed that the rural households' multidimensional poverty status is influenced by age, education, farming experience, farm size, and household size, whereas the MP intensity is subject to credit access, as evidenced by their respective parameter estimates that are within the plausible margin of a 10% error gap.

Age decreases the probability of a household being multidimensional poor, as evidenced by the negative significance of its respective coefficient. *Ceteris paribus*, an increase in labor productivity, which in turn stimulates income streams positively, has the tendency to enable youthful-to-middle-aged households to escape the vicious cycle of poverty. However, at the peak age point—old age—this is most unlikely due to a decline in labor productivity, except for households that are composed of able-bodied men despite having an old-aged household head. Therefore, by marginal implication, a unit increase in age will decrease the probability of a rural household not being multidimensional poor by 7.5%.

Literacy decreases the probability of a household being multidimensional poor, as evidenced by the negative significance of its respective coefficient. Literacy will enable rural households to engage in pluractivity so as to boost their income stream, thus decreasing their vulnerability to poverty. Therefore, the marginal implication of a unit increase in educational achievement will decrease the tendency of a rural household to be non-multidimensional poor by 8.5%.

Farm size significantly decreases the likelihood of a household being multidimensionally poor. The negative relationship of the farm size suggests that economies of scale and crop diversification effects of larger farms reduce households' vulnerability to multidimensional poverty. Conversely, small-scale farmers are more exposed to multidimensional poverty owing to their deficiency in an economic capital base, diseconomies of scale, and marketed surplus. Thus, the marginal implication of a unit increase in a farm size will decrease the chances of a rural household being non-multidimensional poor by 29.40%. Contrary to a prior expectation, farming experience increases the likelihood of a household being multidimensionally poor. Complacency due to previous failed innovations will affect future innovative technologies, marketing, and business innovations, thus exposing households with adequate years of farming experience to multidimensional poverty. Therefore, the marginal implication of a unit increase in farming experience will increase the chances of a rural household being multidimensionally poor by 6.5%.

Household size increases the probability of a household being in multidimensional poverty. The negative relationship of the household size coefficient suggests that large households composed mainly of women and children will surely affect income streams due to the incursion of high expenditure on food and medicine and little or no income remittance by the multiple hands from external sources, thus making them susceptible to multidimensional poverty. Therefore, the probability of a large household being multidimensionally poor for a unit increase in household size against a small household will be 14.94%. Furthermore, empirically, it was deduced that access to credit decreases the intensity of multidimensional poverty significantly because credit will offer households the means to venture expansion. The inverse relationship of access to credit suggests that households that lack credit facilities are at the mercy of poor business concerns due to a lack of additional business investment, thus vulnerable to multidimensional poverty. Therefore, the marginal and elasticity implications of a decrease in the multidimensional poverty intensity of rural households with credit facilities against those with none will be 5.89% and 2.57%, respectively.

Table 4*MP intensity determinants of rural households*

Items	Coefficient	SE	t-stat	Elasticity	VIF
Decision stage					
Constant	1.1323	0.9434	1.200 ^{ns}	-	-
Age	-0.0747	0.0328	2.273 ^{**}	-	-
Gender	0.2832	0.3452	0.820 ^{ns}	-	-
Marital status	0.1330	0.3000	0.443 ^{ns}	-	-
Education	-0.0853	0.0329	2.590 ^{***}	-	-
Farm exp.	0.0654	0.0339	1.929 [*]	-	-
Farm size	-0.2939	0.1689	1.740 [*]	-	-
Income	9.358e-07	6.812e-07	1.374 ^{ns}	-	-
Extension contact	0.0279	0.2677	0.104 ^{ns}	-	-
Sickness	-0.0302	0.2979	0.101 ^{ns}	-	-
Household size	-0.0497	0.0661	2.259 ^{**}	-	-
Outcome stage					
Constant	0.7053	0.1005	7.016 ^{***}	-	-
Co-opt. membership	-0.0143	0.0252	0.568 ^{ns}	-0.0195	1.055
Credit access	-0.0589	0.0262	2.249 ^{**}	-0.0257	1.055
Mobile phone	-0.1325	0.1039	1.275 ^{ns}	-0.2380	1.008
Lambda	-0.0766	0.1297	0.590 ^{ns}	-	-
Rho	-0.6998				
Sigma	0.1094				
Wald Chi ²	8.64[0.034] ^{**}				

Source: Field survey, 2022.

Note: Values in () and [] are standard error and probability level, respectively. ***, **, * & ns are significant at 1, 5, 10%, and non-significant, respectively. Threshold VIF is 10.0

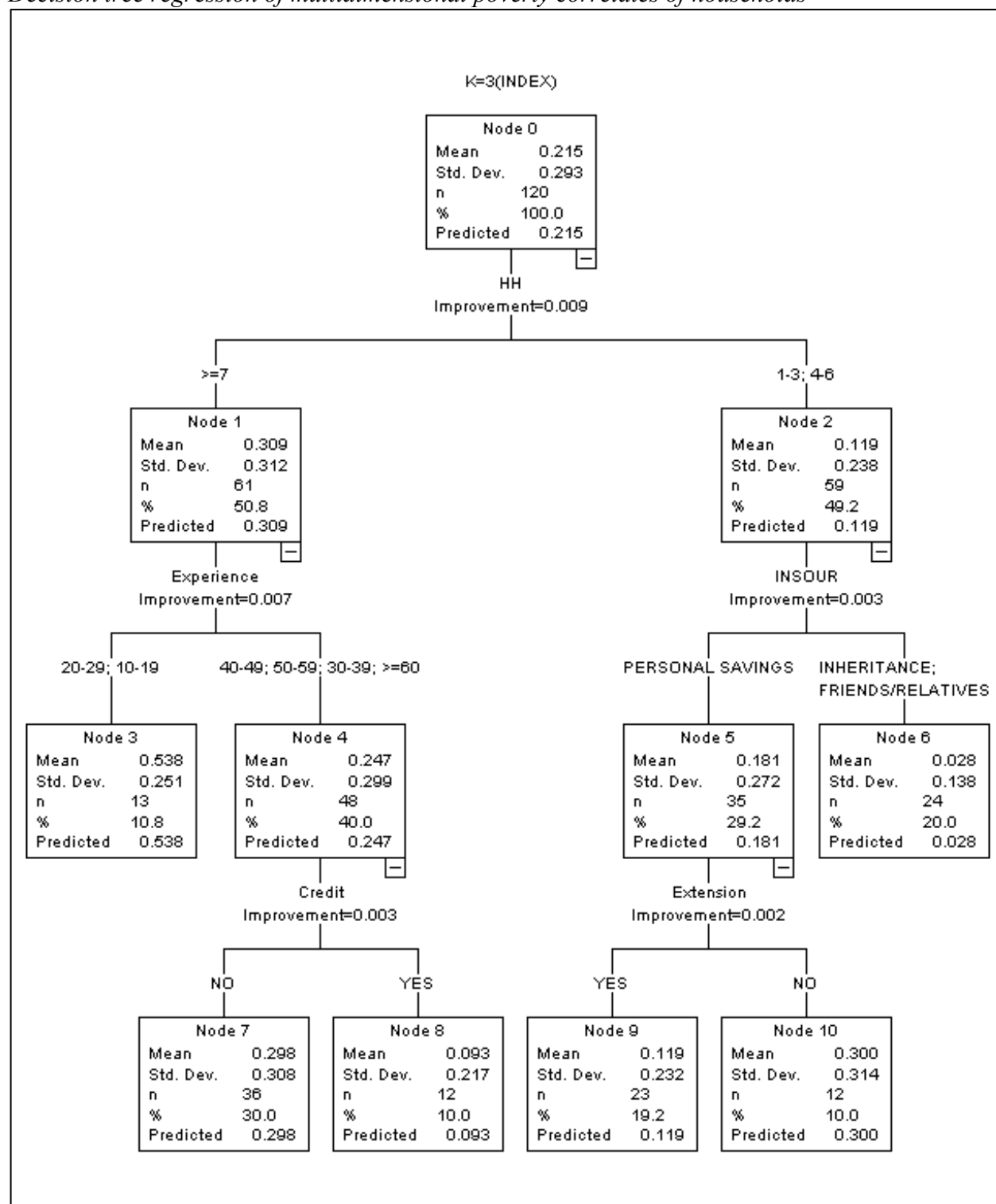
Correlates of Multidimensional Poverty Intensity of Households

The model summary of the tree regression model indicated that only five out of fifteen selected predictors made a significant contribution in determining the intensity of multidimensional poverty, thus the automatic exclusion/ dropping of the remaining predictors (Figure 3). These significant variables are household size, farming experience, income sources, credit access, and extension contact. Besides, the tree model is a simple one as it has 11 nodes and 6 terminal nodes and is truncated at 3 depths. The decision rules are designed in the root (node 0), branch (nodes: 1, 2, 4, and 5), and the leaf (nodes: 3, 6, 7, 8, 9, and 10) views. Empirically, household size is the best predictor of multidimensional poverty intensity, and it divides the households into two groups, viz. large household size (≥ 7) (node 1) and merged small-medium household sizes (≤ 6) (node 2). The results showed that large households would have a poverty intensity of 30.9% against their counterparts (small-medium households), which will have MP intensity of 11.9%. Further, farming experience and income sources, respectively, happened to be the best predictors of MP intensity of large (node 1) and small-medium households (node 2).

Based on farming experience, two groups were identified: households with farming experience between the ranges of 10-29 years (node 3) will have an MP intensity of 53.8%, while those with farming experience above 29 years (node 4) will have an MP intensity of 24.7%. For households with farming experience between 10-29 years, farming experience is the only best predictor of their MP intensity. On the basis of income sources, two groups were identified: households with personal savings as an income source (node 5) will have an MP intensity of 18.10%, while those with merged

inheritance and friends/relatives as income sources (node 6) will have an MP intensity of 2.8%. For the households with merged inheritance and friends/relative income sources, income source is the only best predictor of their MP intensity. The MP intensity of node 5 was determined by credit access, and on that basis, two groups were identified: for households with no credit facilities (node 7), their MP intensity will be 29.8%, while the MP intensity of households with credit access (node 8) will be 9.3%. The households in node 5 had extended contact as the determinant factor of their MP intensity, and it split the group into two, viz., those with contact and none. For households with extension contact, their MP intensity will be 11.90%, while those with no extension contact will have an MP intensity of 30.0%. Nevertheless, the accuracy of the prediction based on the risk estimate of 0.061 indicates that the MP intensity prediction of 6.10% of the sampled population is wrong; i.e., the risk of misclassifying a household's MP intensity is approximately 6.10%. Thus, it can be inferred that 93.90% of the households' MP intensity was accurately predicted.

Succinctly, the results underscore the importance of household size as a critical determinant of multidimensional poverty intensity, indicating that interventions should prioritize large households for more effective poverty alleviation. Furthermore, the significant role of farming experience, income sources, credit access, and extension contact in influencing MP intensity suggests the need for integrated policies that enhance financial inclusion, provide agricultural support and strengthen social networks. Lastly, the high accuracy of the tree regression model highlights its reliability as a decision-support tool for targeting and prioritizing households in poverty reduction programs.

Figure 3*Decision tree regression of multidimensional poverty correlates of households***Source:** Computer Printout, 2022.

Risk estimate = 0.061 (0.007)

Note: HH= Household size; INSOURC = Income source; value in () is standard error.

Poverty Coping Strategies of Rural Households

The results of the varimax rotation identified four interpretable poverty coping strategies adopted by the rural households, as evident by their respective eigenvalues that exceeded unity (Table 5). Besides, the R-matrix has a common factor, and it's not an identity matrix as indicated by the Kaiser-Meyer-Olkin (KMO) value of 0.773 and the plausibility of Bartlett's test of Sphericity at a 1% probability level, respectively. In addition, the KMO value is within the acceptable recommended threshold posited by Keiser (1974), Field (2005), Sadiq *et al.* (2017), and Sadiq *et al.* (2018a & b). Further, each factor has an internal consistency in its factor loadings, as evidenced by their respective Cronbach's Alpha test of reliability, which is not less than the acceptable margin of 0.70. In social science, Nunnally (1978), Nunnally and Bernstein (1994), Prunomo and Lee (2010), Sadiq *et al.* (2017), and Sadiq *et al.* (2018a & b) cited a threshold of not less than 0.70 to be satisfactory. The empirical evidence showed the cumulative variance of the extracted four factors to be 60.85, wherein the variances of factors 1, 2, 3, and 4, respectively, are 28.60, 15.23, 9.81, and 7.20%.

For the extracted factors, factor loadings with an absolute value less than 0.40 were dropped, as rightly done by Bagheri and Fami (2016), Sadiq *et al.* (2017), and Sadiq *et al.* (2018a & b). Besides, in labeling a factor with two loadings, only the higher factor was considered (Sadiq *et al.*, 2018a & b). The extracted factors adopted as poverty coping strategies by the households are labeled self-help measure, social measure, religious measure, and medical measure. Factor 1, labeled self-help measure, showed rural households' concern about the use of reduced frequency of eating, eating less preferred food, food purchase on credit, and seeking food assistance from friends/relatives as coping strategies against poverty. Factor 2, labeled social measure, showed rural households' concern about the use of alms begging, fasting and praying, and the government social safety net as coping strategies against poverty. Factor 3, labeled religious measure, showed rural households' concern about the use of aids from religious organizations as a coping strategy against poverty. Factor 4, labeled medical measure, showed rural households' concern about the adoption of family planning as a coping strategy against poverty.

The identification of distinct coping strategies highlights the diverse and context-specific nature of poverty coping strategies among rural households, reflecting their reliance on both individual and community resources. The prominence of self-help and social measures suggests limited access to sustainable welfare systems, indicating a need for policy interventions to strengthen safety nets and economic resilience. Moreover, the inclusion of religious and medical measures underscores the multidimensional impact of cultural and health-related factors in shaping poverty alleviation strategies, warranting integrated development approaches.

Table 5

Coping strategies adopted by the rural households

Strategies	F1	F2	F3	F4
Reducing the frequency of eating per day	0.803			
Eating less preferred food	0.779			
Purchase food on credit	0.846			
Seeking help from friends/relatives	0.766			
Consumption of stored produce meant for planting			-0.446	0.476
Selling off farm implement/selling assets	0.7			
Children hawking	0.479			
Engaged in non-farming activities	0.513		0.594	
Borrowing money from cooperatives	0.43			

Family planning/use of contraceptives				0.807
Withdrawing children from school	0.418			
Begging for alms		0.865		
Result of fasting and prayer		0.866		
Aids from NGOs	0.42	0.465		
Aids from religious organizations			0.776	
Aids from government social intervention program		0.809		
Eigenvalue	4.576	2.437	1.57	1.153
Variance %	28.598	15.234	9.812	7.204
Cronbach's Alpha	0.837	0.736	0.702	0.746
KMO	0.773			
Bartlett's Test	0.000***			

Source: Field survey, 2022.

Note: Measured on four scale continuum bases (frequently; occasionally; rarely & not used)

*** means significant at 1%.

Conclusions and Recommendations

This study examines the productivity and challenges of the rural labor force, identifying multidimensional poverty as a key issue due to factors like unsustainable household size, credit deficits, and gender stereotypes, with the purpose of exploring coping strategies and recommending gender mainstreaming and asset augmentation to enhance household productivity, highlighting its importance in informing policies for sustainable rural development and poverty reduction.

In lieu of the findings, it was hedged that the labor force of the rural population is not only productive but also mentally and physically fit for any given economic task; agrarian and technologically exposed, thus capable of simulating innovative challenges; globally integrated; and possessed a potential social capital asset. Unfortunately, the rural populace is challenged with unsustainable household size, credit facility deficit, uneconomic holdings, and gender stereotypes. Furthermore, it was inferred that multidimensional poverty has subtly infiltrated the rural populace as households suffered deprivation in at least two livelihood dimensions. Moreover, unsustainable large household sizes and lackluster livelihood enhancement innovative measures were the significant chasm of susceptibility to multidimensional poverty.

However, the intensity of multidimensional poverty revolves around extension service provision in the study area as coping strategies against poverty, measures viz. self-help, social, religious, and medical were adopted in the study area. Consequently, the study recommends the need for gender mainstreaming as a measure to mitigate the vicious poverty cycle among women and the provision of augmenting assets so as to complement the productivity of households' business turnover ratio.

A key limitation of this study is its focus on the rural labor force without an in-depth assessment of the institutional and policy frameworks that influence their economic productivity and resilience to multidimensional poverty. Additionally, while the study highlights major challenges such as unsustainable household size, credit deficits, and gender stereotypes, it does not extensively explore the impact of climate change, market access, and digital financial inclusion on rural livelihoods. Future studies should examine the role of government interventions, technological adoption, and value chain integration in enhancing rural productivity and poverty reduction. Additionally, longitudinal studies are recommended to track the long-term effects of livelihood enhancement strategies and gender mainstreaming policies on poverty alleviation.

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محددات حالة الفقر متعدد الأبعاد للأسر الريفية في ولاية كادونا بنيجيريا

المستخلص

يهدف هذا البحث إلى دراسة حالة الفقر متعدد الأبعاد بين الأسر الريفية، باعتباره عاملاً مؤثراً في دفع عجلة نمو الاقتصاد الريفي. ولتحقيق ذلك، تم اعتماد تقنية المعاينة متعددة المراحل لاختيار عينة مكونة من 120 أسرة، وُجمعت البيانات من خلال استبيان مُنظم مدعوم بمقابلات ميدانية أُجريت في عام 2022. وقد خضعت البيانات المُجمعة للتحليل باستخدام كلٍّ من الإحصاءات الوصفية والاستنتاجية. وفي إطار ذلك، تكشف النتائج التجريبية عن أن منطقة الدراسة تتمتع بقوة عاملة اقتصادية نشطة وصحية، ذات مستوى تعليمي جيد، يغلب عليها الطابع الزراعي، مندمجة عالمياً، ومتقبلة للتقنيات الحديثة، مع امتلاكها لرأس مال اجتماعي قوي. ومع ذلك، يواجه السكان الريفيون تحديات متعددة، أبرزها ارتفاع أعداد أفراد الأسر، ونقص الائتمان، واستمرار الصور النمطية المبنية على النوع الاجتماعي، بالإضافة إلى انتشار الحيازات الزراعية غير الاقتصادية. كما أظهرت النتائج تفشي الفقر متعدد الأبعاد في المنطقة، حيث يعاني الأفراد من الحرمان في بُعدين على الأقل. ويرجع تفشي الفقر إلى عوامل عديدة، من بينها الحجم الأسري غير المستدام، وضعف تبني التدابير المبتكرة لتعزيز سبل العيش. وتُعد خدمات الإرشاد الزراعي أحد العوامل الحاسمة في الحد من حدة الفقر متعدد الأبعاد في المنطقة. وعلى الرغم من هذه التحديات، تبني السكان الريفيون استراتيجيات متنوعة لمكافحة الفقر، شملت التدابير الذاتية، والاجتماعية، والدينية، والطبية. وبناءً على هذه النتائج، يدعو البحث إلى تعزيز إدماج النوع الاجتماعي كآلية لكسر الحلقة المفرغة للفقر بين النساء، بالإضافة إلى توفير الأصول الإنتاجية التي تُمكن الفقراء الريفيين من تجاوز البيع الاضطراري الناتج عن محدودية حجم العمليات الاقتصادية.

الكلمات الدالة: الفقر، متعدد الأبعاد، سبل العيش، الأسر المعيشية، المناطق الريفية، نيجيريا