RESEARCH ARTICLE

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

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ABSTRACT

After the work of Alkire on multidimensional poverty (MP), literature exhibit a paradigm shift in the methodological approach of investigating poverty in the society. A shift from only income- economic approach to a social approach that encapsulates a wider livelihood dimensions- education, health, and standard of living has taken a lead in the literature of poverty. Consequently, in view of this methodological gap in the study area, this research on MP status of rural households was undertaken to serve as one-stop solution to the engine growth of rural economy. Using a multi-stage sampling technique, a total of 120 households is selected and information elicitation was done by the use of well-structured questionnaire complemented with 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 economic viable and healthy labor force, literate, agrarian, and technologically exposed, globally integrated and had a viable social capital pool. However, the rural population is characterized by a vulnerable household size, credit paucity, gender stereotype, and cultivation of uneconomic holdings. Furthermore, MP is riffed in the study area and the rural populace suffered deprivation in at least two dimensions. Besides, vulnerability to poverty owes unsustainable large household size and lackluster toward livelihood enhancement innovative measures. Moreover, an advisory service is the major driving force that regulates the intensity of MP intensity 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 so as to arrest poverty vicious cycle among the women folk; and, provision of augmenting assets to enable these rural poor overcome distress sale that owes to uneconomic scale of operation.

Key words: Households, livelihood, multidimensional, Nigeria, poverty, rural area

INTRODUCTION

The experience of poverty, in accordance with Sadiq (2015a) and Sadiq *et al.*(2018a), extends beyond not having enough money – lack of income.[1] As a result, there is a lack of knowledge, a loss of influence, and little to no control over fundamental life choices.[2] 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 are not provided (Sadiq, 2015b; Sadiq *et al.*, 2018b). Globally, over several government and population, poverty has remained the long-time standing reproach.[3] In 2019, the National Bureau of Statistics and the World Bank International Labor Organization both claim that this reprehensible situation is to blame for the high rate of illiteracy that exists among people worldwide, particularly wome.[4,5] Due to its complexity, it has

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grown difficult to resolve and has proven harmful to both human life and the natural world (Bello *et al.*, 2022).[6,7]

Approximately 413.3 million people lived in extreme poverty on the African continent in 2015, with Sub-Saharan Africa (SSA) having the greatest rate of hunger-related deaths.[8,9] 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 of poverty among Africans, particularly Nigerians.[10] Furthermore, due to the worsening effects of poverty and hunger, the majority of the population is now without hope.[11] More than 70% of the disposable earnings of poor households is used to meet food needs, but at least 31.5% of children under the age of five are underweight.[12,13]

The vast agricultural richness of Nigeria offers tremendous potential for growth for the broader economy as well as the rural sector.[14] Rising poverty is still a significant problem in the nation, despite its abundant natural resources.[15] 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.[16] The fact that a significant portion of the country's population live in destitution in a nation with plenty of natural resources, a robust oil industry, and a growing agricultural sector is highly upsetting.[17,18]

Rural individuals are more likely than urban ones to experience poverty and to remain there for a longer period of time.[19] Rural residents continue to experience extreme poverty and deep deprivation, which is frequently made worse by violent conflicts and a high risk of catastrophes.[20] 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.[21,22] In addition, according to Sadiq *et al.* (2018b), 40% of households across the nation's geopolitical regions are food insecure. In the year 2022, it cascaded to seventy percent (NBS, 2022), thus concomitantly blurring the possibility of halving poverty by 2030 as envisaged by SDGs.[23] It should be mentioned that the population of India is seven times more than that of Nigeria.[24] According to Khan and Cheri (2016), among Nigeria's six geopolitical zones, the North-eastern area has the highest death rate, the largest percentage of males without a high school certificate, and second to Northwest with highest percentage of females without an educational attainment.[25,26]

In addition, poor health and low education contribute to the cycle of poverty, according to Sadiq (2015 a and b); Sadiq and Sani (2022).[27] 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 lowered their income.[28,29] The result is a drop in farm production the next year, which keeps the poverty cycle in motion.[30] Age, sex, education, health, asset ownership, and other household variables are heavily weighted in the available research on the factors that determine poverty.[31] 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.[32] According to the aforementioned, understanding the factors that contribute to rural poverty are essential for establishing policies that aim to reduce it as well as for understanding its causes.[33]

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.[34] This was revealed by the impact of local factors on rural poverty. Regardless of whether a rural household is working on a farm or not, human capital has a lowering impact on the likelihood that they will be poor. Considering how long a remote area of Kaduna State has existed, additional infrastructure development is anticipated.[35] 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 productivity in agriculture, low levels of income, a decline in standard of living, and an elevated prevalence of poverty among rural residents.[36]

In Nigeria, the majority of agricultural production happens in rural areas where, ironically, poverty is most prevalent and severe.[37] 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 beneath 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 to close the knowledge gap with persuading facts and data.

In lieu of the foregoing, this research aimed to address the challenge posed by MP – a social matrix in the study area. The broad objective of the research centered on the MP 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 MP status of the households in the study area; determine the factors responsible for households' vulnerability to MP; determine the driving force of households' MP correlates; and, determine the poverty coping strategies adopted by households in the study area.

RESEARCH METHODOLOGY

The state is situated in the high plains of northern Nigeria. Besides, in the 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 km) southwest of Jos town, and flows northwest until a bend 22 miles (35 km) northeastern of Kaduna town. Before finishing its 340-mile (550-km) 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-km) 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 is rated third in terms of population (about 9, 231, 390 at a 3% annual growth rate), and fourth in terms of total land area (46,053 km²). As of 2021, the state's per capita GDP and GDP at purchasing power parity were $2,905 and $27.88 billion, respectively. The human development index was also 0.511 according to http://kdsg.gov.ng/. Rocks can be found in Kogoro Hill and Zaria and during the rainy season, many communities are vulnerable to seasonal flooding. Kaduna experiences two seasons: A dry season that is hot as well as partly cloudy, and a wet season that is hot, muggy, and gloomy. Over the year, the ambient temperature seldom descends beneath 50°F or soars beyond 102°F, typically fluctuating around 55°F and 95°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, namely, Kachia was selected. Subsequently, in view of population density and agrarian activities, six out of 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, thus given total households of 120. Furthermore, a well-structured questionnaire complemented with 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 (MPI), Heckman's model, decision tree regression, and exploratory factor analysis.

Model Specification

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): Is the proportion of persons who have been classified as multidimensionally poor, that is, those who fall below the poverty line, and is expressed as:

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

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

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

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:

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

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 $\alpha = 0$. M_0 refers to the headcount ratio of MP H, poverty incidence, multiplied by poverty intensity A:

$$M_0 = HA \qquad (4)$$

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.

$$M_1 = HAG \qquad (5)$$

$$G = \sum_{i=1}^{n} \sum_{j=1}^{d} g_{ij}^{1}(k) / \sum_{i=1}^{n} \sum_{j=1}^{d} g_{ij}^{0}(k) \qquad (6)$$

Finally, when $\alpha = 2$, the adjusted squared poverty gap is calculated as the weighted average of the indicator-specific squared poverty gaps. M_2 can be calculated as the product of H, A, and the average squared poverty gap among the poor S, that is, the severity of poverty.

$$M_2 = HAS \qquad (7)$$

$$S = \sum_{i=1}^{n} \sum_{j=1}^{d} g_{ij}^{2}(k) / \sum_{i=1}^{n} \sum_{j=1}^{d} g_{ij}^{0}(k) \qquad (8)$$

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.

$$I^q = \frac{\tilde{\beta}}{q} \sum_{i=1}^{q} [c_i(k) - A]^2 \qquad (9)$$

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 0 and 1, 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 categories have experienced an equal reduction in poverty (Sadiq and Sani, 2022).

Heckman's model

The model is composed of two dependent variables – decision (equation 11) and outcome (equation 12) 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:

$$Y_i = f(X_1, X_2, X_3 \ldots \ldots \ldots \ldots X_n) \qquad (10)$$

$$Y_{it} = \beta_0 + \beta X_{it} + \varepsilon_i \qquad (11)$$

$$Y_i^* = \alpha + X\beta + \gamma IMR + \varepsilon_i \qquad (12)$$

$$Y_i^* = \alpha + X_1\beta_1 + X_2\beta_2 + X_3$$

$$\beta_3 + \ldots + X_n\beta_n + \gamma IMR + \varepsilon_i \qquad (13)$$

Where, Y_{it} = MPI status (non-poor =0, poor = 1); Y_i^* = latent observation of ith processor (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 =

Table 1: Dimensions and indicators of multidimensional poverty construct

Dimension	Indicator	Deprivation cutoff	Weight
Education	Year of schooling	No one has completed 5 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 age 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 good toilet or improve but share with other household	1/18
	Housing	House floor made with mud, dung, and clay	1/18
	Cooking fuel	Use firewood, dung, 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	Problem of domestic violence	1/24
	Political instability	Problem of social/political unrest	1/24
	Self-defense	Problem of personal security	1/24
	Social safety net	Didn't trust government social investment program (E.g., farmers/traders monie)	1/24

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 economic active labor force (42 years), thus a stimulus that should enable them to strive for a sustainable livelihood. Besides, given that majority of the households have education beyond 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 enterprise that should ease them from the vicious cycle of poverty. Besides, the study area has a healthy labor force as evident by majority (73.3%) who reported no case of ill-health during the last production season. In other words, there is less 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 result, thus enhancing labor productivity. However, most of the households maintained a large household size, with the tendency of a household being 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 can the tiny and uneconomic holdings (2.23 hectares) maintained by most of the households contain poverty in the study. Further, gender is skewed toward the male given that 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 on gender stereotype, women households are likely to be constrained with access to productive assets, thus easing their vulnerability to vicious cycle of poverty. Although, credit facilities is very poor (78.3%) in the study but the households have the opportunity of exploring the social capital as an economic buffer against poverty due to the engagement of majority (73.3%) in co-operative organizations. Furthermore, most of the households have the opportunity of innovative technological and marketing tools that

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	Co-operative memb.		
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 contact		
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 and 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
Values in ( ) and [ ] are mean and standard deviation respectively

will buffer their livelihood given the adequate extension/advisory services among the majority (66.7%). Nevertheless, majority of the households have family responsibility to carter for, globally integrated-use mobile phone devices, relied on personal savings as income source; and take to farming and off-farm as major and minor occupations respectively.

MP Status of Households

The empirical evidence of the MP in the study area showed that at the threshold poverty point of 33% – deprived of two poverty dimensions out of six dimensions and 74.88% of the studied population are multidimensional poor [Table 3]. 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 multidimensional poor. Moreover, at both the threshold and severe poverty levels, the poor on the 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 the 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 deprivation that 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 cutoff 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 to be sensitivity to number of deprivations that they experienced, deprivation depth, and deprivation inequality among them. Moreover, contribution-wise, 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 1]. However, deprivation in education has the least contribution to the MP at both lower and higher poverty levels vis-à-vis 5.82 and 2.42%, respectively. Therefore, it can be inferred that majority of the households in the study area are experiencing MP and are at least deprived in not <3 livelihood dimensions. Nevertheless, environmental, empowerment, and standard of living dimensions need proactive intervention so as to minimizing the corrosive effect of poverty in the study area.

Determinants of MP Intensity

Using the maximum likelihood Heckit, the covariates that influenced MP in the study area

Table 3: 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 (M⁰)	0.396951	0.25124
MPG (M¹)	0.351799	0.16501
MPS (M²)	0.173711	0.067908
Inequality	0.00045	0.00024

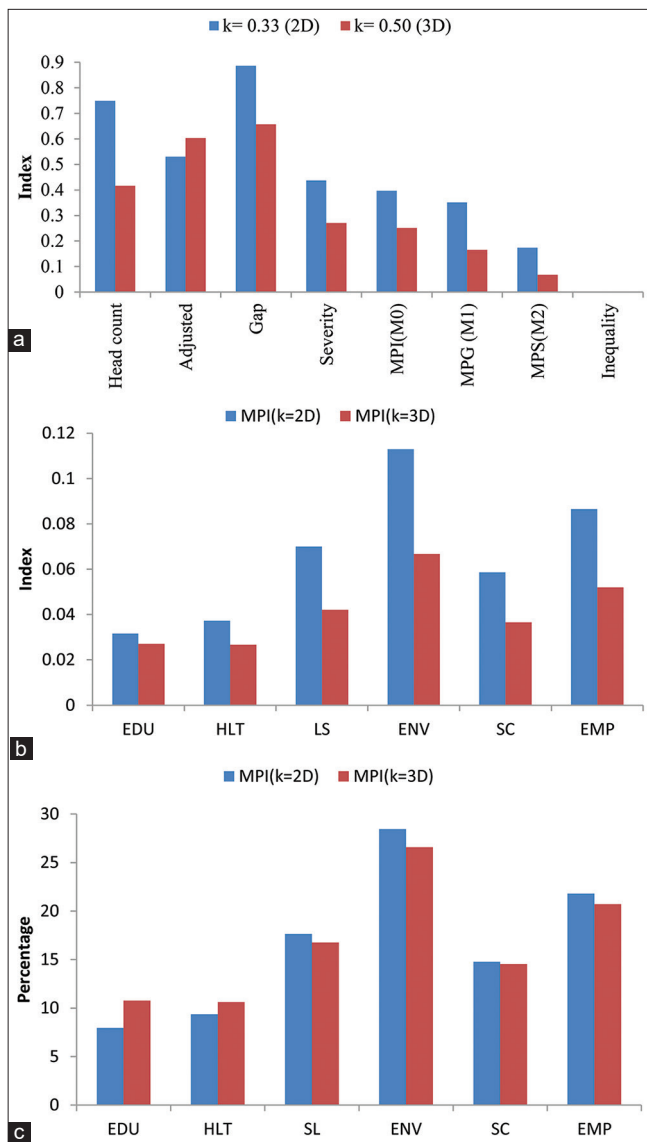| Dimension	Index contribution to MP		Percent contribution to MP	
	k=0.33 (2D)	k=0.50 (3D)	k=0.33 (2D)	k=0.50 (3D)
Education	0.031563	0.027083	7.951225	10.77988
Health	0.037222	0.026667	9.377023	10.61404
Living standard	0.070042	0.042125	17.6449	16.76686
Environment	0.112917	0.066771	28.44597	26.57656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

Source: Field survey, 2022

Figure 1: (a) MPI of rural households, (b) dimensions' index contribution to MPI, and (c) dimensions' percentage contribution to MPI. MPI: Multidimensional poverty index

were determined [Table 4]. The Wald Chi^2 being within the plausible margin of 10% probability level indicates that the chosen model is best fit for the specified equation. Besides, the equations are independent as evident by the plausibility of the LR Chi^2 at 10% degree of freedom. More so, the non-significant of the Mill's inverse ratio at 10% error gap entails that there is no problem of sample selection bias in the use of 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 inter-dependence as evident by their respective variance inflation factors 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' MP status is influenced by age, education, farming experience, farm size, and household size; whereas, the MP intensity is subject to credit access as evident by their respective parameter estimates that are within the plausible margin of 10% error gap. Age decreases the probability of a household being multidimensional poor as evident by the negative significant of its respective coefficient. *Ceteris paribus*, increase in labor productivity which, in turn, stimulates income stream 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 decline in labor productivity except 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 to be multidimensional poor by 7.5%. Literacy decreases the probability of a household being multidimensional poor as evident by the negative significant of its respective coefficient. Literacy will enable rural households to engage in pluractivity so as to boast their income stream, thus decrease 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 decreases the likelihood of a household being multidimensional poor significantly. The negative relationship of the farm size suggests that economies of scale and crop diversification effects of larger farms reduce households' vulnerability to MP. Conversely, small-scale farmers are more exposed to MP due to their deficiency in 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 to be non-multidimensional poor by 29.40%. Contrary to a prior expectation, farming experience increases the likelihood of a household to be multidimensional poor. Complacency due to previous failed innovation will affects future innovative technologies, marketing,

Table 4: Multidimensional poverty 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

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

VIF: Variance inflation factors

and business innovations, thus exposing households with adequate years of farming experience to MP. Therefore, the marginal implication of a unit increase in farming experience will increase the chances of a rural household to be multidimensional poor by 6.5%. Household size increases the probability of a household to be MP. The negative relationship of household size coefficient suggests that large households composed mainly of women and children will surely affect income stream due to incursion of high expenditure on food and medics; and little or no income remittance by the multiple hands from external sources, thus makes them susceptible to MP. Therefore, the probability of a large household being multidimensional 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 intensity of MP 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 going concern due to lack

of additional business investment, thus vulnerable to MP. Therefore, the marginal and elasticity implications of decrease in the MP intensity of rural households with credit facilities against those with none will be 5.89 and 2.57%, respectively.

Correlates of MP Intensity of Households

The model summary of the tree regression model indicated that only five out of 15 selected predictors made significant contribution in determining intensity of MP, thus the automatic exclusion/dropping of the remaining predictors [Figure 2]. 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, 6 terminal nodes and 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 MP intensity and it divides the households into two groups, namely, large household size (≥7) (node 1)
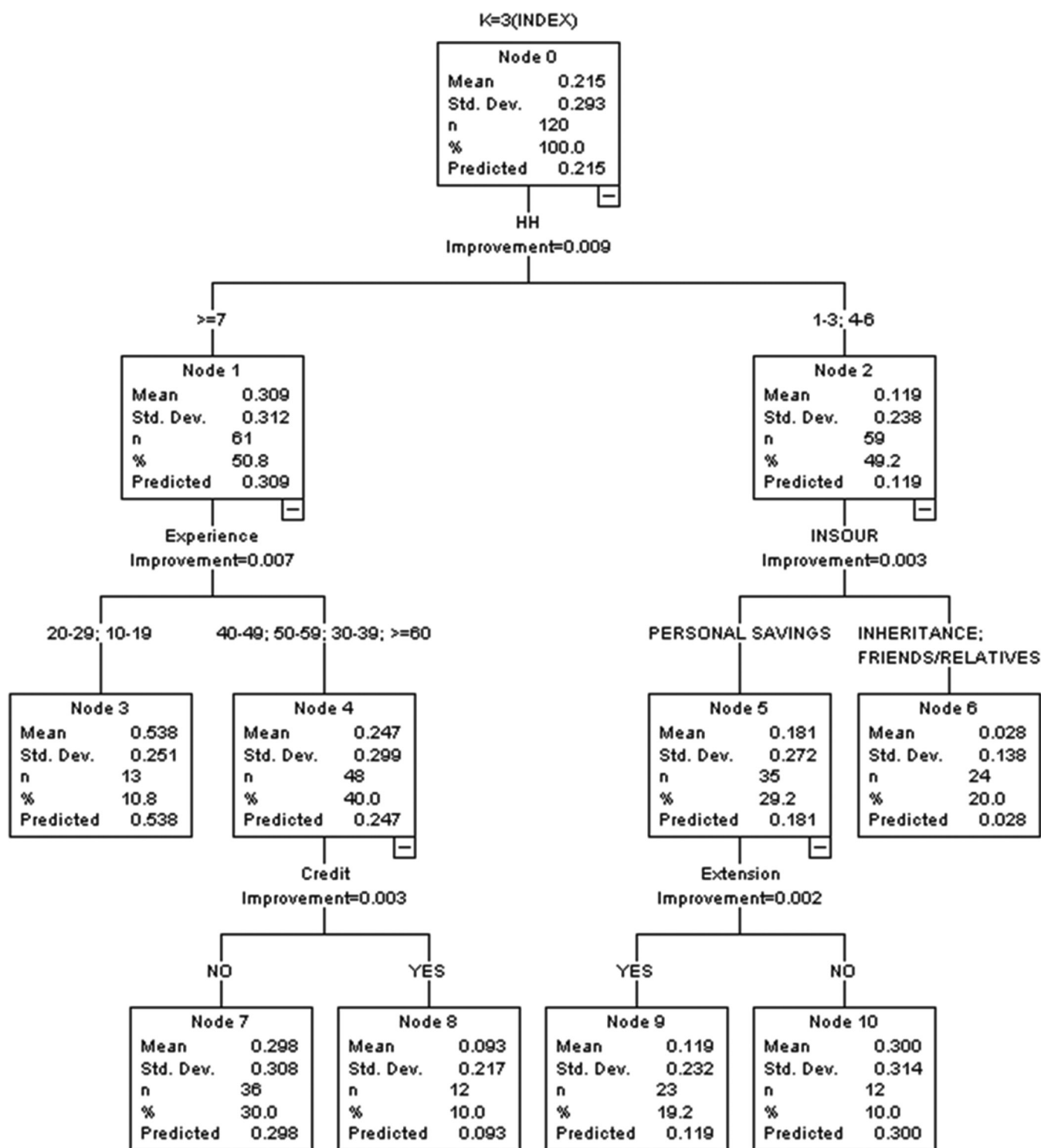
Figure 2: Decision tree regression of multidimensional poverty correlates of households. HH: Household size; INSOURC: Income source; value in ( ) is standard error

and merged small-medium household sizes (≤6) (node 2). The results showed that large households will have poverty intensity of 30.9% against their counterparts (small-medium households) that 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 and 29 years (node 3) will have MP intensity of 53.8% while those with

farming experience above 29 years (node 4) will have MP intensity of 24.7%. For the households with farming experience between 10 and 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 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 extension contact to be the determinant factor of their MP intensity and it split the group into two, namely, 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 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, that is, 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 were accurately predicted.

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 Eigen values 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 1% probability level, respectively. In addition, he KMO value is within the acceptable recommended threshold posited by Keiser (1974); Field (2005); Sadiq *et al*.(2017);

Table 5: Coping strategies adopted by the rural households

Strategies	F1	F2	F3	F4
Reducing the frequency of eating per day	0.803			
Eating of 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 inceptives				0.807
Withdrawing children from school	0.418			
Begging for alms		0.865		
Result to fasting and prayer		0.866		
Aids from NGOs	0.42	0.465		
Aids from religious organization			0.776	
Aids from Government social intervention program		0.809		
Eigen value	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
Kaiser–Meyer–Olkin		0.773		
Bartlett's Test		0.000***		

Source: Field survey, 2022
Measured on four scale continuum basis (frequently; occasionally; rarely & not used)
*** means significant at 1%

and Sadiq *et al*. (2018 a and b). Further, each factor has an internal consistency in its factor loadings as evident by their respective Cronbach's Alpha test of reliability that 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*. (2018 a and b) cited a threshold not <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, factors loadings with absolute value <0.40 were dropped as rightly done by Bagheri and Fami (2016); Sadiq *et al*. (2017); and Sadiq *et al*. (2018 a and b). Besides, in labeling a factor with two loadings, only the higher factor was considered (Sadiq *et al*., 2018 a and 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 on the use of reduced frequency of eating, eat 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 on the use of alms begging; fasting and praying; and, government social safety net as coping strategies against poverty. Factor 3, labeled religious measure, showed rural households concern on the use of aids from religious organization as a coping strategy against poverty. Factor 4, labeled medical measure, showed rural households concern on the adoption of family planning as a coping strategy against poverty.

CONCLUSIONS AND RECOMMENDATIONS

In lieu of the findings, it was hedged that the labor force of the rural population is not only production but also mentally and physically fit for any given economic task; agrarian and technological 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 stereotype. Furthermore, it was inferred that MP has subtly infiltrated the rural populace as households suffered deprivation in at least two livelihood dimensions. Besides, unsustainable large household size and lackluster toward livelihood enhancement innovative measures were the significant chasm of susceptibility to MP. However, the intensity of MP revolves round extension service provision in the study area. As coping strategies against poverty, measures, namely, 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 poverty vicious cycle among the women; and, provision of augmenting assets so as to complement the productivity of households' business turnover ratio.

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