Research Article

# Classification and Productivity of Smallholder Broiler Farms in the Pwani Region, Tanzania

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**Abstract** | Understanding the current performance of the broiler sub-sector in terms of production and finance is crucial for developing and implementing effective plans to enhance and improve it. Hence, the objective of this study is to classify the surveyed farmers in the coastal region of Tanzania based on their rearing characteristics. It also aims to evaluate their productivity by establishing an operating account for one broiler per group of identified farmers. Additionally, the study seeks to identify the factors that may influence the productivity of broiler farms. To this end, 78 broiler farmers were selected using a non-probability snowball sampling method. Information was collected on farmers, flocks, production costs and farm incomes. From this data, eight variables were selected and subjected to a principal component analysis (PCA), enabling three groups of farmers to be distinguished. The productivity of each group was assessed based on the economic information collected from the farmers. Overall, the results showed that the number of birds per flock was less than 1000 on farms ranging in size from 81.2 to 206.3m$^2$. Farmers used more family labour (89.7%) to raise broilers. The grouping of respondents showed that 59% of them (group 1) were beginners of about 47 years of age with an average of 5 years of poultry farming experience, who made more profit from their production than the rest of the older and more experienced farmers (groups 2 and 3). This study therefore showed that the productivity of broiler farms in the coastal region of Tanzania was low to average, and the reasons for this included the high cost of poultry inputs, the inefficiency of poultry farming management, and the selling price of broilers.

**Keywords** | Broiler. Farmers. Productivity. Factors. Coastal region. Tanzania.

**Received** | November 23, 2023; **Accepted** | January 06, 2024; **Published** | January 08, 2024
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**Citation** | Gomez RSA, Mbaga SH (2024). Classification and productivity of smallholder broiler farms in the pwani region, tanzania. J. Anim. Health Prod. 12(1): 31-39.
**DOI** | http://dx.doi.org/10.17582/journal.jahp/2024/12.1.31.39
**ISSN** | 2308-2801



## INTRODUCTION

Tanzania, one of the coastal countries of East Africa, has almost 14.3 million people affected by food insecurity and malnutrition that is further exacerbated by difficult access to animal protein (PAM, 2022). To increase animal protein availability while developing the household economy and improving nutrition, exotic poultry breeds have been introduced since 1937 (Munisi et al., 2016). These breeds include broilers, which are used in commercial farming and have enormous potential in terms of a short production cycle, low capital investment, rapid yield and high-quality protein production (Kawsar et al., 2013; Eze et al., 2017; Molnar, 2017; Yohannes and Tekle, 2018). According to Mahmoudi et al. (2015) and Sanka et al. (2020) commercial broiler farming also has the advantage of ensuring fairly rapid capital turnover. It is mainly practised in urban and peri-urban areas and by small and medium-sized Tanzanian producers with flocks of between 200 and 2,000 birds (Munisi et al., 2016; MLF, 2019). This sub-sector provides most meat from the modern poultry sector (FAO, 2015). Although there are no accurate and up-to-date statistics on the broiler population in Tanzania (Msoffe et al., 2018), this sub-sector has significant po-

tential to improve the poultry value chain and increase the income of Tanzanian broiler farmers (EKN, 2018).

Despite the numerous advantages associated with the broiler sub-sector, small-scale producers are encountering difficulties in advancing their farming activities. This can be attributed to several factors, including inadequate management practices, outdated equipment, high input costs, and unreliable supply chains (FAO, 2015). These challenges severely impact the efficiency and profitability of poultry businesses. Weak management and inefficiency within poultry enterprises not only hinder the growth of the industry but also have a direct impact on household incomes. It is crucial to address these issues and implement strategies to improve management practices, modernize equipment, optimize input costs, and establish reliable supply networks (Kawsar et al., 2013; PAM, 2022; Yekosabeth et al., 2022). By doing so, small-scale broiler producers can enhance their farming operations, increase productivity, and ultimately improve their financial stability (PAM, 2022). The aim of this study is therefore to classify the farmers surveyed in the coastal region of Tanzania according to their rearing characteristics, to assess their productivity by establishing an operating account for one broiler for each group of farmers identified, and then to deduce the factors that may influence the productivity of broiler farms in the study area.

## MATERIAL AND METHODS

### Study area

Most of the commercial poultry farms (layers and/or broilers) surveyed in Tanzania were mainly located in the Pwani administrative regions, making the coastal region the site of this study, in particular the Kibaha and Mlandizi councils. Kibaha Town Council is one of 7 councils in the coastal region (Pwani). Covering an area of 750km$^2$, it lies between latitude 6.8° South and longitude 38.2° and 38.5° East. It borders the Kinondoni district to the east, Kisarawe to the south, Bagamoyo and the town of Mlandizi to the north. Mlandizi is a medium-sized town in the coastal region, covering an area of 84km$^2$ and is located between 6.7° South latitude and 38.73° East longitude.

### Sampling design

A total of 78 broiler farmers were selected using the non-probability snowball sampling method (Orounladji et al., 2022). The principle of this method is to select samples based on their knowledge network (Kone et al., 2018). Thus, the first farmer designated the other farmer in the same area who could also be interviewed (Kouassi et al., 2019).

### Data collection

Information on the farmer (age, family structure, size of farm and type of labour), flock size and production aspects were collected from each household. This information was supplemented by the investment costs and revenues of the broiler farms surveyed. Costs and income were of two types, namely fixed and variable costs, income from the farm as a whole and income from broiler production alone. Fixed costs included the cost of setting up buildings and purchasing rearing equipment, while variable costs included the cost of day-old chicks, feed and water, veterinary care, labour, electricity, etc. (Tandoğan and Çiçek, 2016). Total farm income was estimated from all cash inflows per month and income from broiler farming was estimated from the number of birds sold per month and the selling price per bird (Coulibaly et al., 2018).

Information on the economics of these farms was collected retrospectively from the farmers, making it possible to establish the operating costs of a broiler chicken and to estimate the profit margin and the productivity of these farmers. The details used to draw up the operating account were presented in Table 1.

### Statistical analysis

From the quantitative data (age of the farmer, household size, herd size, etc.), presented in the form of mean ± standard deviation, eight variables were selected and subjected to a principal component analysis (PCA), which was carried out using the factoextra package (Kassambara and Mundt, 2020). This analysis led to the emergence of three homogenous groups of farmers whose characteristics were compared using the non-parametric Mann-Whitney U test. All statistical analyses were done using R software, version 4.0.5 (R Core Team, 2021).

## RESULTS

### Characteristics of Broiler farms

Generally speaking, the farms surveyed were located in small areas and had few livestock buildings. However, the size of the broiler flock was around 1,200 head per batch and more than seven batches of broilers could be reared per year (Table 2).

Being a commercial activity, the majority of broilers reared on the farms surveyed were intended for sale. The labour force on farms in the coastal region was of the family type, to which could be added the work of an employee or occasional help in carrying out the rearing work (Table 3).

### Classification of farmers surveyed

To assess the production potential of the respondents, eight variables selected from the data collected in the field

**Table 1:** Description of the components of a broiler operating account.

| Name | Description | Formula |
|---|---|---|
| Turnover (1) | Total profit or income from broiler farming per bird (Kawsar et al., 2013; Yekosabeth et al., 2022) | (1) = Unit price of broiler chicken |
| Broiler chicken | Finished product of chicken rearing | Broiler chicken = Unit purchase price defined by the breeder |
| Intermediate consumption (2) | Variable costs involved in the production of a broiler chicken | (2) = Σ Variable production costs |
| Purchase of chicks | Estimated purchase price of a day-old chick based on farmers' responses | |
| Starter feed | Based on information gathered from farmers on the cost of feeding broilers and the number of heads reared per batch, a broiler's overall feed cost (noted $FC_{broiler}$) was calculated. With information on the quantity of starter, grower and finisher feed used and the purchase price of a 25kg bag of this different feed, it was estimated that the costs of starter, grower and finisher feed represented 36.66%, 24.26% and 39.08% respectively. | Starter feed = [36.66 * $FC_{broiler}$] / 100 |
| Grower feed | | Grower feed = [24.26 * $FC_{broiler}$] / 100 |
| Finisher feed | | Finisher feed = [39.08 * $FC_{broiler}$] / 100 |
| Drinking water, Transport, Heating, Electricity | Costs of drinking water, transport, heating and electricity per broiler. | Estimated from the cost of drinking water for 500 broilers during a breeding cycle. |
| Disease prevention | Allocated expenditure estimated by the farmer for the purchase of disinfectants, cleaning products, vaccines and vitamins for broiler rearing. | Disease prevention = Total cost of disease prevention per batch / Number of broilers reared per batch. |
| Disease treatment | Purchase cost of veterinary medicines estimated by the farmer for rearing a broiler chicken. | Disease treatment = Total cost of disease treatment per batch / Number of broilers reared per batch. |
| Added value (3) | Profit generated by rearing a broiler chicken. | (3) = (1) – (2) |
| Depreciation (4) | Represents the depreciation of the real estate (poultry houses), drinkers and feeders. The depreciation of poultry houses, drinkers and feeders has been estimated on the basis of their lifespan, the investment cost and the number of animals reared per year. | (4) = Σ Depreciation of hen houses + depreciation of drinkers + depreciation of feeders. |
| Labour force (5) | An annual lump sum fee has been estimated for the labour involved in rearing broilers according to farmer's responses. | (5) = Annual labour costs / Total number of birds reared per year. |
| Net operating income (6) | Real profit or profit margin from rearing a broiler chicken after deducting variable costs and fixed costs. | (6) = (3) – [(4) + (5)] |
| Total cost (7) | Sum of all costs involved in the production of a broiler chicken (variable costs, depreciation and labour) | (7) = (2) + (4) + (5) |
| Rate of return (8) | Level of profitability of broiler rearing | (8) = [(6) * 100] / (7) |
| Productivity (9) | Represents an approximation of the ratio Benefits (sales)-Costs of production giving a slightly adjusted ranking of Kawsar et al. (2013) and de Yekosabeth et al. (2022):<br>Low productivity [0.45-1.000];<br>Medium productivity [1.003-1.25]; and High productivity [1.30-3.812] | (9) = (1) / (7) |

**Table 2:** Production characteristics of the 78 broiler farms surveyed in the coastal region of Tanzania.

| Variables | Mean ± Standard error |
|---|---|
| Number of broiler chickens raised (birds) | 772.4 ± 1184.5 |
| Size of farm ($m^2$) | 250.0 ± 995.7 |
| Number of units (poultry house) | 2.5 ± 1.6 |
| Number of broilers' batches raised per year (batches) | 9.8 ± 6.9 |

**Table 3:** Purpose of broiler production and labour force on 78 farms surveyed in the coastal region of Tanzania.

| Variables | Number | Percentage (%) |
|---|---|---|
| Reasons of bird production | | |
| Sale | 64 | 82.1 |
| Consumption | 8 | 10.3 |
| Other | 3 | 3.8 |
| Labour force | | |
| Employee | 19 | 24.4 |
| Family | 70 | 89.7 |
| Casual labour | 3 | 3.8 |
| Other | 3 | 3.8 |

**Table 4:** Contribution of the axes to the classification of the 78 broiler farmers surveyed in the coastal region (Tanzania)

| Axes | Eigen value | Percentage of variance | Cumulative percentage of variance |
|---|---|---|---|
| 1 | 1.85 | 23.14 | 23.14 |
| 2 | 1.76 | 22.02 | 45.15 |
| 3 | 1.14 | 14.22 | 59.38 |

**Table 5:** Variables explaining the classification of the 78 broiler farmers surveyed in the coastal region of Tanzania (mean ± sd)

| Variables | Group 1 (n=46) | Group 2 (n=13) | Group 3 (n=19) | *p*-value |
|---|---|---|---|---|
| Farmer age (year old) | $47.5 \pm 11.0^{c}$ | $54.3 \pm 8.5^{b}$ | $60.9 \pm 7.0^{a}$ | <0.001*** |
| Farm's income per month (TSH)# | $1178043.5 \pm 1037072.0^{b}$ | $5533846.2 \pm 8274745.3^{a}$ | $620736.8 \pm 651784.9^{b}$ | <0.001*** |
| Broiler farm income (TSH) | $1128391.3 \pm 1043199.5^{b}$ | $3711538.5 \pm 1993338.3^{a}$ | $490263.2 \pm 650595.1^{c}$ | <0.001*** |
| Number of broilers' batches raised per year | $7.4 \pm 2.7^{b}$ | $16.5 \pm 7.5^{a}$ | $8.6 \pm 4.4^{b}$ | <0.001*** |
| Household size (persons) | $4.9 \pm 1.6^{b}$ | $5.1 \pm 1.7^{b}$ | $7.0 \pm 2.6^{a}$ | <0.001*** |
| Size of farm ($m^2$) | $81.2 \pm 56.0^{b}$ | $271.5 \pm 315.5^{a}$ | $206.3 \pm 226.2^{a}$ | <0.001*** |
| Number of broiler chickens raised | $451.2 \pm 294.2^{b}$ | $731.5 \pm 583.3^{a}$ | $788.4 \pm 860.5^{a}$ | 0.0415* |
| Experience in poultry keeping (year) | $5.23 \pm 4.1^{b}$ | $7.0 \pm 3.8^{b}$ | $20.9 \pm 8.5^{a}$ | <0.001*** |

# TSH (Tanzanian Shilling): 1USD is equal to 2515.00 TSH. Significance level: * = p-value < 0.05, *** = p-value < 0.001. The letters a, b and c indicate that the means in the same row show significant differences ($p<0.05$).

**Table 6:** Operating account (in TSH) for the production of one broiler over four weeks of rearing, practised by the 78 respondents in the coastal region of Tanzania.

| Component | Group 1 (n=46) | Group 2 (n=13) | Group 3 (n=19) |
|---|---|---|---|
| Turnover (TSH) | 6000 | 6000 | 6000 |
| Broiler chicken | 6000 | 6000 | 6000 |
| Intermediate consumption (TSH) | 5212.6 | 5610.5 | **12138** |
| Purchase of chicks | 2500 | 2500 | 2500 |
| Starter feed | 820.8 | 978.4 | 3383.4 |
| Grower feed | 543.2 | 647.4 | 2239 |
| Finisher feed | 875 | 1043 | 3606.8 |
| Drinking water | 11.1 | 10 | 10 |
| Transport | 53.2 | 48 | 48 |
| Heating | 55.4 | 68.3 | 63.4 |
| Electricity | 44.3 | 40 | 40 |

| | | | |
|---|---|---|---|
| Disease prevention | 146 | 113.2 | 103.6 |
| Disease treatment | 163.6 | 162.2 | 143.8 |
| Added value (TSH) | 787.4 | 389.5 | **-6138** |
| Depreciation | 96.1 | 27.7 | 72 |
| Workforce | 179.7 | 49.7 | 88.5 |
| Net operating income (TSH) | 511.6 | 312.1 | **-6298.5** |
| Total cost (TSH) | 5488.4 | 5687.9 | **12298.5** |
| Rate of return (%) | 9.3 | 5.5 | **-51.2** |
| Productivity | 1.09 | 1.05 | **0.49** |

Exchange rate: 1 USD = 2515 TSH

were analysed. Figure 1a shows the eight variables that were subjected to principal component analysis (PCA) and from which axes 1, 2 and 3 were formed. Based on the coordinates of the observations on these factorial axes obtained from the PCA, three homogeneous groups of broiler farmers were identified (Figure 1b). Figure 1a also shows a good correlation between certain variables represented by each axis according to the three clusters. The correlation between farmer age, poultry experience and household size was 23.14%. For variables such as the number of birds reared per batch and farm size (axis 2) and the number of batches reared per year, income from broiler farming and overall farm income (axis 3), the correlation was 22.02% and 14.22% respectively.

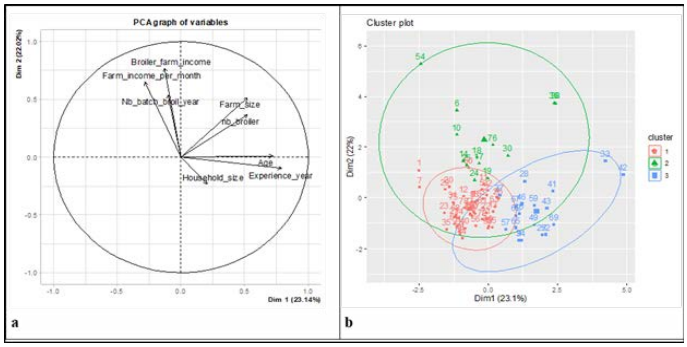


**Figure 1:** (1a) Variables scores in relation to the first and second factors derived from the PCA performed on variables considered for the classification of the 78 broiler farmers surveyed in the coastal region; (1b) Identified broiler groups (Group one in red, Group two in green and Group three in blue).

The cumulative effect of these three axes was greater than 50% (59.38%) (Table 4), proving that there was diversity within the farms surveyed. Cluster characteristics were presented in Table 5. In terms of individuals, cluster 1 accounted for 59% of respondents, cluster 2 for 16.7% and cluster 3 for 24.2%.

Table 5 shows the three groups of broiler farmers identified based on the selected variables. Group 1 was mainly characterised by farmers with an average age of 47 years, five years of experience in poultry farming and a household of about four people. These farmers kept an average of 451 broiler chickens in an area of about 81m$^2$, earning them about 1,128,391 Tanzanian shillings (TSH) per flock reared. They could rear up to seven batches of broilers per year, while also carrying out secondary activities. Their combined activities (broiler rearing and secondary activities) gave them an average monthly income of TSH 1,178,043.

Group 2 farmers were on average 54 years old and had seven years of experience in poultry farming. They had around five family members and a flock of 731 broilers. The average size of their farms was 271m$^2$. The average income from their broiler farming business was TSH 3,711,538 and per year they were able to rear around 16 batches of broilers. Their overall income averaged TSH 5,533,846 per month.

The farmers in the last group had an average age of 60 and 20 years of experience in poultry rearing. Their household consisted of around seven people. They were able to rear eight batches of broilers per year, with around 788 heads per batch, on a 206m$^2$ farm. The average income from broiler farming was TSH 490,263 and that from the farm as a whole was TSH 620,736.

## Financial analysis of broiler rearing

The evaluation of the respondents' productivity was completed by an analysis of the financial transactions for the production of a broiler raised for a four-week cycle (Table 6).

The production costs, rate of return and productivity of the farms surveyed were calculated based on farmers' estimates and declarations. The table shows that broiler production appeared to be a profitable activity for groups 1 and 2. Group 1 farmers had a profit margin of 511.6 TSH per bird, a rate of return of 9.3%. Group 2 farmers had a profit margin of 312.1 TSH per bird, giving a return on investment of 5.5%. Group 3 farmers were found to be making a loss (-51.2% TSH per bird), as their investment was rather

higher than their turnover. In broiler farming, only groups 1 and 2 were able to create added value of TSH 787.4 and TSH 389.5 respectively. Despite these results, the respondents were classified into two categories according to their productivity. Farmers in groups 1 and 2 had average productivity (productivity between 1.003-1.16) while those in group 3 had low productivity (productivity between 0.45-1.000).

## DISCUSSION

The average flock size obtained in this study was between 200 and 1000 birds which implied that the respondents were small-scale poultry farmers (FAO, 2015; Ohajianya et al., 2013; Zinsou, 2019). However, these numbers were lower than those reported by Drif et Mahdi (2017) (average of 3,895 birds) and Aggouni et Attig (2020) (3,526 birds per flock) in Algeria. Available space, number of chicken houses and other production constraints such as feed costs could have influenced the number of broilers reared by the farms visited. Mbuza et al. (2017) also reported the availability of space, funds, day-old chicks or other resources as constraints for small-scale broiler producers to have large rearing populations. Furthermore, the number of flocks reared per year was higher than the results of Mahmoudi et al. (2015) (2.8 flocks/year), Drif et Mahdi (2017) (4-6 flocks/year) and Aggouni et Attig (2020) (4-5 flocks/year), which could mean that farmers in the coastal region were taking advantage of the limitations they faced, particularly space, to compensate for the small flock sizes noted. Similarly, the small flock sizes and increased number of batches could be associated with markets where it is easier to dispose of small numbers of broilers and the lack of cold chain facilities for carcass preservation. This finding would also imply that sometimes animals of different ages could be reared at the same time. All of these production characteristics were similar to the indicators for commercial farms in Sector 3 (Zinsou, 2019). According to these authors, sector 3 comprises small-scale commercial poultry farms operating in a semi-intensive system where the number of birds is below 2,000 and the level of biosecurity is low to minimal.

Most of the broilers raised were marketed by the respondents, which is similar to the results of Loukou et al. (2021), where the majority of products from broiler rearing went to market. Given that any economic activity aims to earn income (Afolabi et al., 2013; Selma et Alloui, 2015) and that broiler rearing represents a profit-making economic activity for the farmers surveyed, it would therefore be normal for most of the finished products to be destined for sale. The workforce was mainly family-based and few farmers employed permanent or occasional paid labour. This result differs from those of Mbuza et al. (2017) and Aggouni et Attig (2020), where salaried labour was the most common, but is similar to the results of Drif et Mahdi (2017), where family labour was more common. This could be explained by the fact that broiler rearing is perceived by respondents as an economic activity designed to satisfy family needs and not as an activity in its own right. Thus, the importance of an employee who will be paid to carry out rearing tasks may not be perceived. In fact, respondents employed permanent or casual paid labour when they or members of their family were not available. The latter form of work was a feature of a minority of farmers, who did not hesitate to accept help from anyone on the farm at the time of need. These people could be customers, neighbours or even visitors. All these facts showed that traffic restrictions on farms or in buildings were not effective and meant that farmers either ignored them or deliberately disregarded them.

Regarding the classification of the broiler farms surveyed, a comparison of the 3 groups showed that the farmers in group 1, followed by those in group 2, made a higher profit margin from their production than the farmers in group 3. In fact, given their age, year of experience, herd size and farm area, farmers in group 1 could be considered beginners in commercial poultry farming (Akanbi et al., 2020) and those in groups 2 and 3 as being the oldest and most experienced in this field. According to Loukou et al. (2021), older and more experienced farmers are likely to be classified as reference farmers with a better approach to broiler rearing. This appeared to apply to farmers in group 2 but not to those in group 3. Although group 3 had more experience, the profit margins achieved were the lowest. This finding is similar to the results of Yekosabeth et al. (2022), who noted that poultry farming experience and production efficiency were negatively correlated. For some older farmers, including retirees, investing in broiler farming seemed easy and was a way to generate additional income and remain engaged in a physical and productive enterprise. In addition, younger producers may be more likely to adopt more efficient production methods than older farmers (Mahjoor, 2013). These findings showed the need for technical assistance to be provided to farmers, in this case, the older ones, in terms of effective technical and financial management (e.g., training in agricultural accounting) to improve profitability while mitigating potential breeding risks. Household size, which varied from four to seven people, could also have influenced the choice of family labour, as also noted by Ohajianya et al. (2013) and Otunaiya et al. (2015). The broiler farm income represented 67 to 96% of the farm's income, thus proving that broiler rearing was the main source of income for the respondents and that secondary activities were complementary (Akanbi et al., 2020).

About the broiler operating account, the rate of return,

which measures the economic performance of a business (Akanbi et al., 2020), suggested that broiler farming in the study area yielded little profit per bird sold. As mentioned above, the factors contributing to low margins could be linked to production and marketing factors such as input costs, flock size and the price of broilers. Indeed, the costs of purchasing chicks and feed were relatively important in the overall cost of production. Aggouni et Attig (2020) also noted that the prices of livestock inputs, poultry houses and the selling price of animals could have an impact on farmers' profit margins. Mbuza et al. (2017) also believed that keeping fewer birds (less than 1000 animals/flock) could influence the farmer's financial performance. The rearing period adopted by the farmers surveyed was four weeks, which was less than the standard rearing time for broiler chickens of 39 to 42 days (Ralivhesa et al., 2013). According to Aggouni et Attig (2020), the production costs of standard chicken (broiler) were considerably reduced with this standard time. It was therefore expected that the production cost of a broiler on the farms visited would be lower, which unfortunately was not the case for all the respondents, especially those in group 3. The four-week duration could mean that farmers were trying to offset high production costs while adapting to market demands by rearing birds that were often sold before reaching standard weights of around 2kg. In addition, the price of carcasses was not based on the finished weight of the birds but rather on an arbitrary value depending on supply and demand. A low-rearing period could be the basis for producing lighter broilers to reduce production costs and satisfy customer demand and purchasing power. Taken together, these results would further contribute to the low to medium productivity levels of the farms visited. According to Kawsar et al. (2013), PAM (2022) and Yekosabeth et al. (2022), age, experience in poultry farming, high production costs, the size of poultry farms and the selling price of broilers were key factors affecting productivity among commercial broiler farmers. According to Adesiyan (2014), high family size reduces the technical efficiency of poultry farming. FAO (2015) noted that the overall performance of broiler production in Tanzania was not optimal, confirming the results of this study.

## CONCLUSIONS

This study conducted in the coastal region of Tanzania revealed that broiler farmers predominantly operated on a small scale, relying heavily on family members for labor in their rearing activities. Based on age, income, household size, flock size, farm size, number of batches per year and experience in poultry keeping, three distinct groups of farmers were identified. The study findings indicated that broiler rearing in this region exhibited relatively low levels of productivity. Interestingly, the research also discovered that younger and less experienced farmers attained higher profit margins compared to their older and more experienced counterparts. The low productivity of broiler farms in the coastal region of Tanzania can be attributed to several key factors, including the high costs of poultry inputs, inefficiencies in poultry farming practices, small flock and farm sizes, and challenges related to the selling price of broilers. In order to address these challenges and pave the way for future strategies and interventions to optimize broiler production, it is recommended that the government provide support in the form of subsidized poultry farming inputs. This would help alleviate the financial burden on farmers and make the necessary resources more accessible. Additionally, organizing technical training programs for farmers would be beneficial in improving their knowledge and skills in efficient broiler farming practices. These measures would not only enhance productivity but also contribute to the overall development and growth of the broiler farming sector in the coastal region of Tanzania.

## ACKNOWLEDGEMENTS

The authors thank the Partnership for Skills in Applied Sciences, Engineering & Technology Regional Scholarship and Innovation Fund, the Department of Animal, Aquaculture and Range Sciences (Sokoine University of Agriculture), the Mawazo Institute, the Southern African Centre for Infectious Disease Surveillance Foundation for One Health, as well as the Livestock Extensions and all the respondents of study areas and Dr Isabella Mandl.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## NOVELTY STATEMENT

There are many advantages to raising broiler chickens. However, small-scale producers in this sub-sector are struggling to develop their farming activities. This study will enable them to identify their groups on the basis of their rearing characteristics in order to deduce their productivity and any obstacles they face or could face in their rearing activities.

## AUTHOR CONTRIBUTIONS

The first draft of the manuscript was written by [Rogia S.A. Gomez] and all authors commented on previous versions. All authors read and approved the final manuscript.

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