ASSESSING SOCIO-ECONOMIC FACTORS INFLUENCING ADOPTION OF IMPROVED POULTRY TECHNOLOGIES IN GOMBE METROPOLIS, GOMBE STATE NIGERIA.

[1]Onwuaroh, A. S*., [1]Sabe, A. T., [1]Chiroma A.I., [1]Tata, L.A., and [2]Doma, A.,
[1] Department of Agricultural Economics and Extension, Federal University of Kashere, Gombe, Nigeria
[2]Department of Agricultural Extension and Management, Federal College of Horticulture Dadinkowa, Gombe, Nigeria
***Corresponding Authors' E-mail:** augustinesundaysimon@gmail.com **Tel.:** +2348062510481.
https://orcid.org/0009-0005-6890-5863

ABSTRACT
This research aimed to evaluate the socio-economic factors affecting the adoption of improved poultry technologies in the Gombe metropolis, Gombe State, Nigeria. A multi-stage sampling method was employed to select 185 respondents, of which 157 questionnaires forms were analyzed. Descriptive statistics and ordered logit regression were utilized to achieve the research objectives. The findings revealed that the majority of farmers (66.20%) were male, with an average age of 49 years, and over half (54.14%) had completed secondary education. Approximately 75% of the farmers were married, and 56.10% had between 1 to 5 years of poultry farming experience. The average household size was about 6 members, and the average annual income for poultry farmers was N368,184.70. Notably, a vast majority (99.40%) of respondents had adopted some form of technology, with vaccines being the most commonly adopted (47.43%). Factors influencing the adoption of improved poultry technologies included access to credit ($p<0.01$), farming experience ($p<0.1$), association membership ($p<0.05$), and education level ($p<0.01$). Membership in associations was significant at the 5% level, while farming experience was significant at 10%. Access to credit and education level were significant at the 1% level. Lastly, 68.15% of respondents cited a lack of funds as the primary constraint to adopting poultry technologies. To address this issue, it is recommended that financial institutions offer low-interest loans to poultry farmers, enabling them to adopt improved technologies and enhance their livelihoods.

Keywords: *Poultry, Adoption, Improved technologies, Socio-economic factors*

INTRODUCTION

The worldwide demand for animal protein is increasing, particularly in developing countries, fueled by urbanization, income growth, and population expansion (FAO, 2015). Poultry farming has become an essential occupation and a major source of protein, valued for its swift financial returns and relatively quick production cycle (Heise *et al.*, 2015). The World Bank (2018) identifies poultry as the fourth largest source of animal protein in Nigeria, contributing approximately 25% of the nation's meat production.

Animal husbandry is fundamental to Nigerian society and the economy, with around 13 million households involved in raising livestock, and the sector contributing 6 to 8% of the national GDP (FAO, 2018). Nigeria has about 180 million poultry, making it the second-largest chicken population in Africa, after South Africa (FAO, 2018). The country's poultry output is approximately 454 billion tons of meat and 3.8 million eggs each year. Of the 180 million birds, roughly 80 million are raised in extensive systems, 60 million in semi-intensive systems, and 40 million in intensive systems (FAO, 2018). Extensive research has been carried out to enhance productivity in agriculture, particularly in local chicken production. However, the farmers who are supposed to implement these findings often make limited use of the research results. A crucial factor in any innovation's success is the effective adoption of the technology involved (Osuagwu et al., 2020).

Ithika (2013) highlighted that poultry not only provides nutritional benefits but also serves as a key livelihood source, employing millions globally in various related industries. Despite the potential for improved productivity through technology adoption, the rate of adoption among family poultry producers in Nigeria remains low (Aboki *et al.*, 2013). Government training programs aimed at modern farming techniques have had a limited impact on rural farmers. Additionally, there is a lack of information on exotic poultry breeds and advanced management practices.

Recently, Nigeria's poultry industry has faced a significant decline in output, primarily due to rising production costs. This increase has forced some farmers out of business and deterred potential investors. The situation poses a serious threat to the survival of the poultry sub-sector and calls for collective efforts to prevent its complete collapse. Despite the existence of poultry technologies developed by various research institutes and universities in Nigeria, their adoption among farmers remains low. This lack of adoption leads to reduced productivity, resulting in lower incomes and diminished socio-economic well-being for those involved in the industry.

Currently, there is insufficient information on the factors affecting the adoption of improved poultry technologies in the Gombe metropolis. This study explores the factors that influence the adoption of

improved poultry technologies among farmers. Understanding these factors can enhance the effectiveness of poultry technology development and ensure better outcomes for the industry. The study assessed the socio-economic factors influencing adoption of improved poultry technologies in Gombe Metropolis, Gombe State, Nigeria.

The specific objectives are to:

i. describe the socio-economic characteristics of poultry farmers in the study area;
ii. identify the poultry management practices adopted by farmers in the study area;
iii. determine the socio-economic factors influencing the adoption of poultry technologies in the study area, and
iv. identify the constraints associated with the adoption of poultry technologies in the study area.

MATERIALS AND METHODS

Study Area

Gombe metropolis is located between latitudes 10°15'00" N and 10°19'30" N, and longitudes 11°07'15" E and 10°13'30" E. Positioned centrally within Gombe State, it borders Kwami Local Government Area to the north and is nearly surrounded by Akko Local Government Area to the east, south, and west. Also, the area covers approximately 52 km² (Rebecca *et al*., 2023). According to the National Population Commission (2006), Gombe State had a population of 2,353,879, with a projected population of 3,978,919 in 2021, assuming a growth rate of 3.5%. The region experiences two distinct seasons: a dry season from November to March and a rainy season from April to October, with an average annual rainfall of 850 mm and daily temperatures ranging from 27°C to 40°C (ADP, 2020).

Gombe State consists of eleven local government areas, with Gombe being the capital located in the central part. The majority of the population includes the Fulani and Hausa ethnic groups (Lamurde, 2021). The residents primarily engage in farming, producing both food and cash crops such as cassava, maize, tomatoes, and groundnuts. These crops serve as essential raw materials for agro-based industries, including tomato processing companies and groundnut oil mills, both within the state and beyond (Rebecca *et al.*, 2023).

Sampling Techniques

This study employed a multi-stage sampling technique. In the first stage, the Gombe metropolitan area was intentionally chosen due to its high concentration of poultry farmers. In the second stage, all ten wards within the area were selected, as each contains poultry farmers. From an initial sample frame of 360 poultry farmers, a sample size of 185 was randomly selected using the Yamane sample size formula as used by Onwuaroh *et al.* (2017).

Analytical Techniques

Descriptive statistics were used to summarize data in an organized manner by describing the relationship between variables in a sample or population. It involved the use of frequency count, percentage, and mean to analyze objectives i, ii, & iv while the socio-economic factors influencing the adoption of poultry farmer's technologies were analyzed using an ordered regression.

Following Williams (2019), the Ordered Logic Model is stated as follows:

$$P(Y_i = m) = \frac{\exp(Z_{mi})}{[1+\sum_{h=2}^{m}\exp(Z_{hi})]} \quad \ldots\ldots (1)$$

Where:

M= vector

P = probability of the variables

Y = independent variable

Z= base of the system of natural logarithms

Furthermore,

The ordered logistic regression explicit form is expressed below;

Y_i = In(Pm /P1) = β1X1+ β2X2+ β3X3+ β4X4+ β5X5 + β6X6 + β7X7 + β8X8+ ei … (2)

Where:

Y = Number of technologies adopted (Farmers who adopt only 1 technology were scored low =1, Farmers who adopt 2-3 technologies were scored medium = 2, Farmers who adopt 4 and above technologies were scored high = 3)

b_o= Intercept

X_1= Age (years)

X_2= Level of education (years spent in school)

X_3= Farming experience (years)

X_4= Access to credit

X_5= Farm size (number of birds reared)

X_6= Household size

X_7= Membership of cooperative

X_8= Access to extension contact (number of contact)

ei= Error term

Y= (1,2 or 3)

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

This section examines the social and economic characteristics of the respondents, including age, gender, marital status, education level, household size, and years of farming experience.

Table 1 shows that males (66.20%) dominate poultry farming compared to females (33.80%), indicating a male-centric industry in the area. This finding aligns with studies by Babalola (2014) and James et al. (2021), which also reported a majority of male poultry farmers. The majority of poultry farmers are aged between 24 and 43 years (63.70%), with a mean age of 49 years. This is consistent with Nurudeen (2012), who found that 52.6% of poultry farmers were relatively young. James *et al*. (2021) reported a mean age of 51, further supporting these results.

Additionally, Table 1 indicates that 74.50% of poultry farmers are married, while 21% are single, suggesting that married individuals play a dominant role in the industry. This aligns with Osuagwu *et al*. (2020), who found that a majority of poultry farmers in his study were married. Similarly, James *et al*. (2021) noted that over 76% of poultry agricultural activities involved married individuals.

Regarding education, 54.14% of poultry farmers have completed secondary education, while 42% have primary education, and only 3.82% have informal education. Higher education levels are associated with improved agricultural practices, as noted by Ermias *et al*. (2015) and Onwuaroh *et al.* (2021), who found that literate farmers are more likely to adopt new technologies. Table 1 also shows that 50.3% of farmers have household sizes ranging from 6 to 10 persons, while 40.5% have households with 1 to 3 persons, yielding a mean household size of 5.8. This is consistent with findings by Otunaiya *et al.* (2015), who reported an average family size of 5 among poultry farmers in Ibadan, Oyo State. Similarly, Okorie *et al.* (2022) indicated a mean household size of 5 persons for poultry farmers in his study.

Table 4.1. Socio-economic characteristics of poultry farmers in the study area (n=157).

Variables	Frequency	Percentage	Mean
Sex			
Male	104	66.20	
Female	53	33.80	
Total	**157**	**100**	
Age			
24-43	100	63.70	49
44-59	53	33.80	
60-74	4	2.50	
Total	**157**	**100**	
Marital Status			
Single	33	21.00	
Married	117	74.50	
Divorced	2	1.30	
Widow	5	3.20	
Total	**157**	**100**	
Educational Level			
Informal education	6	3.82	
Primary	66	42.00	
Secondary	85	54.14	
Total	**157**	**100**	
Household size			
1-5	73	46.50	5.8
6-10	79	50.30	
11-15	5	3.20	
Total	**157**	**100**	

Source: Field Survey, 2023.

Table 2 shows that the majority (56.10%) of farmers have poultry farming experience ranging from 1 to 5 years, with an average experience of 5.8 years. Additionally, 44.6% of these farmers consider poultry farming their primary occupation, and 56.10% are registered with an association. The data further indicates that 88.50% of poultry farmers in the area earn an annual income of less than N200,000, with a mean annual income of N368,184.70. Oyelami *et al.* (2022) noted that about a majority of the poultry farmers had farming experience between 1-5 years which aligns with this study's findings. Anwasia (2015) also suggested that farmers with more experience tend to improve their production performance.

Table 2: Socio-economic characteristics of poultry farmers in the study area (n=157).

Variables	Frequency	Percentage	Mean
Farming experience			
1 – 5	88	56.10	5.8
6 – 10	63	40.10	
11 – 15	6	3.80	
Total	**157**	**100**	
Major occupation			
Poultry farming	70	44.60	
Civil service	41	26.10	
Trading	32	20.40	
Others	14	8.90	
Total	**157**	**100**	
Association			
Yes	88	56.10	
No	69	43.90	
Total	**157**	**100**	
Annual income			
Less than 200,000	139	88.50	₦368,184.70
201,000-400,000	15	9.60	
401,000-600,000	2	1.27	
Above 600,000	1	0.64	
Total	**157**	**100**	

Source: Field Survey, 2023.

Poultry Management Practices Adopted by Farmers

Table 3 presents the poultry technologies adopted by farmers in the study area. The data indicates that a significant majority (99.40%) of farmers have adopted poultry technology, while only 0.60% have not.

Table 3: Adoption of Improved Technologies by Poultry Farmers

Adopted	Frequency	Percentage
Yes	156	99.40
No	1	0.60
Total	**157**	**100**

Source: Field Survey, 2023.

Table 4 outlines the poultry management practices adopted by farmers in the study area. The result shows that 47.43% of farmers implemented vaccination practices, 36.46% adopted disease identification and management technologies, and 26.92% and 24.36% used lighting systems and debeaking technologies, respectively. Ishola *et al.* (2019) found that vaccination was the most commonly adopted improved poultry technology, which aligns with this study's results. Furthermore, Ezeibe *et al*. (2014) reported that all poultry farmers in Enugu State were aware of and interested in adopting vaccination as a crucial management practice. This finding also supports the results of the current study.

Table 4: Management practices adopted by poultry farmers in the study area(n=156)

Variables	Frequency	Percentage
Vaccine	74	47.43
Lighting System	42	26.92
Debeaking Technology	38	24.36
Weather Control Technology	38	24.36
Selection/Isolation Technique	42	26.92
Disease/Identification Technique	60	36.46
Total	***294**	***186.45**

Source: Field Survey, 2023.

* = Multiple responses

Factors Influencing the Adoption of Improved Poultry Technologies

The results from the ordered logistic regression in Table 5 can be analyzed using odds ratios and log odds. For this study, log odds were utilized for interpretation. The P-value from the likelihood ratio chi-squared test (123.41) indicates that the model, which includes a complete set of predictors, significantly improves fit compared to the null model (which has no predictors), with significance at the 1% level. This suggests that at least one of the regression slopes is significantly different from zero. Additionally, the McFadden pseudo-R^2 value is 44.37%, indicating that the full model represents a 44.37% improvement in fit relative to the null model.

The results from the Table indicate that credit, farming experience, membership in associations, and education level are significant factors. Membership in associations is significant at the 5% level, while farming experience is significant at the 10% level. Credit and education levels are significant at the 1% level. Specifically, for each unit increase in membership in an association, a poultry farmer's log odds of achieving a high adoption level of improved poultry technologies increase by 1.05. Similarly, each unit increase in farming experience corresponds to a 0.12 increase in the log odds of high adoption.

Credit also shows a significant positive effect; for every unit increase in credit received, there is a 1.96 increase in the log odds of high adoption levels. In contrast, the level of education, while significant, has a negative impact, indicating that each additional unit of education results in a 3.08 decrease in the log odds of high adoption.

These findings are consistent with Onoerigho *et al.* (2014), which identified education and farming experience as significant factors influencing technology adoption in poultry farming. Furthermore, the results corroborate Nwozuzu *et al.* (2021), who demonstrated that education, farming experience, and association membership have a substantial impact on the adoption of improved poultry technologies.

Table 5: Results of ordered logistic regression showing factors influencing the adoption of improved poultry technologies

Tech. Adoption	**Coef**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
Sex	-.3921386	.4677751	-0.84	0.402	-1.308961	.5246838
Age	.0225674	.0350521	0.64	0.520	-.0461333	.0912682
Marital/S	-.1052495	.5588975	-0.19	0.851	-1.200668	.9901695
Occupation	-.0907232	.2248492	-0.40	0.687	-.5314196	.3499732
Association	1.050896	.445532	2.36	0.018 **	.17766971	.924123
Farm. expe	.1361215	.0822547	1.65	0.098 *	-.0250948	.2973378
credit	1.957523	.6511561	3.01	0.003 ***	.6812809	3.233766
Education/L	-3.07511	.4420113	-6.96	0.000***	-3.941436	-2.208783
/cut1	**-11.14821**	**2.219683**	**-15.49871**	**-6.797716**		
/cut2	**-5.152772**	**1.892843**	**-8.862676**	**-1.442869**		
Number of obs	**= 157**					
LR chi2(8)	**= 123.41**					
Prob> chi^2	**= 0.0000**					
Pseudo R^2	**= 0.4437**					
Log-likelihood	**= -77.369561**					

Source: Field Survey, 2023. ***p<0.01, **p<0.05, *p<0.1

4.4 Constraints Associated with Adoption of Poultry Technologies

Table 6 presents an analysis of the constraints related to the adoption of poultry technologies in the study area. The results show that 68.15% of respondents identified a lack of funds as a significant issue, while 39.49% cited inadequate extension services. Additionally, 26.11% reported the complexity of technology as a barrier to adoption, and 15.92% mentioned difficulties in accessing information, with the same percentage noting low literacy levels as a constraint.

Kolawale and Ojo (2017) noted that limited access to funds is a common challenge faced by farmers in the production process. Similarly, Mamman *et al.* (2016) found that many commercial poultry farmers in the

Nassarawa-Eggon Local Government Area rely on informal credit sources to support their operations. Ishola *et al.* (2019) also highlighted limited funds as a major obstacle hindering the adoption of improved practices among poultry farmers. Furthermore, Osuagwu *et al.* (2020) identified inadequate capital and high feed costs as additional challenges for poultry farmers in Nigeria. These studies reinforce the findings of the current research.

Table 6: Constraints associated with adoption of poultry technologies(n=157)

Variables	Frequency	Percentage(%)
Difficulty in accessing Information	25	15.92
Lack of Funds	107	68.15
Complexity of Technology	41	26.11
Inadequate Extension Workers	62	39.49
Low literacy Level	25	15.92
Total	***260**	***165.59**

Source: Field Survey, 2023.
* = Multiple Responses.

Conclusion and Recommendation

In conclusion, the study found that poultry farming in the area is primarily conducted by male, educated, married individuals who possess substantial experience and larger household sizes. The high adoption rate of introduced poultry technologies suggests that these farmers are not only aware of the technologies but also recognize their potential to enhance profitability. Moreover, factors such as credit access, farming experience, and membership in associations significantly and positively influenced the adoption of these technologies. Conversely, farmers with limited experience, financial constraints, and a lack of association membership are likely to experience reduced adoption rates. Notably, the primary constraint identified was a lack of funds, and ongoing financial difficulties may further hinder the adoption of improved poultry technologies. Addressing these constraints is essential for promoting more widespread adoption and ultimately improving the livelihoods of poultry farmers in the region.

It is recommended that financial institutions offer low-interest loans to poultry farmers to facilitate the adoption of advanced poultry technologies. Additionally, farmers should be encouraged to form cooperative societies, which can provide access to valuable information and other resources that support the adoption of improved practices. Furthermore, the government and relevant stakeholders should increase the number of extension workers to enhance the dissemination of improved poultry technologies to farmers in the study area and surrounding communities. Developing user-friendly extension programs that educate, train, and continually retrain poultry farmers will help ensure they stay informed about modern poultry technologies.

References

Aboki, E., Jongur, A.A.U. and Onu, J.I.(2013). Productivity and Technical Efficiency of Family Poultry Production in Kurmi Local Government Area of Taraba State, Nigeria. *Journal of Agriculture and Sustainability* 4(1):52-66.

ADP, (2020). Ministry of Agriculture Gombe.https://sunnewsonline.com/agriculture-well-address-your-concern-gombe-govt-assures-women-other-farmers/.Accessed on 27/05/2023

Anwasia, A.I. (2015). Production Efficiency of small scale broiler farmers in Delta State, Nigeria. Unpublished M.Sc. Dissertation in Agricultural Economics, Department of Agricultural Economics, Faculty of Agriculture, University of Nigeria Nsukka.

Babalola, D.A. (2014).Determinants of Farmers' Adoption of Agricultural Insurance: The Case of Poultry Farmers in Abeokuta Metropolis of Ogun State, Nigeria. *British Journal of Poultry Science*, 3: 36-41

Babatunde, R.O., Adekunle, A. and Olagunju, F.I.(2012). Effect of poultry production on poverty status of small scale farmers in Oyo State Nigeria. *Asian Journal of Agriculture and Rural Development*, 2:565-578

Ermias T, Berhan T, Zemelak S (2015). Determinants of village poultry technology package Adoption; Limitations, Constraints, and Opportunities in the central Oromia Region, Ethiopia. *International J.Deve. Res.* 5: pp. 4436-4443

Ezeibe, A.B.C., Okorji, E.C., Chah, J.M. and Abudei, R.M. (2014): Impact of Entrepreneurship Training on Rural Poultry Farmers Adoption of Improved Management Practices in Enugu State, Nigeria. *African Journal of Agricultural Research*, 9(20):1604-1609.

Food and Agriculture Organization (FAO). (2015). The food security impact of agricultural technology adoption under climate change, Micro-evidence from Niger. Rome: Food and Agriculture Organization of the United Nations.

FAO (2018) Africa Sustainable Livestock 2050: Livestock and livelihoods spotlight.

NIGERIA. Cattle and Poultry Sectors. Available at: http://www.fao.org/3/CA2149EN/ca2149en.pdf. Accessed on the 15th of March 2020.

Heise, H., A. Crisan and L. Theuvsen, 2015. The poultry market in Nigeria: Market structures and potential for investment in the market. *International Food and Agribusiness Management Review, 18*(1): 197-222. View at Google Scholar

Ishola, B.F. & Olukotun, O (2019). Adoption of Improved Management Technologies among Poultry Farmers in Igabi Local Government Area, Kaduna State, Nigeria. *International Journal of Research and Scientific Innovation (IJRSI)*, 6(7),176-181

Ithika, C.S,Singh,S.P.andGautan,G. (2013). Adoption of scientific Poultry Farming Practices by the Broiler Farmers in Haryana.*Indian Journal of Animal Science.*3(2):417-422

James, H., Mustapha, S. B., Adamu, A. Gadzama, & Janada, J. Ghumdia. (2021). Socio-economic Factors Influencing Poultry Farmers' Accessibility to Credit in Maiduguri Metropolis, Borno State, Nigeria. *Journal of Agricultural Economics, Environment, and Social Sciences*, *7*(1), 76-88. Retrieved from http://jaeess.com.ng/index.php/jaeess/article/view/85

Kolawale, O. & Ojo, S.O. (2007). Economic Efficiency of Small Scale Food Crop Production in Nigeria: A Stochastic Frontier Approach. *Journal of Social Science*, 14(2):123-130

Lamurde, Gombe (2021). Report of Emirpalace Gombe state.

Mamman, B.D.,Anzaku,T.A.K. & Umar,H,S. (2016). Profitability Evaluation of Broiler Production among Small-Scale Commercial Poultry Farmers in Nassarawa-Eggon LGA of NassarawaState, Nigeria. *International Journal of Agricultural and Earth Science*,2(1): 52-57.

Nurudeen, JA.(2012).Economics and social characteristics of registered poultry egg producers in Ilorin, Kwara State. *Russian Journal of Agricultural and Socio-Economic Sciences.11* (11), 18-23

Nwozuzu, S.O., Nwozuzu, C.T., &Onyejiuwa J. N. (2021). Perceived Constraints to Adoption of Improved Poultry Technology Among Poultry Farmers in Owerri Agricultural Zone of Imo State, Nigeria. *World J Agriand Soil Sci*. 6(4): 2021. WJASS.MS.ID.000644

Okorie, N. U. , Okoro, G. I. & Etuk, U. R. (2022). Analysis of Poultry Farmers' Information Needs in Uyo Agricultural Zone, Nigeria. *AKSU Journal of Agricultural Economics, Extension and Rural Development*, *5* (1): 64 – 71

Onoerigho, E. B., Ogondi, E. K. Ernest, B. K. & Clark, J. P. I (2014). Socio-economic traits of small-scale poultry farmers and level of adoption of poultry management practices before and after training, *African Journal of Poultry Farming, 2* (5), 067-072,

Onwuaroh, A. S., Tata, L.A., Chiroma, I, A. & Mohammed, S. Y. Socio-economic determinants of the adoption of improved maize varieties by farmers in Shongom Local Government Area of Gombe State. *International Journal of Environmental and Agriculture Research.* 7(4), 21-29

Onwuaroh, A.S., Yusuf, R.O., Yusuf, O. & Akpu, B. (2017). Impact of Insurgency on Income of Famers in Northeastern Nigeria.*Dutse Journal of Pure and Applied Sciences (DUJOPAS),* 3 (2), 105-117

Osuagwu, C.O. , Anosike, C. , Ahaotu, E. O & Oko, E.C (2020). Factors Influencing Farmer Adoption of Improved Poultry Production Practices in Ahiazu Mbaise Local Government Area of lmo State, Nigeria. *International Journal of Research in Agriculture and Forestry,7* (9), 14-21

Otunaiya, A.O.,Adeyonu, A.G. & Bamiro, O.M. (2015). Technical Efficiency of Poultry Egg Production in Ibadan Metropolis, Oyo State, Nigeria. *Economics*,4: 50-56 unpublished NI. Sc Thesis in the Department of Agricultural Economics. University of Ibadan. p 45

Oyelami, B.A., Osikabor, B., Ugege, B.H., Odeyale, O.C., & Ajanaku, A.O. (2022).Socio-Economic Characteristics Analysis of Backyard Poultry Farming in Etsako Central Local Government Area, Edo State, Nigeria. *J. Appl. Sci. Environ. Manage.26* (7), 1225-1229. DOI: https://dx.doi.org/10.4314/jasem.v26i7.6

Rebecca Stephen, S. ., Kim, I. ., & Chioma Joy, A. (2023). Analysis of The Socioeconomic Benefits of Livestock Rearing Among Women in Gombe Metropolis, Gombe State, Nigeria. *Bima Journal of Science and Technology*, *7*(01), 209-219. https://doi.org/10.56892/bima.v7i01.400

Williams, R. A., & Quiroz, C. (2019). Ordinal Regression Models. In P. Atkinson, S. Delamont, A. Cernat, J.W. Sakshaug, & R.A. Williams (Eds.), *SAGE Research Methods Foundations.* doi:10.4135/9781526421036885901

World Bank. (2018). the World Bank. Climate Change Knowledge Portal. Available at:

http://
sdwebx.worldbank.org/climateportal/index.
cfm?page=downscaled_data_download&me
nu=historical