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Research Paper

Assessment of the Technical, Social and Economic Factors Affecting Poultry Farmer's Production

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Abstract

Poultry farming has achieved remarkable efficiency and profitability in developed countries whereas in developing countries, farmers are still striving to meet productions requirements. This study examined socio, economic and technical determinants of poultry production, guided by Neoclassical Theory. Descriptive and inferential statistics were employed to analyze data from 218 poultry farmers. The study concluded, social factors were experience(β=0.031), family size(β=0.049), and self-prepared feeds(β=0.165). Economic factors were quality of chicks (β=-0.165), feed cost (β=-0.230), income(β=-0.259) and technology(β=0.125), and technical determinant was stocking density(β=0.603). These factors significantly influence poultry production ($p < 0.05$). This study recommends adoption of improved high-yield breeds, poultry waste utilization to organic fertilizer for circular economy sustainability, and policy intervention to improve market access, fair pricing and input subsidies. Future research should examine the effectiveness of training programs and extension services in bridging knowledge gaps related to modern poultry health management.

Keywords: Poultry production, feeding expenses, veterinary services, smallholder farmers, modern practices

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1. Introduction

In developed countries such as the United States and the Netherlands, poultry farming has achieved remarkable efficiency and profitability due to advanced technology, integrated value chains, and significant investments in research and development (Kleyn & Ciacciariello, 2021). For instance, automated feeding systems, improved genetic stock, and well-established cold chains have resulted in higher productivity and better market access. In contrast, many sub-Saharan African countries, including Kenya and South Africa, have made strides in addressing similar challenges by promoting public-private partnerships, investing in feed production, and providing extension services to small-scale farmers. However, despite these efforts, challenges persist, particularly in regions with underdeveloped infrastructure and fragmented markets (Caffyn, 2021).

Estimates place the global poultry population at around 16.2 billion, with developing countries accounting for 71.6% (Sime, 2022). However, in Africa, the traditional or indigenous poultry system dominates, accounting for 70% of total production and 20% of the continent's animal protein intake (Mujyambere et al., 2022). In, Tanzania, poultry is representing only 1.8% contribution of the Gross Domestic Product (GDP) (Moekti, 2020), while the whole livestock farming playing an essential role, and the sector contributes only 7% in the agricultural sector (Wineman et al., 2020). While formal investors report that Tanzania's poultry population stands at 83,280,000 comprising 38,770,000 indigenous chickens and 44,510,000 exotic chickens (Muja et al., 2024) the actual scope and performance of the informal poultry sector remain unclear.

Tanzania's poultry sector reflects this trend, being predominantly rural based with 97% of breeders raising indigenous chickens and only 3% engaging in modern poultry farming. Out of the country's estimated 59 million chickens, 75% are indigenous, and 25% are improved breeds, including 8 million layers and 15 million broilers, primarily managed under small-scale systems (Wilson, 2021). While Tanzania ranks third in livestock production in sub-Saharan Africa, its poultry sector remains underdeveloped and underperforms economically due to poor management practices, unstructured and fragmented nature of the poultry sector and insufficient poultry processing infrastructure (Nanda Kumar et al., 2022; Wetengere, 2021). Poultry farming presents a viable solution to meet the increasing food demands of growing urban populations, which face limited agricultural land and a shift toward white meat consumption (Paneru et al., 2024).

Farmers in Hai District face significant socio-economic challenges, such as limited access to credit facilities, poor infrastructure, and inadequate market access. These issues force farmers to sell at lower prices through intermediaries, reducing profitability (Wilson, 2021). Others include high cost of feed during production, limited market access, and low hatchability rates (Etuah, 2020). At the same time, this juxtaposition creates a debate about whether small-scale poultry farming, which requires lower investment, can offer quicker returns, and production is scalable enough to address scarcity of poultry products and by-products (Kleyn & Ciacciariello, 2021).

In Tanzania, several initiatives have been undertaken to address these issues. For example, the government has promoted policies to increase access to credit for small-scale farmers and improve extension services (Wilson et al., 2022). Programs such as the Tanzania Livestock Master Plan aim to expand poultry production by enhancing hatchery systems and feed production. However, these initiatives have not yet achieved widespread impact at household level. Moreover, the potential for growth in the poultry sector is evident, yet underutilized due to persistent challenges such as high production costs, limited market access, and insufficient materials (Wilson, 2021). This highlights a key issue: is the primary obstacle at household level a technical, social or economic factor?

1.1 Related social, economic and technical determinants of poultry production

Several social factors have been identified to affect poultry production across countries. Chacha, (2024) examined the socio-economic impacts of endemic and epidemic diseases on livestock production systems and found that endemic diseases such as brucellosis, foot-and-mouth disease (FMD), and contagious caprine pleuropneumonia (CCPP) pose ongoing challenges to livestock productivity. Abro et al., (2020) assessed the potential socio-economic benefits of black soldier fly larvae meal (BSFLM) to the Kenyan poultry sector. The study found that, by replacing some percent of the conventional feed sources (fishmeal, maize, and soya bean meal) with BSFLM can generate a potential economic benefit.

Erdaw & Beyene, (2022) found that an increased per capita income, population growth and enhanced communication are the driving forces for poultry improvements. Ursule et al., (2020) found that increased local chicken farming is an activity under the responsibility of men in East-Coast of Madagascar. A study by Omondi, (2019) conclude, that access to high-value markets, household income level and the type of production system, significantly affect profitability of indigenous chicken farming. However, poultry diseases and high input costs, especially feed, are the major constraints to poultry farming. From the present studies (Chacha, 2024; Erdaw & Beyene, 2022; Abro et al., 2020; and Omondi, 2019) rarely separate between social and economic factors on linking their arguments with findings.

In considering relationship between economic factors and poultry production. Mutago, (2022) analyzed the poultry eggs production and marketing in Rwanda and found that, water availability, space reserved to poultry, educational level, experience, and veterinary services were significant factors influencing poultry eggs production and marketing. Marmelstein et al., (2024) highlights that, broiler production costs are heavily influenced by feed, which can account for up to 73% of total production costs. The stocking density of broilers also affects productivity, with optimal density levels maximizing profits while preventing overcrowding and associated health issues (Sugiharto, 2022). Ramukhithi et al., (2023) focused on capital investment, feed costs, stocking density, and biosecurity measures, and found directly impact poultry production efficiency. Additionally, small-scale farmers can still maximize profits by optimizing resource use, indicating that large-scale operations are not always necessary for profitability (Wu et al., 2021).

Asfaw et al., (2021) examined poultry diseases and finds economic indicators of poultry farming are mortality rates and growth rates. Further, argued that mortality rate is higher due to poor management and significantly reduce poultry farming output. Zhou et al., (2020) considers, biosecurity and vaccination in poultry reduce the risk of disease outbreaks, ensuring the health and safety of poultry flocks. Etuah et al., (2020) examined the cost inefficiency in poultry production and farm-specific determinants on cost inefficiencies and found an increase in farm size, veterinary contacts, use of self-prepared quality broiler feed, and membership in the Poultry Farmers' Association (PFA) all help minimize cost inefficiency.

Birhanu et al., (2021) investigated technical efficiency of traditional village chicken production in Africa, and found that, the level of technical efficiency is extremely low in Ethiopia, Nigeria, and Tanzania. The study suggested the use of enormous opportunities to enhance poultry productivity. The heterogeneity in technical efficiency is strongly associated with producers' experience in breed improvements and flock management, limited technical knowledge and skills, limited access to institutions and markets, smaller flock size, gender disparities, and household livelihood orientation.

Oloyo & Ojerinde, (2019) consider technical factors, house setup, ventilation, temperature management, lighting, and water management, being efficient in maintaining optimal poultry productivity. Konkol et al., (2022), argue on quality poultry house should have effective ventilation systems to prevent the buildup of harmful gases such as ammonia, which can cause respiratory issues in both birds and workers.

Saeed et al., (2019) concludes on temperature management and lighting programs are also vital for regulating poultry growth and minimizing mortality rate. Others technical efficient factors are water management, which ensures a continuous supply of clean water, a critical resource for broiler in health improvement and productivity (Jacobs et al., 2020). Adedapo & Adekunmi, (2019) focused on record-keeping are technical factors because of helping farmers make informed decisions based on accurate data, thus contribute on poultry efficiency production.

Bamidele et al., (2020) examined on-station performance evaluation of improved tropically adapted chicken breeds and found that mortality rate of the locally sourced breeds is lower than the foreign-sourced breeds during brooding, growing and laying. Birhanu et al., (2022) assessed sustained adoption of innovation among smallholder poultry and found that smallholder farmers prefer tropically adapted improved breeds (TAIBs) to indigenous breeds. Having advantages of generating higher economic gains.

Most reviewed empirical studies have focused on investigating factors affecting poultry production across both developed and developing countries, typically analyzed in isolation the social-economic and technical aspects. Further, previous studies overlooked how technical inefficiencies, institutional factors, and household-specific dynamics affect each other. Furthermore, many of these previous studies have

provided broad, generalized findings without addressing the unique and regional dynamics that can influence poultry production in specific geographical contexts. In contrast, this study categorizes the factors into socio, economic, and technical, with a stronger focus on problems that are unique to each category. Debate around whether enhancing technical inputs (appropriate stocking densities, and optimized poultry systems) or resolving socio-economic constraints (water, and financial credit access, market availability) can affect production is also addressed. The study narrowed its focus to the Hai District in Tanzania, aiming to analyze determinants of poultry production at a given localized geographical context.

Therefore, this paper analyzes the technical, economic and social factors affecting poultry farmers' production in Tanzania. Technical factors analyzed were veterinary services, quality of feeds, stocking density, poultry production system, and technology used. Economic factors were flock size, cost of feeds, credit access, quality of chicks, Income level, and market prices were examined. On social factors, experience, family size, marketing information and self-prepared feeds form part of the study(Chacha, 2024; Erdaw & Beyene, 2022; Birhanu et al., 2021; Abro et al., 2020; Oloyo & Ojerinde, 2019; Omondi, 2019; and Saeed et al., 2019).

1.2 The Neoclassical theory on poultry farming inputs and outputs

The Neoclassical Theory of Production defines production as the creation of goods and services using inputs or resources like human labour, capital equipment (machines), land, and raw materials (Markauskas, 2021). This theory elucidates how factor inputs are transformed into products (outputs) within a specific timeframe. The commonly employed economic model to understand the relationship between production factors and output in agriculture is the production function model. The production function of a farmer is determined by resource availability, typically simplified to output as a function of capital (K) and labour force (L). This function describes the relationship between input and output proportions, often presented in a mathematical equation, showcasing the maximum output achievable with a given set of inputs and existing technology (Harkushenko & Kniaziev, 2019).

The Neoclassical Theory of Production was chosen because it provides a solid framework for understanding how various inputs (such as labour, capital, and technology) contribute to the production process. This theory enables the analysis of the efficient use of these inputs to maximize output in the context of poultry production. The theory emphasizes the importance of optimizing input allocation to achieve maximum productivity, which is highly relevant when examining technical and social-economic factors that influence poultry farming in the Hai District.

Additionally, the theory aligns well with evaluating the economic decisions made by poultry farmers. It helps in analyzing how farmers respond to changes in input costs, technology, and market conditions that ultimately affect their production choices. This framework is useful in understanding the balance between input costs and output levels, making it ideal for assessing both the technical efficiency and the social-economic influences on poultry production in the district.

The Neoclassical Theory of Production aims to explain the connection between a firm's production factors (land, labour, capital, and entrepreneurship) and its output. Firms are represented as production functions, mainly focusing on the quantitative relationship between labour, capital, and technology, while land and entrepreneurship play more qualitative roles. This model emphasizes the importance of understanding the relationship between capital and labour, leading to mass production and cost minimization for producers and lower prices for consumers. The distinction between short-run and long-run, where factors of production are fixed or variable, respectively, is crucial. The theory suggests that firms can adjust by controlling the number of workers (short-run) and scaling the size of the firm (long-run).

While neoclassical economists argue for the interchangeability of labour and capital in the short run, in practice, changing labour is more feasible than changing capital. Additionally, measuring the productivity of a single employee and understanding how it changes with the addition of more workers is challenging. The neoclassical principle of diminishing returns to labour may be logically coherent, but it struggles to explain the effects of external influences on labour, such as management and social values.

The concept of technical efficiency and economic efficiency were derived by the theory; technical efficiency occurs when the maximum possible output is produced with a given combination of input and

Economic efficiency, on the other hand, is achieved when a firm produces a given output at the lowest possible cost (Lazonick, 2024). However, efficiency assessment was beyond the scope of this study. The theory is relevant to this study as it pertains to inputs like labour and capital, which can be adjusted by replacing variables such as flock size, quality feeds, poultry type, age, sex, income, experience, and access to veterinary services. The study applies the neoclassical production theory, with the assumption that output results from input, where inputs encompass all independent variables and output the dependent variable. Therefore, neoclassical theory was employed to guide how the changing of social, economic and technical factors contributes to the change in poultry production among small holder farmers.

2. Methods

2.1 Design, Data methods, and Selected sample size

A cross-sectional study design focused on social and economic data were collected at once integrating quantitative approach for a structured survey questionnaires to provide a comprehensive understanding of the technical and socio-economic determinants of poultry production in Tanzania. The study was carried out in Hai District in the Kilimanjaro Region, Tanzania targeted sample size of 218 poultry producers (Details in Table 1). The district was chosen specifically for its prominence as one of the highly productive regions for poultry having 3 divisions and 17 Wards. Cluster sampling was used to identify wards followed by simple random sampling of the poultry producers from each ward. Qualitative data was also obtained using interviews as well as secondary data to triangulate inferential statistics. Table 1 shows the representation was by disproportionate sampling per number of wards in a given division in determining the total sample size required.

Table 1. Summary of the Sample Size Selected

Name of Divisions	Number Wards Selected	Number of poultry producers per ward	Disproportionate ratio	Total sample size per Division
Lyamungo	5	13	0.29	64
Machame	6	13	0.35	77
Masama	6	13	0.35	77
Total sample size				218

Source: The authors

Pre-testing of the survey questionnaire was conducted 10 respondents equal to 4.5% of the total respondents. The aim was to rectify questionnaire and validate it; this activity was then followed by complete survey using enumerators. To validate quantitative results, Six Key Informants were selected using purposive sampling, two from each Division, to give a fresh view on technical and social economic factors affecting poultry production. In addition to that, three FGD's, one per Division constitutes 9 participants selected using snowball sampling to contribute determinants of quality poultry productions.

2.2 Analysis

The theoretical framework, Neoclassical Theory of Production, explains how poultry farmers employ input factors to transform them into products, and it guided the analysis of this study. In this study both technical (access to veterinary services, quality feed, and technology); socio factors (financial status, credit access, education, self-prepared feeds and marketing information) and economic factors (flock size, cost of feeds , water availability, quality chicks, technology level, Income, and prices affecting poultry farmers' production in Tanzania, were analysed. According to Kmenta (1967), Constant Elasticity of Substitution (CES) production function provides a clear picture to producers on causes for shifting or move along different levels production by relying on selected factors of production. Thus, the CES function aligned with the Cobb-Douglas function by allowing variation in elasticity of substitution between inputs.

2.3 Method of Estimation

Using the Henningsen, & Henningsen, (2011) approach. The CES function cannot be linearized analytically. The general form of CES function with two input factors, eg: Income and lobor is as follows:

$$y = \gamma \left(\delta x_1^{-\rho} + (1-\delta)\, x_2^{-\rho} \right)^{-\frac{\nu}{\rho}} \quad (1)$$

Whereby:

γ = Quantity of output

x1 and x2 = input quantities (independent variables), and γ, δ, ρ, and ν are parameters.

γ = total factor productivity,

δ = provides inputs optimal distribution

ρ = provides constant elasticity of substitution, which is σ = 1/ (1 + ρ), and

ν = elasticity of scale, where by ν < 1 is for decreasing and ν > 1, increasing returns to scale.

Three special cases are provided with CES function (i) for the CES turns to the Cobb-Douglas form: δ = approaches 1 for ρ = 0, (ii) it turns to the Leontief production function, if ρ = ∞ 1, δ approaches 0. (iii) CES turns to linear function if ν = 1, while ρ = -1, and δ approaches ∞.

The present paper adopted, Cobb-Douglas form: δ = approaches 1 for ρ = 0, because, CES function is non-linear in parameters and it has to be estimated by linear estimation techniques using 'Kmenta approximation' (Kmenta 1967).

Since there are more than two independent variables, the CES function for equation 1 has a limitation of two inputs. Thus, to overcome this problem, the multiple inputs(n) for CES function was provided:

$$y = \gamma \left(\sum_{i=1}^{n} \delta_i x_i^{-\rho} \right)^{-\frac{\nu}{\rho}} \quad (2)$$

$$n$$

With $\sum_{i=1}^{n} \delta_i = 1$

Whereby:

n = number of inputs and x1, ..., xn are the quantities of the n inputs.

Thus, trans log function is imposed to equation 1:

$$\ln y = \ln \gamma + v\delta \ln x_i + v(1-\delta)\ \ln x_2 - \frac{\rho v}{2}\ \delta(1-\delta)(\ln x_1 - \ln x_2)^2 \quad (3)$$

For n = number of inputs and x1, ..., xn, the estimated equation is

$$\ln y = \ln \alpha_0 + \sum_{i=1}^{n} \ln x_i + \ \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \ln x_i \ln x_j \quad (4)$$

Description: y = Dependent variable (number of poultry), α_0 = Constant term (Intercept), β_{ij} = Regression coefficient of and ith independent variable (Where i = 1,2,3...n).

Independent variables (xi) for Socio factors are: Experience(years), Family size(counted), Age(years), Sex (0/1), Education level(years), Marketing information(frequency), Self-prepared feeds (TZS).

Economic factors are: Flock size (Counted), Cost of feeds (TZS), Water availability (TZS), Lower quality chicks (Kg), Technology level (TZS), Income level of poultry producer (TZS), The market prices (TZS/Kg) and:

Technical factors are: Veterinary services(frequency), Stocking density(m2), Poultry system (Broiler Vs Layers), Heating system (0/1), Water system (0/1), Lighting system (TZS), Ventilation (0/1). The (0/1) represents dummy variable

2.4 Statistical tests and model assumptions

The analysis follows, testing of the assumptions of the classical linear regression model (CLRM) (Regenwetter & Cavagnaro, 2019). Multicollinearity was tested using Variance inflation factor (VIF) and

Tolerance (T), variables showed VIF < 2 indicates there is no enough evidence of presence of Multicollinearity. Normality tested by using P-P plot and Homoscedasticity was tested by using standardised residual scatter plot. Variables that found lead to assumptions violation was omitted. To ensure variable consistency, 60 per cent were continuous and their measurements are given in Table 2. The results are presented in Table below:

3. Results and Discussions

3.1 Descriptive statistics on social, economic and technical factors motivate poultry production

Poultry farmers consider a better market price as attractive incentive to increase production. Table 2 displays the study results, showing that most buyers in Hai District (52.8%) pay between 5,000 and 7,000 shillings per chick, with a notable number (30.3%) paying between 7,000 and 9,000 shillings. A smaller proportion (17%) pays less than 5,000 shillings for each chick. Higher prices, such as those between 7,000 and 9,000 shillings per chick, motivate farmers to invest in breeds known for better productivity or specific market demands, potentially increasing production (Marchal et al., 2020). Equally, Wambua (2023) indicated that lower prices below 5,000 shillings influence farmers to opt for breeds that require less initial investment, yield lower returns, or have different growth characteristics. Additionally, when buyers purchase chicks for less than 5,000 shillings, poultry farmers face hindrances such as reduced profit margins, limitations in investing in higher-quality breeds or inputs, and potential challenges in maintaining sustainable production practices due to financial constraints (Campbell, 2019).

Table 2. Average price per unit

Average price per/unit (1USD ≈ 2500TZS)	**Frequency**	**Percentage (%)**
0-5000	37	17.0
5000-7000	115	52.8
7000-9000	66	30.3
Total	**218**	**100.0**

3.2 Types of poultry products

On examine preference of produced poultry products, Table 3 reveals that, a majority of poultry farmers in Hai District sell meat (51.8%), followed by eggs (29.4%), live birds (14.2%), and (4.6%) other products like some parts of the birds. The study implies that the predominant products sold by poultry farmers influence market dynamics and economic viability in Hai District. As a result, with this market access of varied products, farmers kept producing poultry in the study area. Hennessey *et al.,* (2021) indicated that the distribution of products sold by poultry farmers's highlights significant implications for their production practices and economic outcomes. Farmers who primarily sell meat encounter difficulties in maintaining a stable supply chain and meeting market demand (Ijaz *et al.,* 2021). Conversely, Sonaiya *et al.,* (2022) indicated that poultry farmers focusing on egg production benefit from consistent revenue streams and lower perishability risks compared to meat products. The choice of selling live birds suggests a niche market or preferences among consumers, potentially influencing farmers' breeding and management strategies (Franzoni *et al.,* 2021).

Table 3. Poultry products

products sold to customers	**Frequency**	**Percentage (%)**
Meat	113	51.8
Eggs	64	29.4

products sold to customers	Frequency	Percentage (%)
Live bird	31	14.2
Others (specify)	10	4.6
Total	**218**	**100.0**

Using the interview guide, this study evaluated the origins of markets and the methods used by producers to find buyers for their poultry products. Findings from the study show that,

> *My primary markets are local restaurants, also, middlemen play a significant role in my business. These middlemen buy poultry in bulk and distributing to buyers that I cannot access. However, the downside is that middlemen often demand lower prices to maximize their profits, which reduces my margins (Respondent 9, 2024).*

3.3 Identified social factors affecting poultry production

The coefficient results in table 4, provides detailed information on the contributions of independent variables (social factors) to the dependent variable (poultry production). The model results indicated a goodness of fit with Adjusted R-square 0.890. Indicated that 89% of the variance in poultry production is explained by the model. The constant (intercept) is 1.442, which is the expected value of poultry production when all predictors are zero. This highlights the critical role of social support systems, access to resources, and community networks. Previous studies align with these results, Izadi *et al.,* (2024) showed that access to social capital, such as cooperative networks and local knowledge-sharing, enhances poultry farming outcomes. Moreover, social factors like family labor, education, and community involvement have been found to increase productivity, as they contribute to improved farm management and resource utilization efficiency (Kehinde *et al.,* 2021).

The study has found that, an increase in experience by one unit is statistically significant influence an increase in poultry production by .031 units (B = .031, p = .000). The findings suggest that experience plays a crucial role in enhancing poultry production. As farmers gain more experience, they develop better skills, knowledge, and efficiency in managing their poultry projects, leading to higher productivity. Similar studies have demonstrated that experience significantly boosts agricultural productivity. For instance, Mavhura *et al.,* (2022) has shown that seasoned farmers apply more effective techniques and adapt to challenges better, leading to improved production outcomes. This aligns with the idea that experience contributes to the success of poultry farming practices.

For every single unit change of family size, the increase in family size was also found statistically significant lead to an increase in poultry production by .049 units (B = .049, p = .000). This implies, the larger family sizes positively influence poultry production in the local area, where the modern technology is very expensive. Availability of more labor within the household, allowing for better management of poultry activities, thus contributing on productivity. This finding concurs with Ren *et al.,* (2019) who found that, the larger families tend to have more human resources available for farm work, which contributes to increased productivity. Generally, in rural agricultural settings it has consistently found that, family labor plays a crucial role in improving farming production, (Mukherjee et al., 2019).

Table 4. Relationship between social factors and the poultry production

Independent Variables	Coefficients			t-Value	*P*-Value
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta		
Dependent Variable: Poultry production					
(Constant)	1.442	.187		4.048	.000
Experience	.031	.011	.213	4.668	.000*

Independent Variables	Coefficients			t-Value	*P*-Value
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta		
Family size	.049	.014	.283	8.621	.000*
Age	.010	.007	.119	1.904	.058
Sex	.029	.018	.023	7.857	.069
Education level	.009	.033	.019	.460	.646
Marketing information	.045	.019	.178	.489	.625
Self-prepared feeds	.165	.043	.292	3.008	.003*
Observed R-square					0.894
Adjusted R-square					0.890
F – change	3.477				0.002

*Significance at 5%

With regard to self-prepared feeds the coefficient was statistically significant (B = .165, p = .003). Thus, an increase in self-prepared feeds by one unit is associated with an increase in poultry production by 0.165 units. The results indicate a significant positive relationship between self-prepared feeds and poultry production, suggesting that poultry producers who utilize their own feeds or their own produce enhance productivity. Using self-prepared feeds leads to better adaptability and resilience in farming. Almekinders *et al.,* (2019) indicated that farmers who rely on locally sourced feeds achieve higher yields and lower production costs.

3.4 Relationship between economic factors and poultry production

Concerning identified economic factors influencing poultry production, Table 5 display model results indicated a goodness of fit. The Adjusted R-square 0.835 implies 83.5% of the variance in poultry production is explained by the model. The results from independent variables are as such that: An increase in lower quality chicks by one unit is associated with a decrease in poultry production by .897 units. The result is statistically significant at (B = .897, p = .000). The increase in lower quality chicks leads to poor production outcomes, indicating that the quality of inputs is crucial for maximizing poultry productivity. Farmers using subpar chicks face challenges in achieving optimal production levels. Previous studies have confirmed that, the quality of chicks directly affects poultry performance. Apalowo *et al.,* (2024) highlighted that low-quality chicks exhibit higher mortality rates, slower growth, and increased vulnerability to diseases, resulting in lower overall productivity.

In relation to technology level, an increase in technology level by one unit is associated with an increase in poultry production by .125 units (B = .125, p = .000). The above findings implies that there is a statistically significant relation between technology level and the poultry production. The findings indicate that advancements in technology significantly boost poultry production in Hai district. Farmers who adopt modern technologies, such as improved feeding systems, incubation techniques, and disease management, achieve better productivity. This suggests that technological integration plays a crucial role in enhancing efficiency and output in poultry farming. Takahashi *et al.,* (2020) have shown that the adoption of technology in agriculture leads to increased productivity, reduced labor costs, and better disease control. In regions where farmers utilize modern tools and practices, poultry production is more efficient, with higher yields and better profitability.

Technological advancements have a substantial impact on chicken production since they improve efficiency, productivity, and overall management of poultry (Szőllősi *et al.,* 2021). Introduction of new technologies, such as automated feeding systems, climate control, and, minimise the amount of labour

needed for daily activities. These advancements enable meticulous regulation of food, ambient circumstances, and disease control, resulting in enhanced growth rates, reduced mortality, and greater well-being of the birds. In addition, technology aids producers in optimising production processes, forecasting market trends, and efficiently managing resources.

Findings declare a positive relationship between income earning among and poultry production. The results are such that, an increase in the income level of a poultry producer by one unit is statistically significant influencing an increase in poultry production by .259 units (B = .259, p = .000). The above findings implies that there is a statistically significant relation between income level of poultry producer and the poultry production. The findings indicate that higher income levels among poultry producers in Hai district positively influence their production capacity. With increased income, farmers invest more in quality inputs, better equipment, and improved management practices, resulting in enhanced poultry productivity. Balehegn *et al.,* (2020) showed that higher income allows farmers to adopt advanced technologies and access better resources, leading to improved productivity.

Income level significantly impacts poultry production by enabling investment in resources, technology, and operational improvements (Chibanda *et al.,* 2022). Furthermore, increased income allows producers to buy high-quality inputs, invest in technology, and improve farm management. Authors such as (Adomako & Ahsan, 2022) have indicated that limited financial resources can limit investment and limit the capacity to withstand market changes.

The findings of this study resemble that of Gaspard *et al.,* (2022) who found that the economic factors such as water availability, income level and cost of feed do influence the poultry egg production. Poultry production is greatly affected by feed costs, as they constitute the majority of operational expenses. As clearly indicated by (Azabo *et al.,* 2022) that the increased feed expenses might diminish profitability, prompting producers to lower expenditures on health management, so adversely affecting the quality of poultry. (Martin *et al.,* 2020) supported that reducing the expenses for animal feed can increase the overall profitability for producers. This in turn enables poultry producers to allocate funds towards improving their facilities, providing healthier diets for the animals, and pursuing development prospects.

Table 5. Influence of economic factors on poultry production

Coefficients					
Independent Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t-Value**	***P*-Value**
	B	Std. Error	Beta		
Dependent Variable: Poultry production					
(Constant)	.169	.434	0mo	.390	.000
Flock size	-.033	.077	-.424	-6.937	.0801
Cost of feeds	-.230	-.086	-.266	2.117	.008*
Water availability	.020	.099	.024	.206	.837
Lower quality chicks	-.897	-.194	-.570	-4.635	.000*
Technology level	.125	.020	.447	6.248	.000*
Income level of poultry producer	-.259	.072	-.246	-3.608	.000*
The market prices	.074	.119	.033	.624	.533
Observed R-square					0.841
Adjusted R-square					0.835
F – change	2.14				0.000

*Significant at 0.05

Through the use of interview guide, the study respondents indicated the economic variables which normally affects poultry production, the findings from the study shows that,

The fluctuating cost of feed is a significant obstacle. Since feed constitutes a large portion of the production cost, any increase in prices directly impacts our profitability. High feed costs often lead to compromises in poultry feed quality and quantity, potentially impacting growth rates and overall health (Respondent 4, 2024).

For the cost of feeds, an increase in cost of feeds by one unit is associated with an decrease in poultry production by .230 units (B = .230, p = .008). The results indicate a significant relationship between feed costs and poultry production, suggesting that as feed costs rise, poultry production decreases. This show that, farmers are not able to adjusting their production strategies to compensate for higher feed expenses, possibly by investing more in quality feed to optimize production efficiency.

Munguti *et al.,* (2021) have shown that farmers respond to rising feed costs by optimizing feed quality and adopting cost-effective feeding strategies to maintain or increase production levels. They highlighted that managing feed efficiently is crucial for profitability in poultry farming, reinforcing the strong link between feed costs and production outcomes.

3.5 Technical factors influence poultry production

Table 6 provides results for technical factors influence poultry production. The model results indicated a goodness of fit with Adjusted R-square 0.858. This implied that, 85.8% of the variance in poultry production is explained by the model. The veterinary service was found having a positive relationship with an increase in poultry production though not statistically significant. This implies there is no direct influence veterinary services on poultry production but regular veterinary care may contribute on diseases prevention, enhance bird health, and improve overall flock productivity. This suggests that veterinary services are a critical technical factor in boosting poultry output. Doss *et al.,* (2022) showed that regular animal health check-ups and vaccinations reduce mortality rates and increase production efficiency. The availability of veterinary care is linked to improved bird health and productivity, reinforcing the critical role of technical support in poultry farming.

Pérez-Flores (2025) indicated some poultry producers fail to acquire veterinary services due to a combination of financial constraints, lack of awareness, and accessibility issues. The cost of veterinary care can be prohibitive, especially for small-scale or subsistence farmers with limited financial resources, making it challenging to afford regular health services or emergency treatments. In addition to that, the findings from the interview guide concerning the access to veterinary services shows that,

> *For my poultry, I depend on both private and government veterinary officers to access the necessary services. Private veterinary officers provide a range of services including regular health check-ups, emergency care, vaccinations, and treatments. I use their services when I need quick and reliable assistance, especially during urgent situations when immediate care is crucial. I also utilize the services of government veterinary officers, who offer support through scheduled visits and extension services (Respondent 5, 2024).*

With regard to stocking density, found positive and significant (B = .603, p = .000). influencing poultry production. An increase in stocking density by one unit is associated with an increase production by .603 units. The stocking density plays a critical role in poultry production, with higher density correlating positively with increased output. This suggests that when poultry farmers optimize the number of birds per unit area, they achieve greater production efficiency, provided the conditions are well managed to avoid overcrowding. Bergeron *et al.,* (2020) showed that efficient management of stocking density is essential for maximizing poultry productivity. Proper stocking density ensures optimal use of space and resources, leading to better growth rates and health of the birds. However, overcrowding leads to negative impacts, reinforcing the need for balance in density management.

Table 6. Technical factors influence poultry production

Independent Variables	Coefficients			t-Value	*P*-Value
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta		
Dependent Variable: Poultry production					
(Constant)	2.526	.315	2.213	8.026	.000
Veterinary services	.130	.089	.138	1.465	.145
Stocking density	.603	.157	.631	3.841	.000*
Poultry system (Broiler Vs Layers)	.508	.381	.498	6.265	.276
Heating system	-.044	.092	-.039	-.485	.628
Water system	-.267	.127	-.156	-2.101	.337
Lighting system	.024	.072	.024	.329	.743
Ventilation	-.722	.380	-.696	-4.016	.401
Observed R-square					0.863
Adjusted R-square					0.858
F – change	1.510				0.165

3.6 Contribution of the study

In summary, the study has found that, significant factors influence poultry production in Tanzania are poultry producer' experience, change of family size, self-prepared feeds, technology level, change in the income level of a poultry producer. Others are cost of feeds and stocking density. Details are in Table 7. This study contributes to the Neoclassical Theory of Production by empirically validating how economic and technical factors influence poultry production efficiency in Hai District. The findings reveal that economic elements such as feed cost, income level, and market prices have a significant impact on production, aligning with the theory's emphasis on resource allocation and cost minimization to maximize output. Additionally, the study highlights the role of technical factors like veterinary services and modern poultry systems in enhancing productivity, supporting the theory's focus on the importance of technological advancement in production processes. Through a demonstration of the practical application of these factors in a specific context, the study expands the understanding of how traditional and modern farming practices interact, providing valuable insights into optimizing poultry production in similar rural settings. This helps to refine the theoretical framework by incorporating real-world agricultural dynamics.

Table 7. Summary results that significantly influence the poultry production

Independent Variables	Coefficients			t-Value	*P*-Value
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta		
Dependent Variable: Poultry production					
Experience	.031	.011	.213	4.668	.000*
Family size	.049	.014	.283	8.621	.000*
Self-prepared feeds	.165	.043	.292	3.008	.003*
Cost of feeds	-.230	-.086	-.266	2.117	.008*

	Coefficients				
Independent Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t-Value**	***P*-Value**
	B	**Std. Error**	**Beta**		
Lower quality chicks	-.897	-.194	-.570	-4.635	.000*
Technology level	.125	.020	.447	6.248	.000*
Income level of poultry producer	-.259	.072	-.246	-3.608	.000*
Stocking density	.603	.157	.631	3.841	.000*

Conclusion

Determinants of poultry production in Hai District, Tanzania is characterized by a combination of social, economic and technical factors. This study concluded that self-prepared feeds by the farmers, family size, and experience in poultry keeping are social factors influencing poultry production. Whereas, quality chicks, technology level, income were concluded as economic factors influencing positive, the poultry production, but feed cost concluded to have negative influence. Lastly, stocking density and veterinary services support increase in poultry production. This study recommends that poultry farmers should focus on growing high-yield breeds. Stakeholders should prioritize circular economy sustainability practices by utilizing poultry waste as organic fertilizer. Inclusive sustainable rural development policy approach is recommended to integrate training and veterinary extension services to empower poultry producers transferring acquired knowledge across generations. Policymakers should address market access, fair pricing and input subsidies to boost income levels and minimize feed cost incurred by poultry farmers. Future research should examine the effectiveness of various training programs and extension services in bridging the knowledge gaps related to modern poultry health management.

Limitations

This study was limited to small holder poultry farmers, and focused on social, economic and technical factors using cross-sectional data. The study on technical efficiency in production, effectiveness of various training programs and extension services in bridging the knowledge gaps related to modern poultry health management were beyond the scope of this study.

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