



The Adoption of Improved Technologies for Indigenous Chicken Keeping in Sumbawanga Municipality – Rukwa, Tanzania

Luhuvilo Lupondo, Fadhil Ngalawa & Africanus Sarwatt

Institute of Rural Development Planning, Tanzania

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Abstract

The study investigated the adoption of improved technologies among poultry farmers in Sumbawanga Municipality. Data was collected through interviews, focus group discussions, and documentary reviews. 110 poultry farmers were contacted, simple random was used to get chicken keepers, and purposive sampling was used to select key informants. Descriptive and inferential statistical analysis was used. On demographic characteristics of the respondents, the results revealed that the majority of chicken keepers were between 35-60 years, with females being the majority. Also, most of respondents were single, implying that this group does not depend on their husband for accessing necessary needs and therefore they are involved in chicken keeping to meet their needs. On the level of adoption of improved technologies, the majority were in low level they are practicing traditional methods, and more than 70% of respondents are keeping chicken in local ways. On examining the determinant factors that influence farmers to adopt improved technologies in keeping indigenous chicken, binary logistic linear regression was used for analysis, the following factors were obtained, Educational Level ($p = 0.002$): indicates a strong relationship between education and technology adoption. This implies that respondents with at least secondary education are more likely to adopt improved technologies than those with lower educational levels. Another factor is capital ($p = 0.01$): indicating access to financial resources determines the decision of whether to adopt or not to adopt improved technologies. This implies farmers with much capital are more capable of adopting new technologies likely due to affordability and risk management. Another factor was extension services ($p = 0.042$): This implies that, access to extension services (training, demonstrations, and technical advice) positively influences the adoption of improved technologies. Another factor was the size of the flock ($p = 0.032$): which implies that farmers with larger flock sizes are more inclined to adopt new technologies, possibly to manage operations more efficiently or increase productivity. The study recommends the following, first community should be encouraged to make sure that their children get secondary education, and above this will increase chances of them to adopt improved technologies in poultry keeping. Secondly, the government should increase efforts on subsidising inputs such as feeds, vaccination, and treatment medicine. Moreover, the

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government should influence financial institutions to provide loans to chicken farmers with affordable conditions this will encourage them to request loans and get capital; finally, the government should recruit more extension officers and improve their mobility (e.g., transport provision) since extension services are a key driver of adoption.

Introduction

Globally livestock production constitutes an essential component of the agricultural economy in developing countries and it is an instrument to socio-economic change, improved income and quality of rural. It is also an essential source of animal protein (ILRP 2017). It is also a source of vitamin A, which helps protect against night blindness and may prevent skin infections (Ishola & Olukotun, 2019). Moreover, chicken meat has created massive competition and attracted big corporations in this rapidly growing industry. Due to increased competition, there is pressure to achieve a surplus at a minimal margin and minimise production losses (Hafez and Attia, 2020).

Furthermore, poultry has been identified as a significant source of income for poultry producers (Adetimirin et al., 2022). Indigenous poultry farming is facing a significant decrease in production due to diseases such as fowl cholera, Coccidiosis, Fowl Pox, and Newcastle Disease, among others (Ngongolo & Chota, 2022). To increase chicken production, farmers should adopt improved poultry farming technologies. The improved technologies in poultry farming are accompanied by the selection of enhanced breeds (improved chicks), and the use of balanced feeds (ILRP, 2017).

In Tanzania, the poultry industry makes up approximately 72 million chickens. Approximately 40 million are indigenous breeds, and 32 million are commercial poultry, which include 24 million for meat production and 8 million for egg production. Of the 4.7 million agricultural households in Tanzania, 3.7 million households keep poultry. Rural dwellers mainly raise indigenous chickens and contribute almost 100% of the poultry meat consumed in the rural areas and 20% of eggs consumed in urban areas (Mwalusanya et al., 2021). Therefore, indigenous chicken farming is recognised as one of the entry points to address the problems of malnutrition, food insecurity, low income and poverty as a whole.

Most smallholder farmers in Tanzania, particularly in Sumbawanga within the Rukwa Region, rely on local technologies for raising chickens. The most commonly employed system is free-range, which is also widespread in many rural areas (Sonaiya, 2019). Approximately 75% of farmers utilise traditional technologies, as they require minimal resource input. Many farmers perceive poultry keeping as a complementary activity to other agricultural practices, such as crop farming. However, this type of production encounters numerous challenges, including diseases, predation, and low growth rates (Mwalusanya et al., 2021). These limitations hinder farmers from generating sufficient income to enhance their well-being. This study assessed the level of adoption and the factors influencing the adoption of improved technologies for indigenous chicken keeping in Sumbawanga Municipality, specifically in Kasense Ward.

Definition of key terms

Adoption is regarded as a decision to make full use of an innovation or technology (Wilkinson, 2011). The term "adoption" is synonymous with the transfer of technology, which encompasses all efforts made to ensure that farmers adopt new technology (Edquist et al., 2018). Before any technology is adopted, it must pass through a process of adoption, which comprises awareness, interest and decision.



Improved technologies in chicken keeping (poultry farming) refer to modern methods, tools, or systems that enhance productivity, reduce mortality, and improve the overall health and welfare of chickens. These technologies can be applied to both small-scale and commercial poultry farming (George, 2023).

Theories of decision-making

Concerning this study, several theories have been reviewed. These theories emphasise that individual farmers are responsible for deciding whether to adopt improved technologies. However, the adoption of new technologies often involves associated costs. For example, Daniel Bernoulli's theory of decision-making suggests that decision-makers choose between risky and uncertain prospects. Therefore, this theory highlights the importance of assessing the risks and uncertainties associated with agricultural technologies before making adoption decisions (Marra et al., 2003)

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB), proposed by Icek Ajzen (1991), posits that an individual's behaviour is influenced by three key components: attitude, subjective norms, and perceived behavioural control. According to this theory, the adoption of new technologies can be shaped by an individual's attitude, the surrounding context, and behavioural intentions. For example, while farmers may be willing to adopt new technologies, environmental or contextual factors may hinder their ability to do so. Motivation is another significant factor that can influence decision-making regarding adoption. Motivating factors may include frequent interactions with agricultural extension officers and the provision of subsidies for production inputs.

Diffusion of innovation theory (Rogers, 1960)

The main idea of the Diffusion of Innovations theory is that four key elements influence the spread of a new idea: the innovation itself, communication channels, time, and the social system. The diffusion process is characterised as a gradual change that leads to the emergence of different categories of adopters, including innovators, early adopters, and late adopters. Over time, the entire community is expected to adopt the new technology.

The Social Cognitive Theory (Bandura, 1986)

The Social Cognitive Theory (SCT) emphasises the concept of self-efficacy, which is defined as "the judgement of one's ability to use a technology to accomplish a particular job or task" (Compeau & Higgins, 1995). According to SCT, the decision of non-adopters to use new technology depends on their expectations of the outcomes observed among early adopters. Therefore, early adopters can influence non-adopters by demonstrating the positive effects and benefits of the new technology.

National livestock policy

This study complies with national livestock policy (URT, 2006) having the objective "To increase quantity and improve quality of poultry and its products to satisfy domestic demand, increase export and promote sustainable poultry production" Then of policy statement "*the government will support and strengthen technical support services and use of appropriate technologies in poultry production*" (URT (2006). The statement emphasises the promotion of improving indigenous poultry breeds.

Empirical literature reviews

This study utilised a literature review to assess the adoption of improved technologies for indigenous chicken keeping in Sumbawanga. Various articles, books, and reports published between 2015 and 2024 were examined. Comprehensive searches were conducted across major academic databases, including Google Scholar. Several studies on factors influencing the adoption of improved poultry technologies were reviewed.

For example, Chandraker et al. (2019) conducted a study among women poultry farmers in Madhya



Pradesh to assess the impact of improved technologies. A total of 120 members were surveyed, and the study found that a majority (84%) had a high level of adoption, while a minority (16%) showed low adoption. The adoption of technologies was associated with improved access to basic needs and increased ownership of assets.

Another study by Chandraker et al. (2019) compared adoption levels between members and non-members of poultry producer companies. The findings revealed that non-members had lower adoption rates of key technologies, such as the utilisation of improved chicken breeds, compared to members.

Nwozuzu et al. (2021) investigated perceived constraints to the adoption of improved poultry technologies among farmers in the Owerri Agricultural Zone of Imo State, Nigeria. The study identified several barriers, including extended distances to feed sources, limited access to extension services, and the high cost of livestock feed, which discouraged the adoption of artificial insemination.

Bist et al. (2024) examined sustainable poultry farming practices and found that farmers' financial capacity strongly influenced the adoption of improved technologies. Many farmers continued keeping indigenous chickens due to limited access to capital.

Additionally, Kamau (2018) examined the factors influencing the adoption of improved technologies among smallholder indigenous chicken farmers in Kakamega and Makueni, Kenya. The results indicated that adoption decisions were influenced by factors such as flock size, gender of the household head, group membership, distance to training centres, access to credit, age, and engagement in off-farm activities.

While these studies provide valuable insights, most focus on regions beyond Sumbawanga. Consequently, there is limited information regarding the adoption of improved technologies for indigenous chicken keeping within Sumbawanga Municipality.

Methods

Study Area

The study was conducted between September and October 2024 in Sumbawanga, located in the Rukwa Region of Tanzania. According to the 2022 national census, Sumbawanga Municipality has a population of 303,986, comprising 182,970 urban dwellers and 121,016 rural dwellers. This area was selected due to its significant population engaged in small-scale and traditional poultry farming, making it a relevant context for exploring the adoption of improved technologies. Moreover, the municipality comprises a diverse mix of urban, peri-urban, and rural communities, characterised by varied income levels, educational backgrounds, and access to information. This diversity offers a rich setting for examining how different socio-economic factors influence technology adoption. Additionally, the presence of agricultural extension services, non-governmental organisations (NGOs), and livestock development programmes in the region enhances the logistical and institutional feasibility of conducting this research.

Research Design

A cross-sectional research design was employed to collect both qualitative and quantitative data from primary and secondary sources. This design is suitable for capturing data at a specific point in time, enabling the analysis of the current status of technology adoption among poultry farmers. It allows the identification of the number of farmers who have adopted certain technologies, the types of technologies in use, and the characteristics that distinguish adopters from non-adopters. The cross-sectional approach was chosen for its efficiency, cost-effectiveness, and ability to provide a snapshot of the population at a specific point in time.



Sampling and sample size

The study employed both probability and non-probability sampling techniques. Simple random sampling was used to select indigenous chicken farmers, while purposive sampling was employed to select key informants, including extension officers and ward leaders. A total of 110 respondents, all indigenous chicken keepers, were included in the study. The sample size was determined using Kothari’s (2008) formula for sample size calculation.

Ethical Considerations

To ensure adherence to ethical standards, informed consent was obtained from all participants. Consent forms were written in Swahili to ensure clear understanding among participants. Each participant was told about the purpose of the study, their role, the procedures involved, and any potential risks or benefits. Participation in the survey was voluntary, and respondents were free to withdraw at any stage without penalty.

Data collection and analysis

Both qualitative and quantitative data were collected from primary and secondary sources. Primary data were gathered through interviews, focus group discussions, and questionnaires administered to chicken farmers, extension officers, and village leaders. A checklist was also used for documentary review to support secondary data collection. Descriptive statistical analysis was used to summarise demographic characteristics, poultry production data, and levels of technology adoption among smallholder poultry farmers. Inferential statistical analysis, specifically binary logistic regression, was employed to examine the determinants influencing the adoption of improved technologies.

The dependent variable in the regression model is whether or not the farmer has adopted improved technologies.

Binary logistic regression models

$$E(Y_i) = P(Y_i) = \frac{e^{\alpha + \beta X_i}}{1 + e^{\alpha + \beta X_i}} \dots \dots \dots (1)$$

P is the probability of the farmer using improved technologies in keeping chickens

$E(Y_i) + P(Y_i) = 1$, where $Y_i = 1$ if the individual farmer adopts improved technologies and $Y_i = 0$ if the individual farmer does not adopt.

X_i represents a vector of characteristics or attributes associated with the individual. β_i is the vector of the estimated coefficients. The regression model is linearised as follows:

$$\ln \left(\frac{p_i}{1 - p_i} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots \beta_7 X_7 + \epsilon \dots \dots \dots (2)$$

The dependent variable is the natural log of the probability of adopting improved technologies (P) divided by the probability of not adopting improved technologies (1-P). β_0 is the intercept term, and $\beta_1, \beta_2, \dots, \beta_8$ are the coefficients associated with each explanatory variable, X_1, X_2, \dots, X_7 .

The formation of the logistic model was based on the hypothesis that a farmer’s decision to adopt or not at any time is influenced by the combined factors (simultaneously). The variables that were used in the logistic model were estimated using the maximum likelihood method.

Explicitly logistic regression model can be represented as $Y = X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 \dots \dots$ (3)



Y = adoption of improved technologies (dummy) 1 Yes zero otherwise

X1 = Age of the farmers (years)

X2 = Sex of farmers (dummy) 1 male 0 other wise

X3 = Education level (years.)

X4 = Marital status (dummy) 1 married zero otherwise)

X5 = Experience (years)

X6 = Extension Services (1 access and otherwise; 0)

X7= Flock size (numbers)

Result and discussion

Demographic characteristics of respondents

Table 1: Characteristics of respondents

Variable	Frequency	Percent
Age of the respondent		
Less than 35 years	45	40
Above 35 years	65	60
Sex		
Male	42	29
Female	68	71
Marital status		
Married	17	15
Single	81	74
divorced	12	11
Education level		
Primary & bellow	66	60
Secondary+	44	40
Household size		
Bellow five member in household	48	44
Above five members in household	62	56
Experience		
Less than 5 years	46	81
Above 5 years	54	15
Source of income		
Farming	48	44
Non-farming	62	56
Flock size		
Less 100	48	44
More than 100	62	56
Frequency contact with extension officer		
Weekly basis	31	28
Monthly &above	32	30
Not meet	47	42



The findings presented in Table 1 indicate that the majority of respondents (71%) were female, suggesting that women are more involved in chicken keeping than men. This may be due to the perception that poultry farming is a less physically demanding activity. This result aligns with Dumas (2018), who found in a study on the gendered benefits and costs of livestock ownership in Kenya that “men are in front at eating time, but not when it comes to rearing the chicken,” indicating that many men perceive chicken keeping as a predominantly female activity.

Regarding age, approximately 60% of farmers were over 35 years old, indicating that most respondents fall within the young adult to older adult age range. This suggests a mature population likely possessing considerable life and farming experience, which may influence their decision-making regarding farming practices. These findings are consistent with George (2021), who studied poultry production optimisation in Ghana and observed a similar age distribution among farmers.

In terms of marital status, most respondents (81%) were single. This suggests that single individuals may have fewer household responsibilities or different financial decision-making dynamics, potentially influencing their adoption behaviours. This finding corresponds with the study by Erian and Phillips (2017) on public attitudes towards meat chicken production in Australia, which found that single individuals tend to be more engaged in chicken keeping compared to married individuals.

Regarding experience, more than half of the respondents (59%) reported having over five years of experience in raising chickens.

In education, the majority of respondents (60%) had only primary education. This implies basic literacy levels, but limited higher education may affect the ability to understand and implement more complex farming technologies. These results align with those of Ishola and Olukotun (2019), who found that education has a positive influence on the knowledge, attitudes, skills, and aspirations of poultry farmers.

All respondents (100%) were aware of improved feeding technologies; however, actual adoption remains low. This suggests that awareness alone does not guarantee adoption, likely due to constraints such as cost, limited access, or insufficient technical support.

Regarding the level of adoption of improved technologies, Table 2 shows that about 20% of respondents reported using enhanced technologies, indicating significant challenges to adoption within the community. This finding is consistent with Shiferaw (2018), who studied smallholder farmers in the Gibe District of Ethiopia and reported that the majority (68%) relied on traditional poultry technologies. Comments from a focus group participant during the study further supported these results.

In our village, only a few farmers try the new technologies. Most of us stick to traditional methods in chicken keeping because we lack sufficient information or support to make changes. It's risky to try something new when you're not sure it will work. “Focus group participant, October 2024

Table 2: level of using improved technologies

Improved technologies	Adopted		Non-adopted	
	frequency	%	Frequency	%
vaccination	12	10.9	80	72.7
Improved feeding	10	9.1	85	77.3
Improved hurt	8	7.3	82	74.5
Improved heating source	0	0.0	110	100.0
Improved breed	5	4.5	85	77.3
Mean score	20.73		72.46	



Results from Table 2 indicate that the level of using improved technologies in keeping indigenous chicken is very low, with more than 70 per cent of respondents keeping chicken in local ways. The mean score indicates that the use of improved technologies remains minimal.

Determinant factors for the adoption of improved technologies by indigenous chicken farmers

$$\text{Model } (P/ (1- P_i) = \beta_0 + \beta_1X_1 + \beta_2X_2 \dots \beta_7X_7 + \epsilon \dots \dots \dots (i)$$

$$P/1-P = \beta_0 + \beta_1\text{AGE} + \beta_2\text{SEX} + \beta_3\text{EDU} + \beta_4\text{MART} + \beta_5\text{EXPER} + \beta_6\text{EXTENS} + \beta_7\text{FLOCK} + \epsilon \dots \dots (ii)$$

Table 3: Description of variables used in the Logistic model

Variable	Measurement	Expectation
X1 = AGE	Age of the farmers (yrs)	+,-
X2 = SEX	Sex of farmers (dummy) 1 male 2 other wise	+,-
X3 = EDU	Education level (number of years in schools) (yrs)	+,-
X4 = MART	Marital status (dummy one married 0 otherwise)	+,-
X5 = EXPER	Experience (yrs)	+,-
X6 = EXTENS	Extension services (dummy) (1 access and otherwise; 0)	+,-
X7=FLOCK	Flock size (number of chicken)	+,-

Table 4, logistic regression results, on determinant factors for adoption of improved technologies to indigenous chicken farmers

Variable	B (Coeff)	Odds Ratio (Exp(B))	Std. Error	Approx. 95% CI	p-value
Constant	2.279	9.763	—	—	—
AGE	-0.033	0.967	0.087	(0.812 – 1.153)	0.296
SEX	0.301	1.351	0.351	(0.684 – 2.668)	0.553
EDU	-1.681	0.186	0.317	(0.098 – 0.351)	0.002**
MARTU	0.238	1.269	0.276	(0.735 – 2.191)	0.599
CAPITAL	-1.298	0.273	0.362	(0.134 – 0.556)	0.010*
EXPERI	-0.125	0.882	0.288	(0.504 – 1.545)	0.774
EXTENS	0.613	1.846	0.302	(1.024 – 3.328)	0.046*
FLOSIZE	-0.250	0.779	0.230	(0.500 – 0.988)	0.032*

*R2 = 0. 762; * = Significant at * P < 0.05, **P < 0.01*

Results from Table 4 indicate that the level of education significantly influenced the adoption of improved technologies in indigenous chicken keeping. Specifically, education had an odds ratio of 1.86 with a p-value of 0.002, implying that respondents who attended secondary school or higher were 1.8 times more likely to adopt improved technologies. This finding is consistent with studies conducted by Sonaiya (2019) and Khan et al. (2022). Additionally, this result was supported by a participant during the focus group discussion who stated,

“Nowadays, those who went to secondary school or college are the ones trying new ways of keeping chickens. They understand how to follow instructions, keep accurate records, and apply the knowledge and skills extension officers teach. For us with little schooling, it's harder to change from the old ways.”
Member of focus group discussion, September 2024.

Another critical factor was capital. The study revealed that capital had an odds ratio of 0.273 with a p-value of 0.01, indicating that as capital increases, respondents are 27.3 times more likely to adopt improved technologies for indigenous chickens. This relationship is expected because capital enables farmers to cover the costs associated with adopting such technologies. This finding aligns with the study by Inyang et al. (2023), which observed that communities in Akwa Ibom State, Nigeria, with



greater financial capacity were more likely to adopt improved technologies. Similar insights were also reported by an extension officer interviewed during the study.

“From our experience in the field, it is evident that farmers with greater financial resources are more likely to adopt improved technologies for indigenous chicken production. Access to capital enables them to invest in quality inputs, improved housing, and training, all of which enhance productivity.” Ward Agricultural Extension Officer, October 2024

The frequency of contact with extension officers was another critical factor influencing farmers' decisions to adopt improved technologies. The odds ratio for this variable was 1.846, with a p-value of 0.04, indicating that increased contact with extension officers raises the likelihood of adoption by approximately 8.5 times. This finding aligns with Kamau's (2018) study in Kenya, which emphasised the importance of frequent interactions with extension agents to facilitate the adoption of improved practices. Similar results were reported by Gwayem et al. (2024) and Abdon (2024), who studied poultry husbandry competencies and challenges in accessing agricultural extension services in Ghana. These findings were further supported by a focus group participant who stated,

“Whenever the extension officer visits us regularly, we get to understand new farming methods better and feel more confident to try them. Without their visits, most of us wouldn't even know where to start with these new technologies.” Focus Group Participant, September 2024

Results from Table 4 indicate that flock size was also a significant determinant of technology adoption, with an odds ratio of 0.230 and a p-value of 0.032. This suggests that as flock size increases, the likelihood of adopting improved technologies rises by approximately 2.3 times. Larger flocks necessitate greater operational input, motivating farmers to adopt technologies that enhance efficiency and profitability. This finding aligns with Mwalusanya (2021), who reported that the probability of adopting improved technologies increases with flock size. Similarly, Mathiu (2021), in a study conducted in Meru County, Kenya, observed that farmers with larger indigenous chicken flocks were more inclined to adopt improved production technologies. These results were further supported by an agricultural extension officer from Sumbawanga Municipal Council, who stated:

“Farmers with larger flocks are more likely to adopt improved technologies because the cost-benefit of innovations like improved housing, feed, and disease control becomes more evident when managing many birds. It's simply a matter of maximising returns and reducing losses”. September 2024

Conclusion

Based on these findings, the following conclusions were drawn: Most of the respondents were between young age and elderly (above 30 years), on education level, the study revealed that, majority attended primary education, On marital status most of respondents were single, on experience on chicken farming, the results show that, more than half of chicken keepers have much experience have an average of more than 5 years. Regarding awareness of improved technologies for indigenous chickens, the majority of respondents were aware, although their use remains limited. The study indicates that determinant factors for the adoption of improved technologies among indigenous chicken were capital, education level, extension support, and flock size (scale operation). Therefore, capital or access to financial resources is crucial for adoption, and education level indicates that higher education enhances understanding and confidence in using technologies. Interactions with extension officers enhance knowledge and skills, leading to the adoption of improved technologies. Furthermore, the larger the flock size, the greater the likelihood of adopting improved technologies for efficiency or profit.



References

- Abdoni, E. (2024). *Poultry husbandry competencies of farmers and challenges faced by agricultural extension agents in selected districts in the Central Region, Ghana* (Doctoral dissertation, University of Cape Coast).
- Ajzen, I. (1991). The theory of planned behaviour. *Organisational Behaviour and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behaviour to leisure choice. *Journal of Leisure Research*, 24(3), 207–224. <https://doi.org/10.1080/00222216.1992.11969889>
- Bist, R. B., Bist, K., Poudel, S., Subedi, D., Yang, X., Paneru, B., ... & Chai, L. (2024). Sustainable poultry farming practices: A critical review of current strategies and prospects. *Poultry Science*, 103, 104295. <https://doi.org/10.1016/j.psj.2024.104295>
- Chandraker, K., Pandey, A. K., Oraon, J., & Bera, K. N. (2019). Development of a scale to measure the extent of adoption of improved poultry rearing practices by poultry entrepreneurs. *International Journal of Livestock Research*, 9(12), 182–186. <https://doi.org/10.5455/ijlr.20191004070854>
- Compeau, D. R., & Higgins, C. A. (1995). Application of social cognitive theory to training for computer skills. *Information Systems Research*, 6(2), 118–143.
- Dumas, S. E., Maranga, A., Mbullo, P., Collins, S., Wekesa, P., Onono, M., & Young, S. L. (2018). “Men are in front at eating time, but not when it comes to rearing the chicken”: Unpacking the gendered benefits and costs of livestock ownership in Kenya. *Food and Nutrition Bulletin*, 39(1), 3–27. <https://doi.org/10.1177/0379572117747180>
- Edquist, C., Zabala-Iturriagagoitia, J. M., Barbero, J., & Zofío, J. L. (2018). On the meaning of innovation performance: Is the synthetic indicator of the Innovation Union Scoreboard flawed? *Research Evaluation*, 27(3), 196–211. <https://doi.org/10.1093/reseval/rvy008>
- Erian, I., & Phillips, C. J. (2017). Public understanding and attitudes towards meat chicken production and relations to consumption. *Animals*, 7(3), 20. <https://doi.org/10.3390/ani7030020>
- George, A. S., & George, A. H. (2023). Optimising poultry production through advanced monitoring and control systems. *Partners Universal International Innovation Journal*, 1(5), 77–97.
- Gwayem, T. C., Zubairu, A. I., & Sulaiman, G. I. (2024). Socio-economic factors influencing adoption of improved production practices among poultry farmers in Bwari and Gwagwalada Area Councils of the Federal Capital Territory, Abuja, Nigeria. *Journal of Arid Agriculture*, 25(2), 48–57.
- ILRP – Improved Livelihood for the Rural People. (2017). *Training on the improved local chicken practices in Kisarawe District: General report*. Sokoine University of Agriculture.
- Inyang, H. B., Esheya, S. E., & Udoh, M. I. (2023). Analysis of the profitability of poultry egg production in Etim Ekpo Local Government Area of Akwa Ibom State, Nigeria. *Journal of Agriculture and Food Sciences*, 21(1), 40–53.
- Ishola, B., & Olukotun, O. (2019). Adoption of improved management technologies among poultry farmers in Igabi Local Government Area, Kaduna State, Nigeria. *Journal of Agricultural Extension*, 23(4).
- Kamau, C. N. (2018). *Impact of improved poultry production technologies among smallholder indigenous chicken farmers in Kakamega and Makeni, Kenya* (Master’s thesis, Kenyatta University).
- Khan, K., Saeed, A. F., Khattak, S. W., & Liaqat, S. (2022). Determinants of poultry technology adoption: Evidence from District Lasbela, Balochistan, Pakistan. *Sarhad Journal of Agriculture*, 38(3), 960–967.
- Kouhounde, S., Adéoti, K., Mounir, M., Giusti, A., Refinetti, P., Otu, M., Adetimirin, V., & Razafindralambo, H. L. (2022). Applications of probiotic-based multi-components to human, animal, and ecosystem health: Concepts, methodologies, and action mechanisms. *Microorganisms*, 10(9), 1700. <https://doi.org/10.3390/microorganisms10091700>



- Mathiu, E. M. (2021). *Technology adoption, production and market participation among smallholder indigenous chicken farmers in Tigania West Sub-County, Meru County* (Doctoral dissertation, University of Embu).
- Mwalusanya, N. A., Katule, A. M., Mutayoba, S. K., Mtambo, M. M. A., Olsen, J. E., & Minga, U. M. (2002). Productivity of local chickens under village management conditions. *Tropical Animal Health and Production*, 34, 405–416. <https://doi.org/10.1023/A:1020054209284>
- Ngongolo, K., & Chota, A. (2022). Effect of sex, age, diseases, and control intervention on chickens' mortality and its financial implications in Dodoma, Tanzania. *Poultry Science*, 101(5), 101785. <https://doi.org/10.1016/j.psj.2022.101785>
- Nwakwasi, R. N., Nwozuzu, S., & Okeke, M. N. (2021). Socioeconomic influence on smallholder crop farmers' use of electronic input marketing and distribution system in Imo State, Nigeria. *Journal of Community & Communication Research*, 6(1), 61–68.
- Samantaray, S. K., Ranabijuli, S., Mohanty, B., Satapathy, B., Panda, P. K., & Behera, M. R. (2020). Adoption level of scientific backyard poultry practices: A socio-technical analysis in the state of Odisha. *Age (Years)*, 21(30), 28.
- Shiferaw, D. (2018). *Determinants of exotic poultry breeds adoption by smallholder farmers in Gibe District, Hadiya Zone, Ethiopia* (Doctoral dissertation, Haramaya University).
- Sonaiya, E. B. (2019). The context and prospects for development of smallholder rural poultry production in Africa. In *CTA seminar proceedings on smallholder rural poultry production* (pp. 9–13).
- United Republic of Tanzania (URT). (2006). *National livestock policy*. Ministry of Livestock Development. Government Printers.
- Wilkinson, R. (2011). The many meanings of adoption. In *Changing land management: Adoption of new practices by rural landholders* (pp. 39–49). CSIRO Publishing.
- Wolfgang, G. O. D. W. I. N., Makindara, J., & Mbaga, S. (2023). Farmers' preferences for tropically adapted improved chicken breeds in selected agro-ecological zones in Tanzania. *Tanzania Journal of Agricultural Sciences*, 22(2), 458–466.