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Technological Adoption and Poultry Market Improvement in Tanzania: A Case of Arusha District Council

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Abstract

This study assessed the contribution of modern poultry technologies to market improvement among poultry farmers in Arusha District Council, with particular emphasis on access to market information, product quality, extension services, and pricing decisions. Guided by the Technology Acceptance Model (TAM), the study adopted a pragmatist philosophy and used a convergent mixed methods design to integrate quantitative and qualitative data. The target population consisted of 2,527 poultry farmers and government officers, from which 96 respondents were selected through simple random and purposive sampling. Data were collected using structured questionnaires and semi-structured interviews. The quantitative results indicated that modern poultry technologies moderately improved production efficiency (M = 2.06) and the marketability of poultry products (M = 2.04). Technologies such as automated feeders and vaccination tools reduced labor demands, minimized feed losses, enhanced bird growth, and improved product quality. Digital platforms also supported better pricing decisions and enabled direct market access, thereby strengthening farmers' participation in poultry markets. Despite these positive outcomes, the level of technology adoption remained low due to high costs, limited technical skills, poor access to modern tools, and weak institutional support. Qualitative findings confirmed that government programs and extension officers play a crucial role in addressing these challenges through training, technical support, and awareness creation. Overall, the study concludes that modern poultry technologies positively influence poultry market performance. It is recommended that for a wider adoption affordable technology, strengthened capacity-building initiatives, and improved institutional support are inevitable.

Key words*: Technological adoption, poultry farming, poultry market, Arusha DC and Tanzania*

1.0 Introduction

Poultry farming is a critical agricultural activity that contributes significantly to food security, nutrition, and income generation globally. Over the past decades, the poultry industry has experienced rapid technological advancement aimed at enhancing productivity, disease control, and improvement on markets efficiency (FAO, 2021). Technologies such as automated feeding systems, climate-controlled housing, and digital market platforms have been increasingly adopted in developed countries, resulting in efficient market systems (World Bank, 2022).

Furthermore, digital marketing and e-extension services are becoming vital in bridging information gaps among poultry farmers, particularly in rural and underserved areas (OECD,

2023). However, despite these innovations, there remains a technological gap between developed and developing countries, largely due to infrastructural, financial, and literacy challenges (IFAD, 2020). In Africa, poultry farming remains a key contributor to livelihoods, especially in rural households. The sector, however, continues to grapple with low productivity, poor disease control, and limited access to competitive and sustainable markets.

According to African Union (2022), only a small proportion of poultry farmers utilize modern technology, mainly due to high costs and lack of awareness. While continental initiatives such as the Comprehensive Africa Agriculture Development Programme (CAADP) have emphasized agricultural transformation through innovation, uptake remains inconsistent across countries, (NEPAD, 2021). Mobile technologies and digital platforms have begun to bridge some gaps, offering new pathways for accessing veterinary services, feed suppliers, and buyers. Nevertheless, the scale and consistency of adoption remain uneven across regions (CTA, 2020).

In the East African Region, poultry farming plays a significant role in both subsistence and commercial agriculture. Countries like Kenya and Uganda have made significant strides in introducing mobile apps and SMS-based advisory services that assist poultry farmers with disease management, feed rationing, and market connections (East Africa Farmers Federation [EAFF], 2022). These innovations have shown improvement in increasing efficiency and enabling farmers to fetch better prices and access to new markets. However, the region continues to face barriers such as poor internet connectivity in rural areas, limited extension support, and low digital literacy among farmers (USAID, 2023). Moreover, the disparity between urban and rural technology adoption rates remains a major concern in maximizing the potential of poultry farming across East Africa (Kilimo Trust, 2021).

Tanzania, like other East African countries, views poultry farming as a key driver for rural development and poverty reduction. The poultry sector in Tanzania has witnessed growth due to increasing demand for poultry products in both urban and peri-urban markets. However, most poultry farmers still rely on traditional farming techniques, with limited integration of modern technologies (URT, 2023). Government policies and donor- supported initiatives such as the Agricultural Sector Development Programme (ASDP II) have promoted agricultural innovation, but the reach to smallholder poultry farmers remains limited (MAFC, 2022).

In Arusha District Council specifically, poultry farming is common among small-scale farmers who face challenges in market access and sustainability, disease outbreaks, and poor access to prompt market information. While some interventions, such as mobile veterinary clinics and online agro-input shops, have been introduced, adoption levels remain low due to financial constraints, poor awareness, and infrastructure limitations (Tanzania Poultry Association [TPA], 2024). Therefore, understanding the influence of technology adoption in improving poultry farming and market efficiency is essential for designing effective interventions in Arusha District and similar rural setting.

Poultry farming in Arusha District Council is vital for rural livelihoods and food security, yet it operates below its potential due to low productivity, weak market integration, and limited sustainability. The district records an average of 150 eggs per chicken annually, which is below the national average of 200 (URT, 2023; TPA, 2024). Smallholder farmers lose up to 30% of potential income because of post-harvest losses, inadequate use of modern technologies, and unstructured markets (USAID, 2023). Although modern technologies can enhance productivity and reduce disease prevalence (Kimaro et al., 2023; Said & Msuya, 2021), their adoption among smallholders remains limited. High costs, poor infrastructure, low digital literacy, and informal marketing systems continue to constrain productivity and market performance (Komba & Mng'ong'o, 2022; Mutagahywa & Lusekelo, 2023).

The general objective of the study was to assess technological adoption and poultry market improvement in Arusha District Council. Specifically, the study sought to examine how digital platforms improve the poultry market in Arusha DC, determine how integrated technologies enhance poultry production and market improvement in Arusha DC, and examine barriers to technology adoption among poultry farmers in Arusha DC. To address the specific objectives well, the following research questions were answered; How do digital platforms improve the poultry

market in Tanzania? In what ways do integrated technologies enhance poultry production and overall market performance? And what are the barriers hindering technology adoption among poultry farmers in Tanzania?

This study generated important insights for policymakers, practitioners, and scholars by demonstrating how technology adoption enhances productivity and market performance in poultry farming in Arusha District Council. The findings provide empirical evidence on the role of digital advisory tools, automated feeding systems, and e-marketing platforms, supporting policy and investment decisions aligned with ASDP II and Tanzania's Vision 2050 (MAFC, 2022; URT, 2023). For rural communities, the study shows that technology-driven poultry systems can improve food security, nutrition, and household income by reducing losses and strengthening market linkages through innovations such as communal incubators and group marketing (FAO, 2021; USAID, 2023). The study also informs extension services, credit schemes, and training programs tailored to farmers' conditions as recommended by Kimaro et al., (2023; TPA, (2024); Said & Msuya, (2021).

2.0 Theoretical Literature Review

This study was guided by the Technology Acceptance Model (TAM), a widely used framework developed by Davis (1989) to explain the adoption of new technologies based on perceived usefulness and perceived ease of use. The model assumes that individuals are more likely to adopt a technology if they believe it is beneficial and easy to operate. Over time, TAM has been refined and validated across various sectors, including agriculture, health, and education, making it a reliable tool for analyzing technology adoption behavior (Venkatesh & Davis, 2000).

In the context of this study, TAM was applied to examine how poultry farmers in Arusha District Council perceive agricultural technologies such as mobile-based advisory platforms, automated feeding systems, and disease diagnostic applications. These perceptions influence farmers' willingness to adopt and consistently use such technologies, which in turn affects poultry market efficiency. The framework therefore provides a logical link between the independent variable, technology adoption, and the dependent variable, poultry market efficiency, in line with the study's objectives.

TAM was selected because of its practicality, simplicity, and strong empirical support, particularly in settings were behavioral factors and varying levels of digital literacy influence adoption decisions. Although TAM is robust and easy to apply, its limitation is that it does not explicitly incorporate external factors such as culture, infrastructure, or social influence unless extended.

2.1 Conceptual Framework

This study is grounded in a theoretical framework that links technology adoption to poultry market efficiency in Arusha District Council, drawing on the Technology Acceptance Model (TAM) developed by Davis (1989). The framework explains adoption decisions based on perceived usefulness, ease of use, and contextual factors such as social influence and infrastructure (Venkatesh & Davis, 2000). In poultry farming, these factors shape farmers' ability to engage efficiently in markets through improved price transparency, reduced transaction costs, and better access to information.

The model identifies three key independent variables: factors influencing market improvement, impacts of technology adoption, and barriers to adoption, all of which jointly affect poultry market improvement. These variables are measured using indicators such as access to digital platforms, coordinated market participation, and availability of price information, designed using SMART criteria. The framework emphasizes that enabling factors enhance market efficiency, while constraints such as high costs and weak institutions limit progress, thereby aligning the study with Tanzania's agricultural transformation goals, (Fig.1).

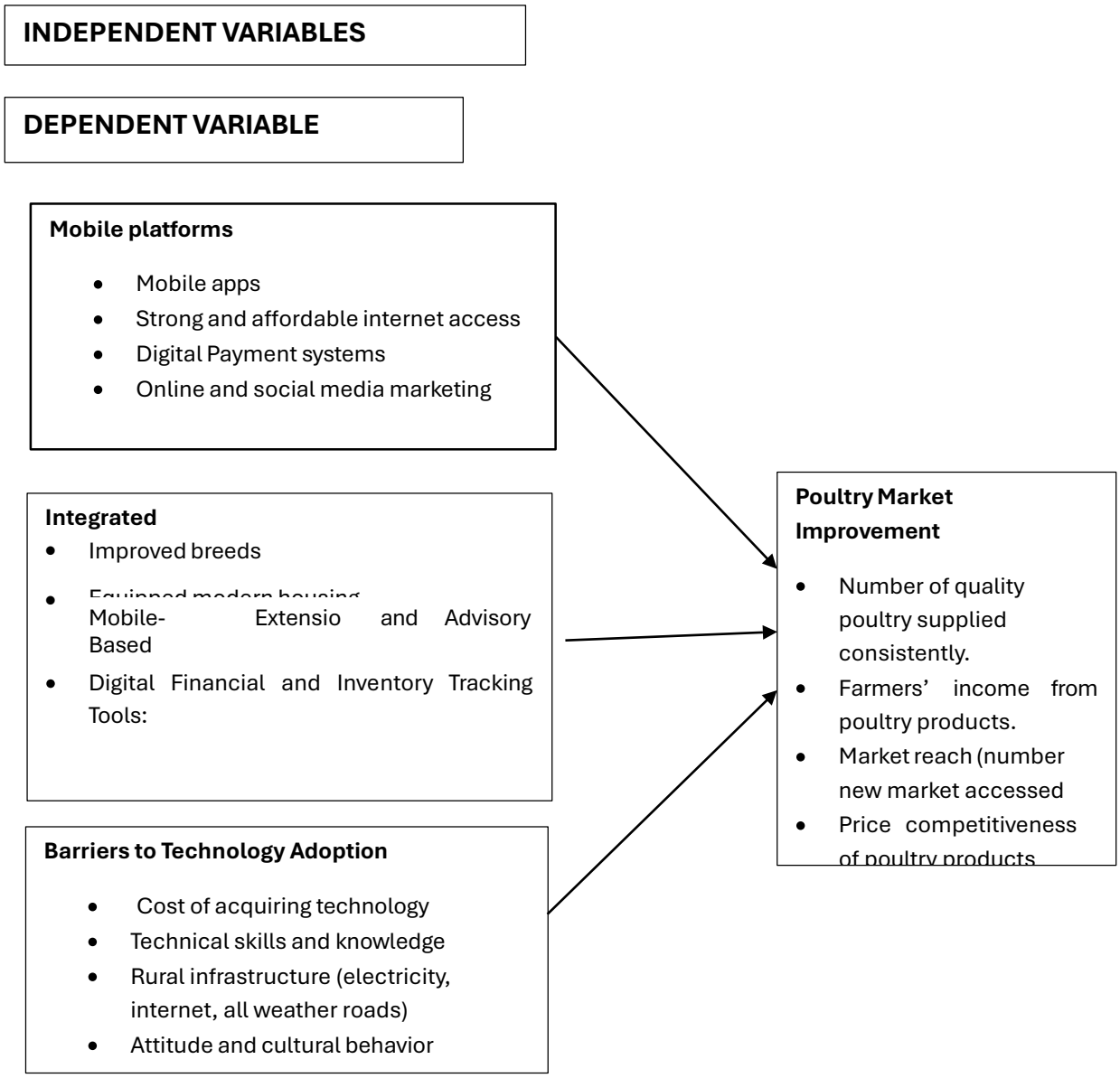

Figure 1: Conceptual Framework Illustration

Source: Authors' Own Construction, (2025)

3.0 METHODOLOGY

3.1 Research Design

This study employed a convergent parallel design to assess the influence of technological adoption on poultry market efficiency in Arusha District Council. The design enabled the simultaneous collection and analysis of quantitative and qualitative data, providing both statistical and contextual insights (Creswell & Clark, 2018). Quantitative data from structured questionnaires measured technology adoption levels and market efficiency indicators. Qualitative data from interviews with farmers, extension officers, and buyers explored barriers such as high costs, limited skills, and weak infrastructure. Integrating both data sets enhanced the validity of findings and offered a comprehensive understanding of how technology adoption shapes poultry market efficiency in a complex rural setting (Mwangi & Kariuki, 2015; Mtega et al., 2022).

3.2 Study Area

This study was conducted in Arusha District Council in the Arusha Region, northern Tanzania. This has been selected because it is among the pioneer regions in poultry farming in Tanzania and there are small- and medium-scale farmers involved in poultry farming for local breed, broiler and layers as income generating activities. As highlighted by Tanzania National Bureau of Statistics (2022), there has been quick growth in poultry farming in the Arusha District due to the high demand for poultry products. Despite that, technology, low adoption, market constraints, and inefficient production were some of the issues that still challenge it. Therefore, Arusha District offers a valuable and productive setting to examine the dynamics of poultry production, technology use, and access to markets. The findings were useful information for comparable rural settings in Tanzania.

3.3 Population and Sample Size

3.3.1 Population

A study population refers to all individuals or units that share characteristics relevant to a research inquiry (Saunders et al., 2020). In this study, the target population comprised poultry farmers and livestock-related government officers in Arusha District Council. Although the district lacks a centralized register of poultry farmers, records from the District Livestock Office (2025) estimate about 2,500 active small- and medium-scale poultry farmers keeping between 100 and 5,000 birds. These estimates align with national livestock profiling standards used by the Ministry of Livestock and Fisheries (2022). The study also included 27 council officers involved in poultry production, extension, and market facilitation. Overall, the study population totaled 2,527 respondents, representing both producers and institutional actors influencing technology adoption and poultry market access.

3.3.2 Sample Size

A sample size represents a subset of a population selected to participate in a study and must be sufficiently large to produce reliable, valid, and generalizable findings (Creswell & Creswell, 2023). Given that the population size of 2,527 individuals was known based on credible operational estimates Yamane's (1967) formula was used to determine the sample size. The formula is appropriate when the population (N) is known, even if established through administrative rather than census data.

$$N$$

$$n = \frac{}{1 + N(e^2)}$$

Where:

n = sample size

N = total population (2,527)

e = margin of error (10%)

The study adopted a 90% confidence level with a 10% margin of error, suitable for exploratory community research. Using Yamane's formula, a sample of 96 respondents was obtained, comprising 90 poultry farmers selected through stratified random sampling and 6 council officers purposively selected for their expertise.

3.4 Sampling Strategies

Sampling strategies are systematic approaches used to select a subset of individuals (sample) from a larger population to draw conclusions about the whole group (Etikan & Bala, 2020). Selection depends on research objectives, population characteristics, and desired data accuracy. Sampling methods include probability sampling, where each member has a known selection chance, and non-probability sampling, based on researcher judgment or accessibility (Saunders et al., 2021). In this study, 90 poultry farmers were selected through stratified random samplings from 2,500 farmers to ensure fair representation across wards. Six council officers were purposively selected due to their roles in production, extension, and policy, yielding a total sample of 96 respondents.

3.4 Data Collection Methods

Data collection is the systematic process of obtaining relevant information from selected sources to answer research questions, test hypotheses, and measure outcomes (Creswell & Creswell, 2023). In this study, investigating factors affecting technology adoption and poultry market efficiency in Arusha District Council, multiple techniques were employed, including survey questionnaires and semi-structured interviews, to provide both breadth and depth of data. Questionnaires were the primary tool for quantitative data, enabling collection from 90 poultry farmers on production capacity, market access, and technology adoption using close-ended and Likert-scale items (Bryman, 2021). Semi-structured interviews targeted six extension officers and council employees, allowing in-depth exploration of institutional support, barriers, and context-specific challenges (Saunders et al., 2021). Together, these methods facilitated data triangulation, offering a comprehensive understanding of technology adoption and market efficiency dynamics.

3.6 Data Analysis

Data analysis is the systematic process of organizing, interpreting, and presenting data to address research questions and test hypotheses (Creswell & Creswell, 2023). Following a mixed-methods approach, this study combined quantitative and qualitative techniques to examine the influence of technology adoption on poultry market efficiency in Arusha District Council.

Quantitative data from structured questionnaires, including Likert-scale and categorical responses, were analyzed using descriptive statistics such as frequencies, percentages, and cross-tabulations to summarize farmer profiles and trends in technology use and market efficiency (Field, 2021). Chi-square tests assessed

associations between technology use and market outcomes, with Cramér's V measuring relationship strength. Analyses were conducted in SPSS v27 for reliability.

Qualitative data from semi-structured interviews with extension officers and NGO staff were examined using thematic analysis (Braun & Clarke, 2022), identifying barriers, institutional support, and market integration issues. NVivo software facilitated coding and organization. Guided by the Technology Acceptance Model (Davis, 1989; Venkatesh & Davis, 2000), the integrated analysis triangulated findings, providing both measurable patterns and contextual insights into technology adoption and market efficiency.

3.7 Validity and Reliability

Validity refers to how well a research instrument measures what it is intended to assess (Bryman, 2021). In this study, validity ensured that data from poultry farmers and council officers accurately reflected factors influencing market access, technology adoption, and poultry production. Content validity was achieved by covering all research objectives in the questionnaires, construct validity through pilot testing and expert review, and criterion validity by aligning results with established benchmarks (Guba & Lincoln, 2020). Reliability, or the consistency of measurements (Creswell & Creswell, 2023), was confirmed through internal consistency, with Cronbach's alpha values of 0.779–0.872, and test-retest procedures, ensuring stable responses. Together, these measures enhanced the credibility, dependability, and generalizability of the study findings on technology adoption and market efficiency in Arusha District Council.

3.8 Ethical Consideration

The study strictly followed ethical principles to protect participants' rights and ensure research integrity. Ethical clearance was obtained from the Institutional Review Board, and permission was granted by the Arusha Agricultural Authority to access poultry farmers and stakeholders. Participants were fully informed about the study's purpose, procedures, risks, and benefits, and informed consent was obtained, emphasizing voluntary participation and withdrawal rights. Confidentiality and anonymity were maintained, and data were reported in aggregated form. Non-maleficence was observed, and research assistants were trained in ethical conduct. Ethical practices were applied throughout, ensuring responsible data collection and benefiting the wider community by improving poultry production and market access.

4.0 Findings and Discussion

4.1 Influence of Resource Availability and Market Access on Poultry Production

The study examined the extent to which the availability of production resources such as land, feed, and housing affected poultry productivity among farmers in Arusha District Council. Based on the descriptive statistics computed to summarize respondents' overall perceptions of resource availability, market information, infrastructure quality, and government support, the following findings were obtained.

Table 1: Factors Influencing Poultry Production in Arusha District Council

Statement	N	Mean	Std. Deviation
The availability of resources positively affects my poultry production.	96	1.53	0.597

Access to market information improves my ability to sell poultry products.	96	1.7	0.526
Good infrastructure improves my market access.	96	1.53	0.597
Government support plays a vital role in improving market access.	96	1.7	0.526
Valid N (listwise)	**96**		

Source: Field Data, (2025)

The results in Table 1 indicate that all mean values were between 1.53 and 1.70, suggesting strong agreement across all four variables. The lowest mean (M = 1.53) was recorded for both resource availability and infrastructure, implying that respondents strongly believed these factors had the greatest influence on poultry production. Slightly higher means (M = 1.70) for market information and government support indicated similarly positive perceptions but with slightly more variability. Overall, these findings showed that resource availability, infrastructure, government support, and access to market information collectively played a significant role in shaping poultry production outcomes in Arusha District Council.

The above findings were seconded by one respondent (Respondent A) who pointed out as follows:

> *"From my observation, market access for poultry products largely depends on infrastructure, transport availability, and reliable market information. Farmers in areas with poor roads or long distances to urban centers face high transport costs and delayed deliveries. Additionally, access to up-to-date market prices is limited, so farmers sometimes sell at lower rates. Although the council organizes occasional market linkages and cooperatives, these efforts do not reach all wards uniformly. Farmers in remote villages often miss out due to lack of awareness or coordination……" Respondent A (Council Officer, Tuesday, 12th November 2025 — 10:00 AM).*

This response indicates that access to poultry markets is conditional on both physical and informational resources. While council-led initiatives exist, structural barriers such as poor infrastructure, inadequate transport, and limited market intelligence constrain equitable participation. Furthermore, another respondent (Respondent B) had this to say:

> *"Resource availability significantly influences poultry production and market access. Feed, quality chicks, and adequate land for poultry housing are the main limiting factors. Labor is another challenge, especially for smallholder farmers who manage farms alongside other household activities. Some farmers struggle to afford feed consistently, and local suppliers cannot always meet demand. When these resources are insufficient, production drops, which in turn reduces the volume of products available for market sales…." Respondent B (Council Officer, Tuesday, 12th November 2025 — 11:15 AM)*

This testimony highlights the critical role of production resources in determining both output and market participation. Limited feed, chicks, land, and labor affect farmers' ability to maintain consistent supply and meet market demands, emphasizing the need for targeted support interventions.

Theme 1: Factors Influencing Market Access

Code 1.1: Infrastructure and Market Linkages

Both respondents emphasized that roads, transport, and market information are pivotal for poultry farmers to reach buyers efficiently. Poor connectivity and lack of price awareness remain significant barriers to equitable market access.

Code 1.2: Institutional Support

Council efforts such as cooperatives, farmer sensitization, and market facilitation help bridge gaps between farmers and buyers. However, coverage is uneven, and remote farmers may still face exclusion.

Theme 2: Availability of Production Resources

Code 2.1: Feed, Chicks, and Land

Respondents reported that shortages or high costs of feed, day-old chicks, and suitable land constrain poultry production. These limitations directly reduce the quantity and quality of products supplied to markets.

Code 2.2: Labor Constraints

Limited family or hired labor affects daily poultry management, impacting productivity and timely delivery to markets. This aligns with broader findings that production capacity is tightly coupled with resource availability.

Testimonies from Respondent A and B indicate that both market access and production output in Arusha District Council are strongly influenced by infrastructure, resource availability, and institutional support. While council interventions aim to facilitate market participation, systemic challenges such as resource scarcity, poor roads, and information gaps continue to hinder farmers' ability to fully exploit market opportunities. Enhancing infrastructure, providing reliable input supplies, and strengthening cooperative linkages could significantly improve production efficiency and market integration among poultry farmers in not only in Arusha DC but also elsewhere in Tanzania.

The study found that modern poultry technologies positively influenced both production outcomes and market efficiency. Respondents highlighted that automated feeders and vaccination systems reduced labor intensity, minimized feed wastage, and decreased bird mortality, resulting in higher egg and meat yields. Digital platforms, mobile applications, and communication networks enhanced access to real-time market information, facilitated direct buyer connections, and improved product pricing.

According to TAM, perceived usefulness explains this outcome: technologies are adopted and integrated into farming operations when farmers recognize tangible improvements in production and sales performance. Additionally, perceived ease of use including availability of user-friendly tools and supportive platforms further reinforces adoption and consistent utilization.

Empirical studies support these insights. For example, Kamau and Otieno (2023) observed that adoption of automated feeding and health monitoring systems improved farm productivity, while mobile-based market applications allowed small-scale poultry farmers to negotiate better prices and expand their market reach.

4.2 Effect of Technological Adoption Among Poultry Farmers in Arusha DC

Several factors are said to influence technological adoption, production efficiency, marketability, and accessibility among poultry farmers in Arusha DC. As indicated in Table 2.

Table 2: Technology Adoption Effect in Poultry Production in Arusha DC

Statement	N	Mean	Std. Deviation
I currently use modern poultry technologies (e.g., automated feeders, health monitoring).	96	2.53	0.94
The use of technology improves the efficiency of my poultry production.	96	2.06	0.708
Technology has improved the marketability of my poultry products.	96	2.04	0.664
It is easy for me to access modern technological tools for poultry farming in my area.	96	2.06	0.708
Valid N (listwise)	**96**		

Source: *Field Data*, (2025)

The results indicate strong agreement that technology enhances efficiency and marketability of poultry products. The lowest mean (M = 2.04) was recorded for marketability, while slightly higher means (M = 2.53) were noted for current technological use, reflecting moderate adoption levels. Overall, modern poultry technologies are perceived as critical tools for improving production outcomes and market access in Arusha District Council. One of the respondents (Respondent C) stated as follows:

> *"Adopting modern poultry technologies has noticeably improved production efficiency. Automated feeders and vaccination systems have reduced labor demands and minimized feed wastage. Mortality rates have dropped because vaccinations are more systematically applied, and birds grow faster due to consistent feeding schedules. Before these technologies, farmers had to feed manually several times a day and relied on irregular vaccination campaigns, which often led to disease outbreaks." Respondent C (Council Officer, Wednesday, 13th November 2025 — 10:00 AM)*

This response highlights that modern technologies directly enhance production efficiency, reduce operational labor, and improve poultry health outcomes. Automated systems allow farmers to achieve more predictable and higher outputs with less effort. The same argument was also raised by another respondent (Respondent D) that:

> *"Technology also plays a critical role in market access and efficiency. Digital platforms and mobile applications provide real-time market prices and connect farmers to buyers directly, reducing dependence on middlemen. Farmers can coordinate deliveries better, negotiate fairer prices, and avoid losses from unsold products. For instance, some poultry groups now use WhatsApp-based networks to link with traders in Arusha city, which has increased their sales volumes and profits significantly." Respondent D (Council Officer, Wednesday, 13th November 2025 — 11:15 AM).*

This testimony demonstrates how technology supports not only production but also market integration. Digital communication and marketing platforms enable farmers to reach broader markets, make informed pricing decisions, and enhance overall market efficiency.

Code 2.2: Efficient Marketing Channels

The respondent further illustrated that technology-enabled communication networks allow for coordinated deliveries and expanded market reach, reducing reliance on intermediaries and increasing sales. The testimonies from Respondent C and Respondent D illustrate that modern poultry technologies enhance both production efficiency and market access. Automation reduces labor intensity and improves bird health, while digital tools facilitate better pricing, coordination, and direct buyer engagement. Combined, these technologies strengthen production outcomes and contribute to more efficient and profitable poultry value chains in Arusha District Council.

4.3 Barriers to Technology Adoption in Poultry Farming in Arusha DC

The study examined barriers and impinging modern poultry technologies, such as automated feeders and health monitoring systems whereby lower mean values indicated stronger agreement as depicted in Table 3.

Table 3: Barriers of Technology Adoption Among Poultry Farmers in Arusha DC

Statement	N	Mean	Std. Deviation
The high cost of technology is a major barrier to adopting modern poultry farming techniques.	96	2.04	0.664
A lack of technical skills among farmers limits the adoption of technology.	96	2.06	0.708
Government and NGO programs effectively help to overcome barriers to technology adoption.	96	1.52	0.502
Agricultural extension services play an important role in promoting technology adoption.	96	2.04	0.664
Valid N (listwise)	**96**		

Source: *Field Data*, (2025)

The results indicate strong agreement that cost and technical skills are key barriers, while government, NGOs, and extension services are effective enablers. Government and NGO support recorded the lowest means (M = 1.52), highlighting its crucial role in overcoming adoption challenges. Overall, these findings demonstrate that addressing both financial and technical constraints is essential to improve modern poultry technology uptake in Arusha District as narrated by one of the respondents (Respondent E) as follows:

> *"The major barrier to adopting new poultry technologies is the high cost of equipment and inputs. Automated feeders, health monitoring tools, and other modern systems are expensive, and many farmers cannot afford them without financial support. This limitation affects both production and market access, as small-scale farmers struggle to produce at competitive volumes and maintain consistent product quality, which reduces their bargaining power with buyers. (Respondent E, Council Officer, Thursday, 14th November 2025 — 09:45 AM)*

This response highlights that financial constraints are the primary obstacle to technology adoption. The high costs limit production capacity, efficiency, and consistency, which in turn negatively impacts market access and competitiveness for poultry farmers. Another respondent (Respondent F) stated as follows:

> *"To overcome these barriers, we believe that targeted support programs such as subsidies, low-interest loans, and training initiatives could significantly improve technology uptake. Government and NGO interventions that provide both technical skills and financial*

> *assistance would enable farmers to acquire and use modern tools effectively. Extension services and community-level demonstrations also help build confidence and show practical benefits, encouraging wider adoption of technologies that boost both production and market performance." (Respondent F, Council Officer, Thursday, 14th November 2025 — 11:00 AM.*

This testimony emphasizes that institutional support, capacity building, and financial assistance are key solutions for overcoming adoption barriers. Programs that combine technical guidance with affordable access to technologies can enhance production efficiency and improve farmers' ability to access and compete in poultry markets.

Theme 1: Barriers to Technology Adoption Code Code
1.1: High Cost of Modern Equipment

Respondent E highlighted that the expensive nature of modern poultry technologies restricts farmers' ability to invest, limiting both production scale and market competitiveness.

Code 1.2: Limited Financial Capacity and Market Impact

The respondent also noted that these cost barriers affect not only production efficiency but also the ability to meet market demands, reducing profitability and access to buyers.

Theme 2: Solutions to Enhance Technology Uptake

Code 2.1: Financial and Institutional Support

Respondent F emphasized that programs such as subsidies, low-interest loans, and grants from government and NGOs could help farmers adopt modern poultry technologies.

Code 2.2: Capacity Building and Extension Services

The respondent also stressed the role of extension services, training, and practical demonstrations in equipping farmers with technical knowledge and confidence to use new technologies effectively. The perspectives from Respondent E and Respondent F illustrate that while high costs and limited financial capacity are major barriers to technology adoption, institutional support, financial assistance, and skill-building initiatives can significantly enhance both production efficiency and market access. Effective interventions can strengthen poultry value chains, increase farmer competitiveness, and improve livelihoods in Arusha District Council.

Despite positive impacts, several constraints limited technology adoption in Arusha District. Respondents reported that the high cost of equipment, lack of technical skills, and limited accessibility of technological tools were major barriers. For example, 79.2% of respondents agreed that high technology costs restricted adoption, while 74.0% cited inadequate technical skills.

The discussion draws upon the Technology Acceptance Model (TAM) to explain farmers' adoption behaviors and technology-mediated productivity outcomes. Interpreted through TAM, these barriers relate to perceived ease of use: if technologies are too costly or complex to operate, farmers are less likely to adopt them, even when the perceived benefits are high. Moreover, limited exposure, insufficient training, and lack of practical demonstrations reduced confidence and willingness to integrate technologies fully into poultry operations. Empirical literature confirms these constraints. Mwakajila and Maganga (2022) noted that smallholder poultry farmers often face economic and skill-based obstacles that prevent full utilization of modern technologies, reducing potential productivity gains and market competitiveness.

4.4 Strategies to Overcome Technology Adoption Barriers among Poultry Farmers in Arusha DC

Respondents identified several mechanisms for overcoming adoption barriers, including support programs from the government and NGOs, training and extension services, and access to affordable technologies. Financial assistance, practical demonstrations, and technical guidance were also perceived as critical for enhancing both production efficiency and market access (Table 4).

Table 4: Strategies to Overcome Technology Adoption Barriers among Poultry Farmers (n =90)

S/N	Type of Support	Frequency (n)	Percentage (%)
1	Support from Government and NGOs	60	67.0
2	Provision of Training and Extension Services	70	78.0
3	Provision of Affordable Technologies	85	94.0
4	Financial Assistance	50	56.0
5	Practical Demonstrations	36	40.0
6	Technical Guidance	60	67.0

Note: Percentages exceed 100% due to multiple responses.

As shown in Table 4, poultry farmers identified several issues which, if addressed, could enhance the effectiveness, efficiency, and economic benefits of poultry production. Most farmers (94%) emphasized the need for affordable technologies in terms of skills and costs, as most poultry farmers have low levels of skills, education, and income. Other critical issues requiring improvement include the provision of extension services to equip farmers with relevant skills and knowledge (78%), support from the government and NGOs (67%), and technical guidance on various aspects of poultry production (67%). Issues mentioned by fewer respondents though still important include financial assistance (56%) and practical demonstrations. Overall, farmers believe that addressing these issues would help streamline the entire poultry production process.

TAM suggests that interventions enhancing perceived ease of use through training, extension support, and simplified technological interfaces can significantly improve adoption rates. Likewise, demonstrating tangible benefits and profitability enhances perceived usefulness, motivating farmers to invest time and resources in technology integration.

Empirical studies corroborate these strategies. Nyariki et al. (2021) highlighted that combining subsidies, training, and peer-learning platforms increased adoption of automated feeding and vaccination systems, improving productivity and market outcomes among smallholder poultry farmers.

The findings indicate that while modern poultry technologies enhance production efficiency, reduce labor demands, and improve market access, adoption remains constrained by high costs and limited technical capacity. TAM provides a useful framework for understanding these dynamics: farmers adopt technologies when they perceive clear benefits and find tools manageable and accessible. Effective interventions including financial support, training, and extension services can strengthen both adoption and sustained utilization, thereby improving production outcomes, market efficiency, and profitability in Arusha District Council.

5.0 Conclusion and Recommendations

5.1 Conclusion

This study provides extensive and context-specific empirical evidence demonstrating how modern poultry technologies shape production efficiency and market access among smallholder farmers in Arusha District Council. By grounding the analysis in the Technology Acceptance Model, the study clearly illustrates how farmers' perceptions of usefulness, ease of use, trust, and system reliability, together with external enablers such as extension support, training, and institutional facilitation, directly influence the adoption and sustained use of technological innovations. The findings further highlight that while digital platforms, automated feeders, vaccination tools, and advisory systems significantly enhance production quality, decision-making, and market connectivity, their full potential remains constrained by challenges such as high costs, limited technical skills, and insufficient institutional backing. These insights provide strong practical value for policymakers, development partners, and local government authorities by underlining the importance of designing supportive policies, capacity-building initiatives, financial incentives, and farmer-centered digital systems that respond to real challenges faced by poultry keepers.

The study also emphasizes the critical need for improved infrastructure, strengthened extension services, enhanced digital literacy, and better coordination between stakeholders to ensure equitable and sustainable technology uptake across diverse farming communities. Overall, this research enriches existing literature by offering locally grounded evidence, advancing theoretical understanding of technology adoption in rural agricultural settings, and providing actionable guidance for strengthening technology-driven poultry development, improving productivity, and enhancing market participation within Arusha District Council and similar contexts. Overall, while technology has improved efficiency, reduced labor intensity, and enhanced market connectivity, its impact is constrained by financial, skill, and infrastructural barriers. Sustainable adoption requires both resource provision and capacity-building support.

5.2 Recommendations

5.2.1 Policymakers, Ministry of agriculture, and local government authorities

Policymakers, including the Ministry of Agriculture and local government authorities, should prioritize subsidizing modern poultry technologies to enhance affordability and increase adoption among farmers. In addition, training in technology use and farm management should be integrated into routine extension services to build farmers' skills and confidence. Efforts should also be directed toward improving farmers' access to digital platforms that provide real-time market information, enabling better pricing decisions and stronger market linkages. Furthermore, enforcing Public private partnership programs and development of policies that facilitate favorable enabling environment to partners along the poultry value chain. Extending subsidy programs to poultry value chain to facilitate implementation of technologies.

5.2.2 District and community levels, agricultural officers and local councils, and extension officers

At the district and community levels, agricultural officers and local councils should enhance farmers' skills and confidence by conducting regular demonstrations of modern poultry technologies. They should also support cooperative purchase schemes or shared technology hubs that reduce individual costs and improve access to essential tools. In addition, promoting group-based marketing initiatives that leverage digital platforms can help farmers expand their market reach and improve pricing outcomes. Continuous mentorship and technical assistance are necessary to ensure proper use and maintenance of the technologies, while systematic monitoring of adoption rates and performance outcomes will provide

valuable insights to guide future technological interventions and improve overall poultry sector performance.

5.2.3 Recommendations for Further Study

Given the time and resource constraints that limit the scope of this study, future research is encouraged to adopt a broader and more longitudinal approach. First, long-term studies should be conducted to measure how technological adoption influences income trajectories, profitability, and household welfare among poultry farmers over time. Such longitudinal evidence would provide deeper insights into whether technology adoption leads to sustained economic improvements.

Second, future research should extend the geographical scope by undertaking comparative district-level or regional studies to identify variations in adoption levels, contextual barriers, and successful models that could be replicated or scaled. Third, additional qualitative studies involving policymakers, technology suppliers, and extension officers are recommended to better understand institutional dynamics, support systems, and structural constraints affecting technology uptake.

Moreover, there is a need for research focusing specifically on sustainability measures for technology adoption, including maintenance capacity, cost–benefit resilience, farmer behavioral change, and long-term operational viability of digital and integrated technologies. Finally, experimental or quasi-experimental studies that test integrated packages combining technology, farmer training, finance mechanisms, and market linkage interventions would offer robust evidence to guide comprehensive and scalable poultry development strategies in Tanzania.

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