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Exploratory Analyses of Existing Nexuses Between Cooperative Membership, Production, Wellbeing, And Determinants Among Layer Egg Production Enterprises: Evidences from South West Nigeria

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ABSTRACT: *Cooperatives have been evidently solicited to play a positively significant multifaceted role in the promotion of wellbeing among members hence, this study was conducted to examine the existing interrelationships between cooperative membership, farmers' welfare, and farm production level along its determinants among layer egg producers in southwest Nigeria, using a multidimensional approach. A multistage sampling technique was employed in the collection of data from 185 poultry farmers; 94 Cooperators, and 91 Noncooperators, randomly from four local government areas, using well-structured questionnaires. Descriptive statistics, T-test, Variance inflation factor, Alkire-Foster multidimensional poverty measures, and multiple regression are employed in data analysis.: Many (54%) of the poultry farmers are medium scaled, within which a larger proportion of about 61% are cooperators. Also, the output of the cooperator category was found significantly higher than their non-cooperator counterpart by 128.1 % crates per day at 5 % probability level. Furthermore, there exists a veritable positive relationship between farmers' multidimensional welfare and increased production scale, while years of farming experience, farming as a primary occupation, farm size, and cooperative membership, significantly influence increased output. The finding showed that farmers' multidimensional poverty headcount indices are inversely proportional to their scale of production. There also exists a significant positive relationship between increased production scales, cooperative membership, and farmers' welfare statuses.*

KEYWORDS: South West Nigeria, cooperative membership, layer egg production, Alkire-Foster multidimensional poverty measures, econometric analysis.

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INTRODUCTION

Within the Agricultural production activities which majorly consist of crop, and livestock production the latter has been emphasized as an important source of livelihoods and a potential pathway out of poverty[1].

Between the years 2000 and year 2017, the Global trends in the availability of animal-source foods showed an increase in livestock production which precludes; eggs, fish, poultry, processed meat and dairy products wherein most of these global increases were observed in lower and upper-middle-income countries where Nigeria is inclusive, but homestead poultry production is often hindered by diseases like Newcastle and insufficient inputs, and other risk factors, bringing about low productivity that also imposed a negative impact on consumption of poultry products as many consumers are left food insecure while, almost 8.9% of the world population are estimated to have been undernourished in 2019[2].

Furthermore, according to Federal ministry of agriculture and rural development[3], Nigeria has made significant progress in the production of animal protein however, the country's poultry sector is still faced with menaces such as Low productive breeds, Limited feed access, Income loss and human health effects due to pest and diseases, besides loss of income of farmers due to wide spread pest- and disease that reduce produce (e.g., avian flu) due to limited prevention and lack of control measures.

In an attempt to confront these menaces over the years, willing farmers are found of associating in order to form a members' focused institutions where their resources can be pooled together usually through a "jointly owned and democratically controlled enterprising", The International Cooperative Alliance[4] defines a cooperative as "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise".

How cooperatives promotes poverty reduction is imperative, ranging from identification of viable economic prospects for members; empowering those disadvantaged; securing the deprived by allowing them divert their individual risks into idiosyncratic risks, while soliciting members' accessibility to livelihood assets[4], towards poverty reduction.

The corporate measurement, and analysis of poverty have historically relied upon a single dimension; consumption-based/monetary approach, which is unidimensional. Merely few of the published literature adopted the multidimensional approach. Recent advancements in poverty measurement highlighted serious limitations of the monetary approaches[5,6] hence, should therefore be measured by integrating well-being indicators as done in this study.

Cooperatives play a significant role in promoting the economic activities of their members through the provision of input support, periodic training, and advisory services. They also pool resources together in order to enjoy economies of scale thereby converting supposed liable individual risks to mutual or shared risk since poultry production is such a highly risky enterprise. The essence of their economic support and mutuality is expected to be evident, and well measurable as visibly obtainable from their output level, and quality of livelihood, relative to the noncooperators hence, studies need to be carried out to evaluate their effective functioning and economic developmental roles, considering the state of Nigeria which is currently classified as a developing country. To the best of the researcher's research advancement trend knowledge, and from the search of existing literature, there are very limited research works that studied the effect of cooperatives on poultry farmers' welfare, using the multidimensional approach, and none have extended the same to production scale, or production output level so far. Regarding existing studies on farmers' welfare, very few (if any) have explored the nature of existing interrelationships between multidimensional poverty, cooperatives, and farm production, using the multidimensional approach. [7]used data from Nigeria in analyzing the effect of group farming cooperatives on food production and poverty using a randomised sampling method to select 122 farmers from five local governments in Osun State. Probit regression model estimate is used in data analysis. It was obtained that, group-farming cooperative membership significantly affects food production positively, while poverty prevalence is higher among the noncoperators. This study however employs the unidimensional approach to measure poverty without furthering to explore its relationship with farm scale and farm production. Also, [8]studied the socio-economic factors influencing poultry egg production among farmers in Ondo state, using data obtained from 60 poultry farms from 5 Local Government Areas, with the aid of a structured interview schedule. The study revealed that a number of layers, level of education and years of experience significantly influenced poultry egg production. This study however did not further investigate how cooperative membership improves farm production and multidimensional poverty. This study hence sets out to address these inadequacies.

This study thereby sets out to measure the interrelationships between cooperative membership, farm production, and welfare of layer egg producers in southwest Nigeria, with specific objectives to; profile the scale of poultry production outlays, determine the differentials between the output levels of cooperators and noncooperators, evaluate their multidimensional poverty statuses by production scale, and analyze the determinants of output level among layer egg farm holders in the study area.

MATERIALS AND METHODS

Theoretical framework

a. Sen's capability theory of poverty

This study used Sen's capability theory of poverty, focusing on the success, or failure of individuals in relation to their capabilities to adequately fulfill certain crucial functions

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minimally[9,6]. The inability of an individual "I" to satisfactorily meet a need as an individual may make him collude or combine recourses with another.

Sen insisted monetary-based approach to only emphasize commodity-based utility hence, may not necessarily provide adequate measures that can evaluate people's well-being. Hence, this study adopts the non-monetary/multidimensional approach. The capability theory of poverty sees human life as a set of "doings and beings" i.e., "functionings"–and it relates the evaluation of the quality of life to the assessment of the capability to function.

Cooperative membership decision of a farmer "I" with a function "X_i", with an existing resource/budget function in itself is a state of being or becoming a Cooperator with a function "Q" wherein a member should be able to attain a social/economic capacity with a function "F" owing to membership and, or vice versa. A Cooperative's members' capacity status after becoming a cooperator may be poor/low-level producer ($\frac{dQ}{dF} < 1$)or Non-poor/increased producer ($\frac{dQ}{dF} > 1$), depending on the interplay of these factors whose empirical outcome remains conjectural until a veritable scientific investigation is administered. These brought about this study. According to[6], the development of a person's capability or achievements/functioning's can be expressed as;

$Q_i(X_i) = \mathrm{F}[I(B), Z_i]$ ..... (1)

Where;

- Q = capability of individual given the resource constraint "X".
- F = function mapping the characteristics into the state of being.
- X_i = vector of choices made by the individual "I".
- B = standard budget constraint.
- Z_i = vector of uncertainty.

A capability model emphasizes the fact that the development of human capital, or capability is influenced by availability of financial resources and other social, or environmental factors[6] while, according to NBS[10], educational achievement is a prime factor for distribution of poverty.

Study area/ Data Collection.

This study was conducted in Oyo State, South West Nigeria, a State comprising of 33 local Government areas (LGAs) with an estimated population of about 7.8 million persons[11] and the land topography covers about 35,743 km^2 situated within latitude 2°N and 5°N; between longitude 7°E and 9.3°E. Data were collected from the poultry farm holders from June 2017 to January 2021, via a multistage sampling technique. In the first stage, Oyo State was purposively selected from the existing 6 States in the South West zone due to the existence of a large number of poultry farmers therein in addition to favourable climatic conditions in favour of poultry farming[12], followed by stratification into non-heterogeneous and non-overlapping categories of; dense

poultry production area and less dense poultry production area strata, based on the concentration of poultry production activities, from which two agricultural zones (i.e., Oyo and Ibadan/Ibarapa respectively) are randomly selected per strata, out of the four existing Agricultural Zones within this State. The third sampling stage involves a random selection of three Local Government Areas (LGAs) per Ibadan/Ibarapa Zone (Ibadan North, Ibadan South, and Ido), and Oyo agricultural zones (Oyo Central, Oyo West, and Afijio) which are followed by a random selection of 10 farm settlements/communities; one community/farm settlement within the Ibadan North, Ibadan South LGAs and two from Ido LGA (owing to relatively larger poultry production activities taking place in Ido), while one community/Farm settlement was selected per Oyo central, Oyo west, and four communities/farm settlements from Afijio LGA (owing to relatively larger poultry production activities taking place in Afijio), from which a total of 210 farming household was randomly selected in total, while 185 was utilized owing to the quality of responses.

Statistical Analysis

a. Scale of production.

Farming scale group categorization follows that of studies [13,14] &[15], where farms having ≤ 1000 birds were considered as small-scale poultry farmers, those with >1000-5000 birds are classified as medium scale poultry farmers, while those having >5000 birds and above are regarded as large scale poultry farms.

b. The Alkire, and Foster multidimensional poverty measures (AFM).

The AFM differentiates the poor from the nonpoor as it considers the range of deprivations they suffered, It firstly considers a range of deprivations that they suffer, followed by an aggregation to generate some parametric poverty indices (Mα) that is decomposable towards targeting the poor, alongside the dimensions of deprivation.

i. Dimensions, indicators, cutoffs, and weights

A vector w = (w1,…,wd) of deprivation counts indicates the relative extent of the respective deprivations and all weights aggregates to the number of dimensions "d", with vector "C" of deprivation counts that is compared against a cut-off "k=33.3" to identify the deprived category. A poverty threshold "k" satisfying $0 < k \leq C$ is used to determine whether a farmer has sufficient deprivations to be considered poor or otherwise, following[5], are given as;

$$H_o\,(X; k; Z) \equiv \frac{1}{N}\sum_{n=1}^{N} I\,(Cn \geq k) = \frac{q}{N} \quad \ldots\ldots(2)$$

$$A\,(X; k; Z) \equiv \frac{\sum_{n=1}^{N} I\,(Cn \geq k) Cn}{q} = \frac{\sum_{1}^{q} c}{q} \quad \ldots\ldots(3)$$

$$M_o \equiv \left[\frac{1}{N}\sum_{n=1}^{N} I\,(Cn \geq k)\right]\left[\frac{\sum_{1}^{q} c}{q}\right] = H_o \times A \quad \ldots\ldots(4)$$

Where:

Ho= Head-Count Ratio, A = Average depth of deprivation, M_o = Multidimensional Poverty Index (MPI), q= count of multidimensionally poor, N= Population total, C= set of deprivation score, I (Cn ≥ k) = Cut-off.

c. Multiple regression analysis.

The Ordinary least square (OLS) multiple regression model was employed to analyze the various determinant factors of output level among layer egg farmers. The model is specified as follows;

$$Y_i = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \mu_i \quad \text{.....(5)}$$

Explicit model specification;

$$Y_i = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 \text{.....} + \beta_n\chi_n + \mu_i \quad \text{.....(6)}$$

Where; $\mu \sim N(0, \sigma^2)$, β = Parameter estimates β_0 Intercept, β_1= Slope, Y_i = continuous dependent variable (farm output in crates), X_i = Explanatory variables. i =1, 2, 3,….. 8.

X_1 = Household size, X_2 = Age of Household head in years, X_3= Years of farming experience, X_4= Primary source of labour (Dummy; Paid labor=1), X_5= Primary occupation (dummy; Farming=1; Otherwise=0), X_6= Farm size capacity layers, X_7= Wellbeing, X_8= Cooperative membership status (dummy; Yes=1; No=0).

Multicollinearity

Multicollinearity as a common phenomenal menace do arise from nonexperimental data, and no single unique method of detecting it, or measuring its strength. There however exists, some rules of thumb[16]. Such as the variance inflation factor (VIF) analysis.

Variance inflation factor (VIF).

The rate at which the co-variances and the variances of an estimator increase is reflected via the VIF analysis specified as follows;

$$\text{VIF} = \frac{1}{(1-R_j^2)} \quad \text{.....(7)}$$

Where; $1-R_j^2$ = Tolerance.....(8)

j= Explanatory variables, R_j^2 = determination coefficient of a "j^{th}" regressor. As a rule of thumb, if 5 ≤ VIF, such variable is identified to be collinear[16,17,&18] and highly collinear when 10≤ VIF hence, dropped.

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RESULTS AND DISCUSSION

Scale of production.

The cooperators' farm size holding is larger than the noncooperator category on the average. Also, majorities of the respondents (54%) practices medium scale poultry farming while only a few (of about 8%) of the respondents are into large scale poultry farming. This relatively low incidence of large-scale poultry farming can be linked to the existing state of low level of poultry production technology required to embark on a large-scale production in the study area due to its cost intensiveness as only a few of the farmers can afford the high cost involved as shown in Table 1 and Fig. 1.

Table 1. Distribution of poultry production scale among the respondents by cooperative membership status.

POULTRY BIRDS PRODUCTION SCALE	NON COOPERATORS		COOPERATORS		POOLED	
	FREQ.	%	FREQ.	%	FREQ.	%
SMALL SCALE	38	41.76	32	34.04	70	37.84
MEDIUM SCALE	43	47.25	57	60.64	100	54.05
LARGE SCALE	10	10.99	5	5.32	15	8.11
MEAN DIFFERENCE	2389.967 423.9159		2813.883		2697.538	
TOTAL	91	100	94	100	185	100

Source: Field Survey data analysis results

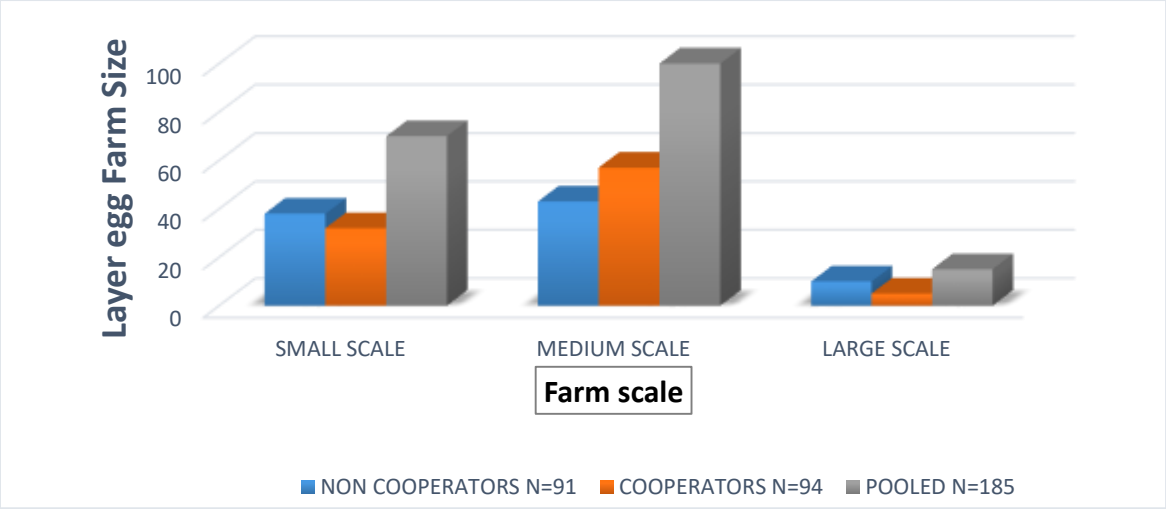

Fig. 1. Distribution of poultry production scale by cooperative membership.

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Output level

The bulk (46.49%) of the poultry farming households produces less than 20 Crates/day on the average wherein the output of the cooperators is significantly higher than their noncooperator counterparts, revealing a positive influence of cooperative membership in promoting increased output level, hence the null hypothesis was rejected. This was in line with the findings of[7]–as shown in Table 2 and Fig 2.

Table. 2 Test of difference significance between cooperators and noncooperators.

AVERAGE PRODUCTION OUTPUT (In Crates)	NON COOPERATORS		COOPERATORS		POOLED	
	FREQ.	%	FREQ.	%	FREQ.	%
≤20	50	54.95	36	38.30	86	46.49
21-40	23	25.27	26	27.66	49	26.49
≥41	18	19.78	32	34.04	50	27.03
MEAN	35.6593	(6.1553)	81.3351	(20.8113)	58.8675	(11.0986)
DIFFERENCE	-45.6758	(22.0032)			P= 0.0393**	
TOTAL	91	100	94	100	185	100

Source: Field Survey data analysis result. Standard error parenthesized. ** if P≤0.05

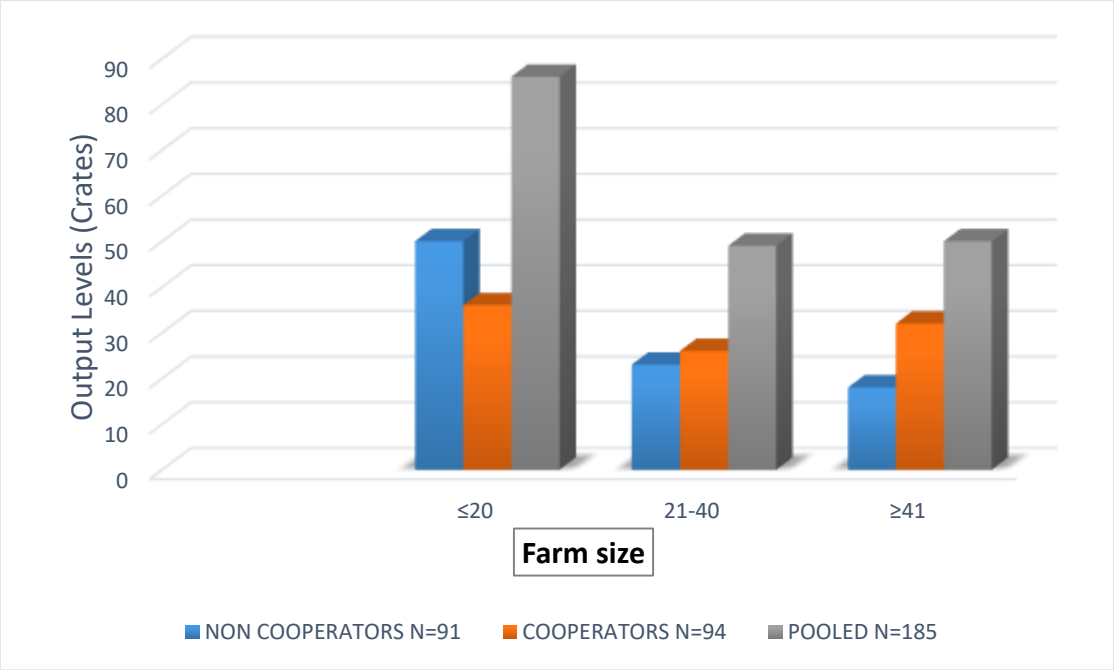

Fig.2 Effect of cooperative membership on output levels

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Multidimensional poverty indices and production.

The multidimensional poverty headcount was found to be inversely proportional to their scale of production. This relationship is the same for the average intensity of deprivation indices, and the multidimensional poverty indices categories thereby revealing a positive relationship between increased production scales, and poultry farmers' welfare indices. The result on the average intensity of deprivation was similar to the finding of [7].as shown in Table 3 and Fig 3.

Table 3: Multidimensional poverty status of the respondents by production scale.

PARAMETERS K=3	SMALL SCALE N=70	MEDIUM SCALE N=100	LARGE SCALE N=15	POOLED N=185
Multidimensional Poverty Headcount (H_0)	0.2143	0.16	0.0667	0.1729
Average Intensity of Deprivation (A)	0.4556	0.4306	0.025	0.4444
Multidimensional Poverty Index (M_0)	0.0976	0.0689	0.0333	0.0768

Source: Field Survey data analysis result.

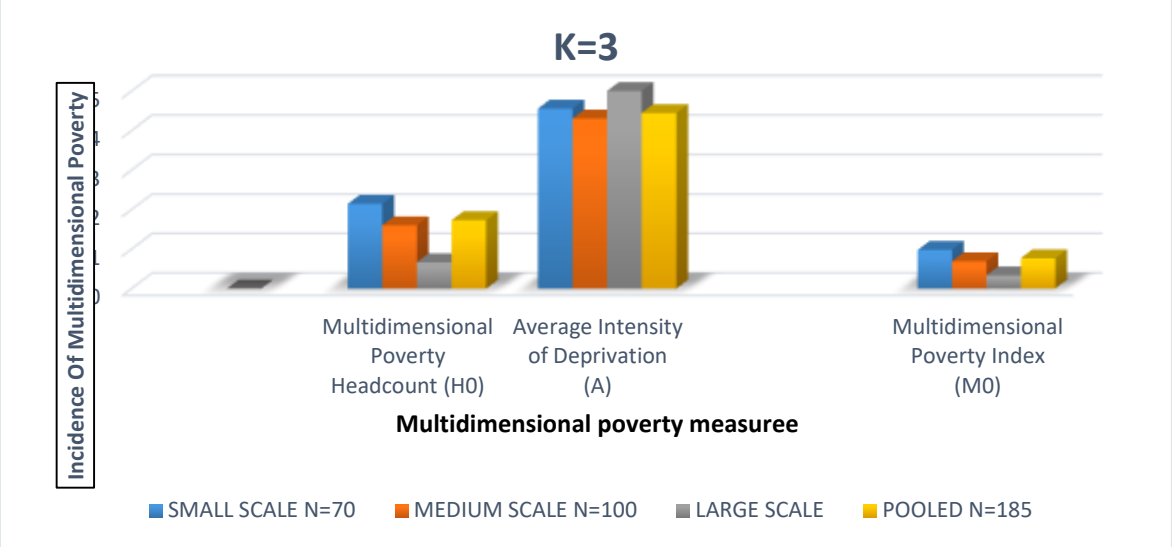

Fig. 3 Multidimensional poverty status of respondents.

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Nexuses between hypothesized variables.

	Farm size	Daily output	Multidimensional poverty	Cooperative membership	Farm Income	Farming experience
Farm size	1					
Daily output	0.1869 ***	1				
Multidimensional poverty	0.1327*	0.1077 *	1			
Cooperative membership	0.0298	0.1517 **	0.0593	1		
Farm income	0.2319 ***	0.8453 ***	0.0942	0.105561	1	
Farming experience	0.1014	0.1788 ***	0.0835	0.0449	0.2510	1

Fig. 4. Pairwise correlation matrices. * if P≤0.1, ** if P≤0.05, ***if P≤0.01.

Determinants of output level.

A common problem encountered in multiple regression model is multicollinearity hence, a diagnostic check (VIF analysis) was carried out, and the result obtained as shown in the Table 4 validated a reliable multiple regression analysis result which was presented in Table 5.

Table. 4 Showing the results on the multicollinearity test.

Variables	VIF	1/VIF
Household Size	1.30	0.769300
Age	1.29	0.773083
Farming experience	1.20	0.830308
Primary labor source	1.09	0.914169
Primary occupation	1.07	0.935130
Wellbeing	1.05	0.950727
Cooperative membership	1.05	0.954432
Farm size	1.05	0.955666
Mean VIF	1.14	

Source: Field Survey data analysis result.

The result on the analysis of determinants of output level among the poultry farming households was presented in Table 5. The result showed that, out of 8 variables hypothesized to influence layer egg production, only four variables are significant. These includes years of farming experience, farming as primary occupation, Farm size, and cooperative membership, with all these significantly influencing layer egg output level positively at 10%, 10%, 5%, and 10% probabilistic levels respectively. These corroborates the findings of[8], where farmer's years of farming experience and farm size positively determines egg production output level.

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Table 5: Determinants of output level among poultry farming households

Explanatory Variables	Coef.	Std. Err.	t-stat
Household size	7.222024	5.76547	1.25
Age of household head	0.3007361	1.065162	0.28
Years of farming experience	1.640937	1.052295	1.56*
Primary source of labour	-12.05976	22.48773	-0.54
Primary occupation	28.97299	22.24988	1.30*
Farm size	0.0029674	0.0015481	1.92**
Wellbeing	28.88601	25.50821	1.13
Cooperative membership	39.27296	22.01087	1.78*
_constant	-63.66176	53.76896	-1.18
Prob > F = 0.0130*, R^2 = 0.1026, Root MSE = 146.22**			

Source: Field Survey data analysis result. * if P≤0.1, ** if P≤0.05, *** if P≤0.01

CONCLUSION AND RECOMMENDATIONS

Empirical findings from the study conclude that (46.49%) produces less than 20 Crates/day wherein the output of the cooperators is significantly higher than that of their noncooperator counterparts. Furthermore, there exists a positive relationship between increased production scales, cooperative membership, and farmers' welfare statuses hereby, while; years of farming experience, farming as primary occupation, farm size, and cooperative membership status, significantly increases output level positively.

Succinctly, the study recommends that, large scaled poultry farming be encouraged by the government via periodic provision of sufficient input supports, which may be disbursed to the farmers via registered cooperatives, and helping farmers create new ones where/when necessary, while ensuring that they are consolidated with adequate training in order to guarantee efficient input/resource use hereby increasing farm output production which also will invariably reduce multidimensional poverty as confirmed in this study. Also, formal education, farming as primary occupation, increased farm size, and cooperative membership should be encouraged owing to their significant positive effect in the promotion of output level among the egg layer producers in the study area. Furthermore, upper class citizens who happens to operate large scale poultry farms should be encouraged to join cooperatives in order to leverage their economies of scale on a sustainable and complementary institution, such as cooperatives.

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SIGNIFICANCE STATEMENT: The peculiarity of cooperative membership with specific respect to farm output increment, wellbeing promotion, and the influencing factors in the Nigeria Agrarian economy are largely obscure. Field survey data analytical findings showed that; significant relatively high farm output increment was found to be associated with cooperative membership, which also positively correlate with farmers multidimensional wellbeing, and increased farm production scale. Furthermore, there exists significant increased output level causality on increased years of farming experience, farming as primary occupation, increased farm size, and cooperative membership.

Conflict of interest: No existing conflict.