

Analyzing Production Cost of Chicken and Eggs in Sri Lanka: A Rapid Assessment 2023

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Abstract

Recent increase in chicken meat and egg prices in Sri Lanka has been attributed to several factors. One significant issue was insufficient local production of maize, which was the main ingredient in poultry feed, resulting in a steady increase in feed prices. Additionally, the tax imposed on commercial poultry feed and feed ingredients, shortage of day-old chicks (DOCs), and improperly maintained parental stock contributed to the recent increase in chicken meat and egg prices in Sri Lanka. Hence the objectives of the study are to determine the production costs of one kilogram of chicken meat and table eggs for small-scale, medium-scale, and large-scale producers. The sample was selected using a multi-stage random sampling technique. Data was collected from September to October 2023. Eighty farms were visited including 47 chicken meat producers and 33 egg producers. The cost of production and feed cost of eggs and meat at large-scale, medium-scale, and small-scale producers were calculated separately. The total cost of production of one kilogram of chicken meat with skin was 863.69 LKR/kg for small-scale farmers and 731.99 LKR/kg for large-scale farmers whereas the cost for one kilogram without skin was 912.59 LKR/kg for small-scale farmers and 773.14 LKR/kg for large-scale farmers. The total cost of production of one egg was 34.82 LKR for large-scale and 43.81 LKR for small-scale producers.

Keywords: *Cost of Production, Chicken Meat, Eggs, Large-Scale, Small-Scale*

Introduction

The poultry industry in Sri Lanka has witnessed significant growth and development over the past three decades. Poultry farming has become widespread throughout the country, with both traditional village chicken breeds and exotic and improved strains (broiler/layer) playing important roles in the industry (Silva *et al.*, 2010). Considering the present status of the Sri Lankan poultry industry, the production of poultry feed was 1,176,630 mt, chicken meat production was 228,130 mt, and the production of eggs was 2,089.7 million in 2023. Additionally, the per capita availability of chicken meat was 10.2 kg in 2022 and the per capita availability of eggs was 93 in 2023 (Department of Census and Statistics, 2023). The annual average retail price of broiler chicken meat has significantly increased from 679.00 LKR/kg in 2021 to 1,126.00 LKR/kg in 2023. The price has shown an upward trend up to now. The retail price of chicken was 1,412.00 LKR in May 2023 (Figure 1).

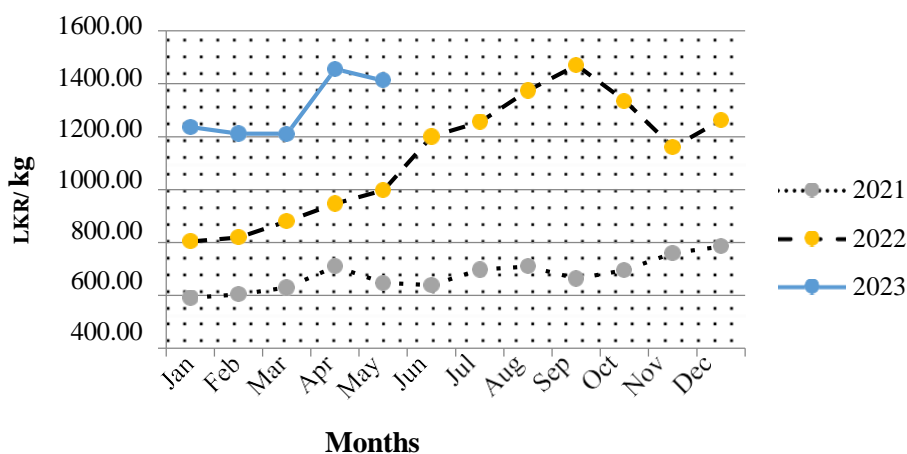


Figure 1: Price Behavior of Broiler Chicken (LKR/Kg) in 2021-2023

Source: Authors (Data Management Division, HARTI)

According to the price data of Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) 2023, it showed that both wholesale and retail prices of brown and white eggs have increased significantly from June 2022 up to now. The average retail price of eggs has doubled in 2022 compared with 2021. It has been reported average retail price of brown and white eggs was around 52.00 LKR and 50.00 LKR respectively in 2023 (Figure 2). In the meantime, the government has imposed a maximum retail price for both brown and white eggs that are 46.00 LKR and 44.00 LKR respectively with effect from 20th April 2023. However, according to the Poultry

Industry Monthly Bulletin February 2023, Department of Animal Production and Health (DAPH), the cost of production for eggs has ranged from 34.97 LKR/egg to 40.71 LKR/egg while the chicken meat production cost is 1,132.39 LKR/kg. In addition, there is no maximum retail price for chicken meat at present.

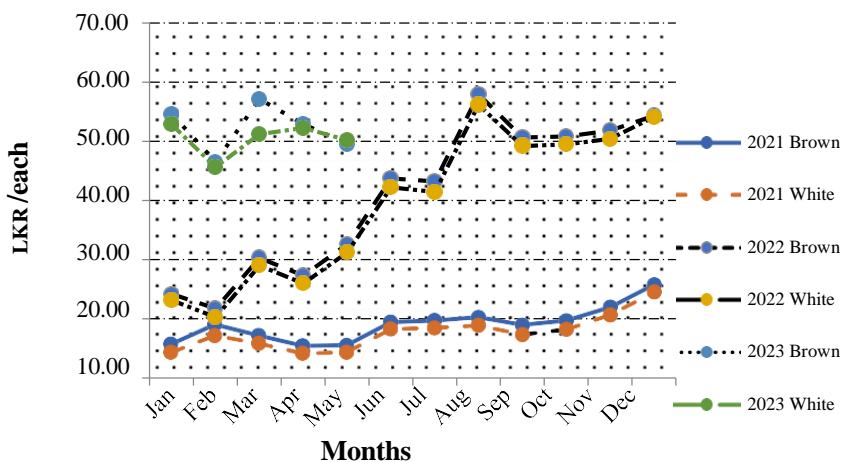


Figure 2: Retail prices of brown and white eggs (LKR/each) in 2021-2023
Source: Authors (Data Management Division, HARTI)

The production cost of chicken meat and eggs in Sri Lanka was influenced by various factors, including feed production challenges, tax impositions, and economic events. Additionally, the insufficient local production of maize, the main ingredient in poultry feed, has led to a steady increase in feed prices and a significant drop in feed production, further impacting the industry. Furthermore, the tax imposed on commercial poultry feed and their input feed ingredients has maintained a smaller parent stock flock, resulting in a shortage of day-old chicks (DOCs) and the mixing up of grade 1 and grade 2 DOCs by most hatcheries. These challenges have contributed to the recent increase in chicken meat and egg prices in Sri Lanka, prompting the need for a comprehensive analysis of the production cost dynamics. Hence the objectives of this study were to calculate the cost of production of one kilogram of chicken meat with skin and without skin at small-scale, medium-scale, and large-scale producers and to calculate the cost of production of eggs at small-scale, medium-scale, and large-scale producers.

The rest of this paper is organized as follows: literature review in Section 2, the methodology in Section 3, results and discussion in Section 4, and Section 5 is the conclusion.

Literature review

Broiler chicken meat dominates the meat industry in Sri Lanka (Silva *et al.*, 2010). The production of broiler chicken meat has increased rapidly in recent years due to higher demand compared to other meat types (Silva *et al.*, 2010). The country has a mix of small-scale retailers selling chicken meat independently and large-scale local manufacturers producing whole chicken meat and meat products (Devine, 2003). The poultry industry in Sri Lanka has experienced significant growth in recent years while providing a significant contributor to the country's economy. It involves various types of production systems, including large-scale commercial farms, buyback operations, small-scale farms, and backyard systems (Prabakaran, 2003).

Most chicken farms were located in the North Western region, with almost half of them categorized as large-scale farms (Silva *et al.*, 2010). The demand for chicken meat in Sri Lanka was particularly high during festival seasons, especially in April and December (Wickremasinghe *et al.*, 2015). The poultry sector in Sri Lanka was well-established compared to other livestock industries in the country (Wickremasinghe *et al.*, 2015). The industry has experienced significant expansion, particularly in the broiler sector, due to the active involvement of the private sector (Department of Census and Statistics, 2014). According to Devine (2003), global meat consumption continues to rise at a rapid pace, surpassing other agricultural commodities. This growth was attributed to increasing incomes, evolving consumer preferences in emerging economies, and the declining costs of meat production and prices.

In Sri Lanka, the meat industry remains a crucial component of the livestock sub-sector, with chicken meat accounting for approximately 70 percent of this sector (Silva *et al.*, 2010). The industry's ability to sustain itself is largely due to the current purchasing habits (Wickremasinghe *et al.*, 2015). However, among Sri Lankan meat consumers, chicken meat was the most popular source of animal protein, followed by preferences for pork, mutton, and beef (Silva *et al.*, 2010). The sector has been highly profitable and notably contributed to the country's Gross Domestic Product (GDP). In 2019, the poultry sector contributed 0.38 percent to Sri Lanka's GDP, which accounted for 64 percent of the total contribution from the livestock sector (Department of Census and Statistics, 2020). However, the COVID-19 pandemic and subsequent economic crisis had a significant impact on the poultry sector's growth in the following years. Despite these challenges, the poultry industry remains a vital component of Sri Lanka's livestock sector and continues contributing to the country's economy.

In 2020, there was a 2 percent decrease in production and a 1 percent reduction in the global chicken meat trade (US Department of Agriculture, 2020). These declines were attributed to various factors, including lockdown measures, disruptions in global poultry supplies, and fluctuations in feed quantity and prices, shipments, and meat availability (US Department of Agriculture, 2020).

The layer industry in Sri Lanka has experienced rapid growth in recent decades, with a reported population of 16.02 million layers and 2.20 million backyard poultry as of 2021 (Livestock Statistical Bulletin, 2021). The egg industry in Sri Lanka was capable of meeting the local demand for eggs, which is estimated to be 21.8 million for the population. The most recent data suggests that the total egg production in Sri Lanka reached 2,934.55 million, with an annual per capita consumption of 132.3 (Livestock Statistical Bulletin, 2021). However, the consumption, buying behavior, and perception of eggs within the community were influenced by various factors, including socio-economic and cultural aspects. Misconceptions about eggs, particularly related to health concerns such as the risk of coronary diseases due to daily consumption, may impact consumer behavior (Wickremasinghe *et al.*, 2015). It was noted that consuming eggs up to one egg daily reduced the risk of cardiovascular diseases (Drouin *et al.*, 2020). Additionally, the American Heart Association recommends a daily cholesterol intake limit of 300 mg on average, which aligns with the cholesterol content of a single egg.

The per capita availability of chicken increased from 6.8 kilograms in 2012 to 10.7 kilograms in 2021, indicating an increase in consumption. Similarly, the per capita availability of eggs reached 132 in 2021 compared to 112 in 2012 (Livestock Statistical Bulletin, 2021). Additionally, chicken meat production increased by 9.5% in 2020 compared to 2012. The per capita consumption of chicken meat and eggs had changed from 100 grams and 38 eggs in 1980 to 10.68 kilograms and 132 eggs in 2021 (Livestock Statistical Bulletin, 2021). According to the Department of Census and Statistics in 2023, there were broiler farms of 7001 (chicken below 1000) and 1055 (chicken over 1000) whereas egg-producing farms of 16,086 (chicken below 1000) and 718 (chicken over 1000). Private companies were in charge of the chicken production, with advance contracts mostly for small-scale broiler production for the supply of inputs and marketing.

Considering the livestock sector in Sri Lanka, the poultry industry showed the fastest growth expanding the fastest was the poultry industry. In 2020, poultry accounted for 65 percent of all livestock in Sri Lanka and 0.68 percent of the country's nominal GDP (Department of Animal Production and Health, 2022). Since 2020, the poultry industry had to adapt to a new normal because of COVID-19 control measures, which have increased production chain expenditures. With the country's economic downturn, limits on the import of commodities and import procedures were put in

place, severely harming production operations. Since the majority of the restrictions were implemented in the latter half of 2021 and 2022, the effects were felt in 2022 (Department of Animal Production and Health, 2022). The more noticeable effects were emphasized as being huge increases in production costs, a decline in agricultural productivity, a shortage of raw materials, and a fuel shortage.

The current economic crisis in the country is expected to have a significant impact on feed production. However, the production of maize within the country has helped to mitigate the effects of the crisis on feed production (Department of Animal Production and Health, 2022). In the year 2021, the Maha season recorded the highest maize yield in the last decade, reducing the need for importing cereals for feed production (Department of Animal Production and Health, 2022). This increase in maize production has played a crucial role in ensuring an adequate supply of poultry feed in 2021, despite the challenges faced by the industry in importing feed raw materials.

The world market prices of raw materials have been on an inclining trend, leading to continuous increases in feed prices throughout the year 2021 (Department of Animal Production and Health, 2022). On average, feed prices have seen a close to 35% increase while looking ahead to 2022, there was a predicted drop in egg and meat production, which required a feed production of 1,200,000 metric tons for the industry (Department of Animal Production and Health, 2022).

The minimum requirement for cereals is estimated to be around 450,000 metric tons (Department of Animal Production and Health, 2022). However, the foreign currency shortage worsened in 2022, making it more challenging to import raw materials for feed production (Department of Animal Production and Health, 2022). Factors such as the lack of foreign currency at local banks, changes in letters of credit (LC) terms, price increases in the world market, rapid depreciation of the local currency (LKR), and difficulties in locating freight are hindering the importation of raw materials. However, without the government's ability to allocate around 30 to 35 USD per month for feed raw material importation, a severe depletion in feed production was expected (Department of Animal Production and Health, 2022).

Methodology

Pannala, Dummalasuriya, Katupotha, Bingiriya, Paduwasnuwara, Wariyapola, and Kobeigane Veterinary Surgeon (VS) divisions in the Kurunegala district and Mahakubukkadawala, Puttalam, and Anamaduwa VS divisions in the Puttalam district were selected as study locations. The large-scale farm is farm rearing more than 50,000 birds and 10,000 to 49,999 birds per flock rearing farm is a medium-scale farm while the small-scale farm is the farm rearing less than 10,000 birds per flock for broiler or egg purposes. Details of the poultry farms were collected from the Department of Animal Production and Health registries. 125 farms were expected. However, due to the present conditions of the industry, it was unable to reach the expected sample because most of the farms were closed and some of the selected farms were not willing to reveal information. Hence sample was selected mainly based on accessibility to the farms and their information.

During the study, a total of 80 farms were interviewed from chicken meat and egg producers. There were 47 broiler farms and 33 layer farms. Since during the study the expected sample number was not reached; key informant interviews were conducted in the Western Province. Because most of the head offices of large-scale poultry farm players were in the same province. Key informant interviews are conducted to gain in-depth understanding and insights from individuals who have specialized knowledge and unique perspectives on the poultry industry. Even though the sample size was not large enough to capture the diversity of perspectives these key informant interviews allow for a detailed and comprehensive analysis of the poultry industry.

The sampling technique was a multi-stage random sampling. Data was collected from September to October 2023. When conducting multi-stage random sampling in the poultry industry, VS divisions in the Kurunegala and Puttalam districts were selected. Then the total sample was divided into three scales by considering the market supply share 60 percent from large-scale farms, 25 percent from medium-scale farms 15 percent from small-scale farms. Primary data was collected to calculate the cost of production of both broiler chicken meat and eggs. The data was gathered through a structured questionnaire from a selected sample. At the same time, key informant interviews were conducted covering the Western Province to gather data and information from actors of the value chain for both layer and broiler meat production.

The cost of production of eggs and meat at large-scale, medium-scale, and small-scale producers, and feed cost distribution of eggs and meat were calculated separately. The data was analyzed using the Statistical Package for the Social Sciences (IBM/ SPSS, 2005) and Excel (version, 2019). Considering the components of cost of production (COP), fixed costs include housing depreciation, interest on

capital invested, repairs, and maintenance. Subsequently, equipment depreciation, repairs, and maintenance while land rent and capital were invested in land.

Considering the components of cost of production (COP), variable costs include the cost of purchasing Day Old Chicks (DOCs), the cost of feed, and wages for workers involved in feeding, cleaning, and managing the poultry. Subsequently, utilities include electricity, water, heating, and cooling costs while vaccines, medications, and veterinary service costs. Miscellaneous variable costs were bedding material, waste disposal, transportation, insurance, and other miscellaneous costs.

When determining the annual depreciation, divide the total cost of the fixed cost by its useful life then add annual repairs and maintenance costs.

$$\text{Fixed Cost Depreciation}_{\text{Annual}} = \frac{\text{Total Cost of Fixed Asset}}{\text{Useful Life Time}} + \text{Repairs and Maintenance}_{\text{Annual}}$$

When determining the total feed cost based on feed consumption rates and duration,

$$\text{Feed Cost}_{\text{Variable}} = \text{Number of birds}_{\text{Total}} \times \text{Feed Consumption}_{\text{Bird}} \times \text{Cost}_{\text{Unit Feed}}$$

When determining the sum of wages paid to the workers,

$$\text{Labour Cost}_{\text{Variable}} = \text{Number of workers}_{\text{Total}} \times \text{Wages}_{\text{Per worker}}$$

When determining the average total cost of production,

$$\text{Cost of Production}_{\text{Total}} = \text{Total Fixed Costs}_{\text{Total}} + \text{Variable Costs}_{\text{Total}}$$

When determining the feed conversion ratio (FCR),

$$\text{Feed Conversion Ratio}_{\text{FCR}} = \frac{\text{Total quantity of feed consumed}}{\text{Mean body weight gain}}$$

This study followed an experimental procedure outlined below in Figure 3.

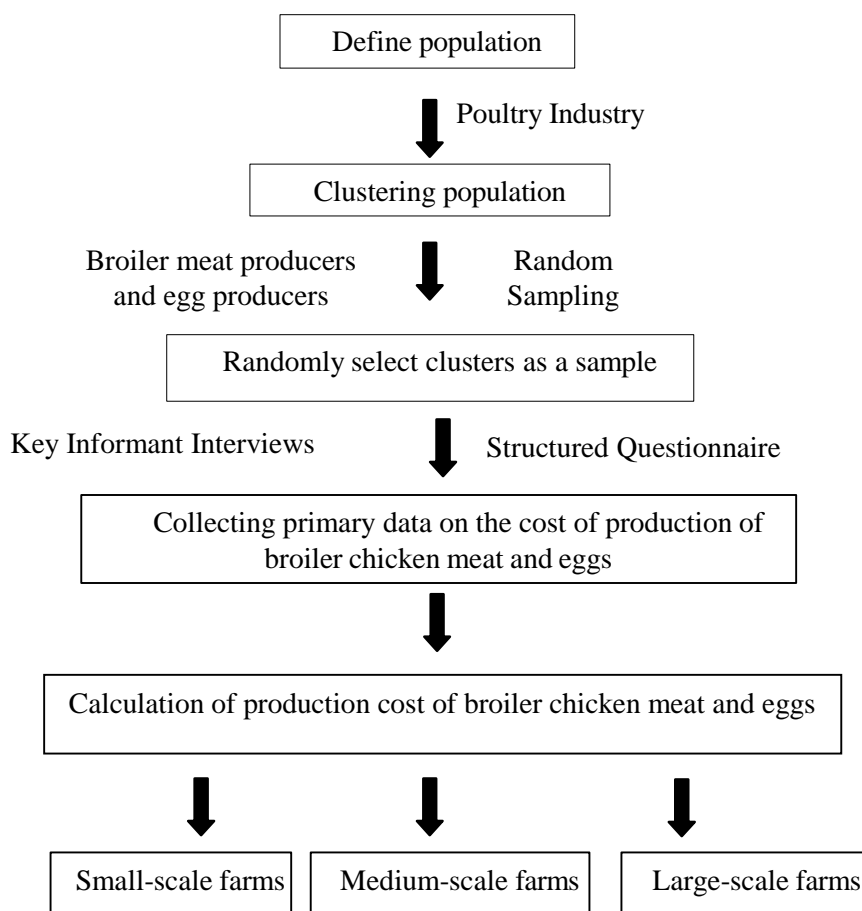


Figure 3: Research framework of the study
Source: Authors

Results and discussion

The cost of production of one table egg was calculated at large-scale, medium-scale, and small-scale levels. All the cost items including fixed costs and variable costs have been considered when calculating the cost of production (COP) of eggs. Poultry house preparation cost, feeders and auto drinkers, chick crates, and manual drinkers were the main variables of the fixed cost. All the fixed cost variables depreciated according to the number of flocks for the entire lifetime of particular cost items. Cost for day-old chicks, feed and medicine costs, labor costs, and other variable costs are included in the variable costs. According to Table 1, 34.82 LKR/egg for large-scale farmers, 39.51 LKR/egg for medium-scale farmers, and 43.81 LKR/egg for small-scale farmers spent on producing one egg. According to the study average number

of eggs produced by one hen was 250 to 280 eggs per year while the average weight of one hen used for the production of curry chicken ranging from 1.2 to 2.0 kg and the retail price was considered for the calculation of this income.

Table 1: Cost of production of table eggs (LKR/egg)

Cost Items	Large		Medium		Small	
	LKR/egg	%	LKR/egg	%	LKR/egg	%
Depreciation cost of Fixed cost	0.01	0.032	0.06	0.130	0.43	0.927
Day-old chick cost	1.60	4.323	2.01	4.747	2.61	5.619
Chicks transport cost	0.001	0.003	0.005	0.011	0.027	0.058
Feed cost - up to laying	0.032	0.088	0.045	0.107	0.050	0.108
Laying feed cost	33.27	89.960	36.51	86.322	36.74	79.187
Electricity cost	0.07	0.197	0.09	0.208	0.25	0.543
Medicine cost	0.39	1.044	0.97	2.299	0.31	0.667
Labor cost - Female	0.80	2.169	1.63	3.851	2.85	6.147
Labor cost - Male	0.71	1.927	0.94	2.219	3.05	6.578
Rice husk cost	0.09	0.234	0.03	0.077	0.06	0.136
Litter removing cost	0.01	0.023	0.01	0.026	0.005	0.010
Other costs	0.0002	0.001	0.0009	0.002	0.0093	0.020
Total cost	36.98	100	42.30	100	46.40	100
Income received from curry chicken (-)	-2.16		-2.78		-2.59	
Net cost of Production	34.82		39.51		43.81	

Source: Authors (HARTI survey data, 2023)

Considering the depreciation costs, large-scale operations benefited from economies of scale, as it spread the fixed costs of equipment and facilities over a larger number of units (more birds, more eggs). This reduces the per-unit depreciation cost. However, in small-scale the fixed costs including depreciation are divided among fewer units, resulting in a higher per-unit depreciation cost. Large-scale farms typically use their equipment more efficiently and continuously due to their higher production volume. This higher utilization led to better amortization of the equipment costs. Small-scale farms did not use their equipment as intensively, leading to underutilization and relatively higher depreciation costs per unit of production (Table 2, 3).

Table 2: Depreciation costs related to fixed costs in broiler farm

Depreciation costs	Large	Medium	Small
Depreciation cost for poultry house (one bird)	7.38	11.8	22.2
Depreciation cost for house repair (one bird)	0.63	3.04	10.38
Depreciation cost of feeders (one bird)	0.52	1.72	1.32
Depreciation cost of drinkers (one bird)	0.45	0.97	0.58
Depreciation cost of chicks' crates	0.10	0.13	0.11

Source: Authors (HARTI survey data, 2023)

Table 3: Depreciation costs related to fixed costs in layer farm

Depreciation costs	Large	Medium	Small
Depreciation cost for poultry house (for 1 egg)	0.009	0.04	0.34
Depreciation cost for house repair (for 1 egg)	0.0008	0.0025	0.026
Depreciation cost of feeders (for 1 egg)	0.0006	0.002	0.036
Depreciation cost of auto drinkers (for 1 egg)	0.0004	0.0019	0.018
Depreciation cost of chick crates (for 1 egg)	0.0001	0.0004	0.005

Source: Authors (HARTI survey data, 2023)

Feeding cost was the main contributory cost item of COP of eggs. Around 90 percent of the total COP was the feed cost for large-scale producers while it was 86 percent for medium-scale producers and around 79 percent for small-scale farmers. A large share of the COP was the feed cost of egg production. The farmers highlighted that feed costs have increased more than three times compared to 2021. The feeding cost varied with brands, quality, and different feed formulas. The average feed cost for the first 18 weeks of birds (up to laying) varied from 200.00 LKR to 226.00 LKR and feed cost after 18 weeks of birds (Laying period) varied from 154.00 LKR to 181.00 LKR (Table 4).

Table 4: Feed cost distribution of table egg production

Feed cost (Rs/kg)	Feed costs up to 18 weeks for birds			Feed cost after 18 weeks of birds till culling		
	Large	Medium	Small	Large	Medium	Small
Mean	200	201	226	181	154	159
Minimum	179	165	165	170	140	104
Maximum	274	250	350	195	170	201

* The recommended period for Day-Old Chicks (DOCs) to start laying eggs is around 18 weeks of age

Source: Authors (HARTI survey data, 2023)

The feed cost per unit in medium and small-scale poultry farms was lower than in large-scale farms due to small and medium-scale farms producing their feed or sourcing it locally, which reduced transportation and middleman costs. Moreover, smaller farms often purchase directly from local feed mills, avoiding additional costs associated with large-scale supply chains.

Cost for day-old chicks was the next highest cost variable which was around 4 to 6 percent among different scales. It ranged between 475.00 LKR to 550.00 LKR for large-scale farms. Day-old chick cost has varied from 210.00 LKR to 870.00 LKR among medium-scale farms. For small-scale farmers, it varied from Rs. 200.00 to Rs. 1,200.00 LKR. This is one of the major issues currently faced in the sector. This huge price variation for small-scale farmers is a result of the ability of medium-scale farms to negotiate as they purchase chicks in bulk. Small-scale farmers, purchasing fewer chicks, do not benefit from bulk discounts and therefore have to pay higher per-unit costs. Furthermore, small-scale farmers often purchase through several intermediaries, each adding their markup, leading to higher costs. But medium-scale farmers buy directly from hatcheries, avoiding additional costs added by middlemen, while small-scale farmers rely on local distributors. Day-old chicks supply was not adequate to fulfill the demand of the sector. Therefore, hatcheries have increased the deposit amount while ordering day-old chicks. Before the crisis, the hatcheries had to place a deposit of 25,000.00 LKR for 1,000 chicks but it has increased to 200,000.00 LKR. In contrast, hatcheries were unable to meet the demand. As a result of the shortage supply of day-old chicks in the market, a black market for day-old chicks has emerged. When the hatchery price of a day-old chick was 550.00 LKR, the black-market price was 1,100.00 LKR to 1,200.00 LKR. This was the reason for the huge variation in the day-old chick market prices. On the other hand, it was a major constraint to enter the sector as well as small-scale and medium-scale farms exist in the sector. It was observed that most of the farms were not functioning at their full capacity of production.

According to the study the average weight of broiler chicken ranged from 1.5 to 2.5 kg. At the farm level, egg waste occurred due to several factors including infertility, damage, poor quality, disease, overproduction, and grading. Those wastes were calculated under miscellaneous costs. According to Table 6, the fixed costs were 34.71 LKR/bird for small-scale farmers, 17.91 LKR/bird for medium-scale farmers, and 9.05 LKR/ bird for large-scale farmers. When considering the fixed costs most large-scale farms had automated systems while some had battery cage systems. Small-scale farms had deep litter systems. Hence even the initial investment was high on a large scale; with the time value of money, it had less fixed cost compared to small-scale farms. Moreover, cages in small-scale farms' durability were low. Hence, frequent maintenance should be performed on small-scale farms and ultimately it increases the cost of production.

Table 5: Feed cost distribution of meat production

Item (Rs.)	Small	Medium	Large
Total Fixed Cost (with Poultry House & Equipment depreciation cost) per Bird	34.71	17.91	9.05
Cost per Day Old Chick (DOC)	371.29	350.40	190.75
Cost of Transportation for One Chick	1.87	1.56	1.00
Total Feed Cost for One Bird	642.34	610.39	747.90
Electricity and Water Cost for One Bird	6.71	9.20	10.13
Medicine Cost for One Bird	10.01	11.29	8.06
Labor Cost for One Bird	33.71	29.80	23.86
Paddy Husk Cost for One Bird	4.54	6.50	5.80
Cost for Removing Litter per Bird	3.29	3.40	3.88
Other Miscellaneous Cost per Bird	2.64	4.60	5.93
Processing Cost: Slaughtering/Cleaning/Skin Removal/Packaging	19.86	13.40	9.82
Total Cost for One Bird Up to Start Processing	1111.12	1045.05	1006.35
Total Cost for One Live Bird with Processing Cost	1130.01	1057.80	1015.49
Cost for One kg (With Skin)	863.69	794.95	731.99
Cost for One kg (Without Skin)	912.59	840.12	773.14

Source: Authors (HARTI survey data, 2023)

The average cost per day-old chick was 371.29/LKR per bird for small-scale farmers, 350.40 LKR/bird for medium-scale farmers, and 190.75 LKR per bird for large-scale farmers. Average feed costs were 642.34 LKR per bird for small-scale farmers, 610.39 LKR per bird for medium-scale farmers, and 747.90 LKR per bird for large-scale farmers (Table 5). Currently, there is a shortage of day-old chicks (DOC) in the market and consequently, the closure of small and medium-scale farms can be visible. However, with the economic crisis; farmers had to deposit around 200,000.00 LKR to buy thousands of DOCs. But when considering the small scale, they cannot place the order at once. As a result, small-scale farmers were unable to afford therefore they had to buy DOCs from the black market. In the black market, the prices of broiler DOCs ranged from 450.00 to 520.00 LKR (HARTI survey data, 2023). In this scenario, intermediaries were maintaining the black market while acquiring a huge profit margin. Some large-scale farmers had their hatcheries therefore transport cost was less compared to ordering DOCs from other hatcheries.

When considering variable costs, medicine was the second most contributory cost variable of COP of meat. The average medicine cost for a bird is 10.01 LKR per bird for small-scale farmers, 11.29 LKR per bird for medium-scale farmers, and 8.06 LKR per bird for large-scale farmers (Table 5). The small-scale farms' DOCs' mortality rate was 6-8 percent and large-scale farms were 2-4 percent (HARTI survey data, 2023).

Poultry diseases pose a significant challenge to the efficiency of production and profitability. Hence, this cost for the medicine should be critically evaluated when considering the costs of production. Even small-scale farms should pay attention to medication and safeguard against any zoonotic diseases that might by chance attack the flock and cause unprecedented loss of cash and meat. There was a relatively higher cost of production under good hygienic conditions on a large scale as compared to the average hygienic conditions due to the extra cost involved in maintaining good hygiene. However, the benefit of good hygiene was reflected in the numerically higher gross income and net profit in response to the good hygienic conditions.

Labor cost was 33.71 LKR per bird for small-scale farmers, 29.80 LKR per bird for medium-scale farmers, and 23.86 LKR per bird for large-scale farmers. When considering labor costs in small-scale farms they operated manually which increased the labor cost. But when considering large-scale farms most of them had fully automated systems which lowered the labor cost as compared to small-scale farms. The cost for removing litter per bird is 3.29 for small-scale farmers, 3.40 LKR per bird for medium-scale farmers, and 3.88 LKR per bird for large-scale farmers. The total cost for one bird up to start processing was 1,111.12 LKR per bird for small-scale farmers, 1,045.05 LKR per bird for medium-scale farmers, and 1,006.35 LKR per bird for large-scale farmers. A poultry farmer who wants top performance from his/her broiler flock must satisfy the birds' requirements through a carefully controlled management program that includes proper housing, lighting, nutrition, and disease control. Hence removing litter should be done properly.

The total cost for one live bird with processing was 1,130.01 LKR per bird for small-scale farmers, 1,057.80 LKR per bird for medium-scale farmers, and 1,015.49 LKR per bird for large-scale farmers (Table 5). The cost for one kg (with skin) was 863.69 LKR/kg for small-scale farmers, 794.95 LKR/kg for medium-scale farmers, and 731.99 LKR/kg for large-scale farmers whereas the cost for one kg (without skin) was 912.59 LKR/kg for small-scale farmers, 840.12 LKR/kg for medium-scale farmers and 773.14 LKR/kg for large-scale farmers. The improved feed, slaughter facilities, and processing technologies have increased the safety and efficiency of large-scale units rather than small-scale producers; hence total cost for one live bird with processing on a large scale was less compared to small-scale producers.

The cost for one kg (with skin) ranged from 790.70 LKR to 932.36 LKR/kg for small-scale farmers, 689.75 LKR to 841.58 LKR/kg for medium-scale farmers, and 651.84 LKR to 838.94 LKR/kg for large-scale farmers while the cost for one kg (without skin) ranged 835.88 to 984.74 LKR/kg for small-scale farmers, 729.16 to 889.67 LKR/kg for medium-scale farmers, and 689.08 to 884.82 LKR/kg for large-scale farmers. The cost to produce one kilogram at a small scale was high compared to a large scale as they have poor technology and most of the processing was done manually.

Feeding cost is the main contributory cost item of COP of meat. The total feed consumed by one bird was 3.39 kg/bird for large-scale farmers, 3.31kg/bird for medium-scale farmers, and 3.55 kg/bird for small-scale farmers. The benefits of broiler production depend on supplying the birds with the highest possible quality offeed. Feed millers face challenging times as prices of inputs including maize, and soybean have been rising like never before with the economic crisis. The time lag in decision-making and offering of the quota to maize imports resulted in most feed millers leaving the feed industry. Simultaneously, the scarcity of raw materials was one of the leading problems for feed mill operations, which influenced poultry feed price and quality found that feed conversion ratio was considered an important factor for determining the farm profitability, which resulted from the quality of chicks and feed and the broiler farm's management techniques. Almost the entire amount of soybean meal required for the feed industry is imported. Other ingredients such as fish meal, meat and bone meal, vitamins, minerals, and amino acid supplements as well as all feed additives are imported. In Sri Lanka, only 40 percent of maize was produced (Vidanapathirana *et al.*, 2022). Feed quality is vital, as it plays a significant role in both intake and digestibility.

Production of commercial poultry feed is subject to a 15 percent Value Added Tax (VAT), but not the production of other animal feed. The levy solely applies to commercial chicken feed, which lessens the competitive advantage of commercial feed manufacturers and causes the feed business to collapse. In actuality, it is a tax on the rise in poultry feed sales as it moves up that chain. Since the end consumer would ultimately be responsible for paying the VAT, it will essentially work as a tax on the domestic consumption of meat and eggs.

The feed conversion ratio (FCR) is the quantity of feed the bird consumes that can be transformed into one kilogram of live weight. It varied from 1.67 for large-scale farmers, 1.75 for medium-scale farmers, and 1.91 for small-scale farmers. For broiler producers, an FCR of 1.91 means that their chickens gain 1 kilogram of weight for every 1.91 kilograms of feed consumed. The lower the FCR denoted the more efficient birds are at converting feed into food. Feed and water were offered ad libitum on any system to maintain an effective FCR ratio. A large share of the COP is the feed cost of meat production. The farmers highlighted that feed costs have increased

more than three times compared to 2021. The feeding cost varied with brands, and quality and used different feed formulas. When considering the percentage of feed cost out of total cost per bird up to processing was around 57 percent for small-scale producers while it was 58 percent for medium-scale producers and around 73 percent for large-scale farmers.

Moreover, the average weight of a bird with skin was 1.38/kg for small-scale producers while it was 1.41/kg for medium-scale producers, and around 1.50/kg for large-scale farmers. Furthermore, the average weight of a bird with skin ranged from 1.40 to 1.63/kg for large-scale farmers, 1.33 to 1.55/kg for medium-scale farmers, and 1.16 to 1.63/ kg for small-scale farmers. The average weight of a bird without skin was 1.31/kg for small-scale producers while it was 1.33/kg for medium-scale producers, and around 1.42/kg for large-scale farmers. Furthermore, the average weight of a bird without skin ranged from 1.28 to 1.54/kg for large-scale farmers, 1.26 to 1.47/kg for medium-scale farmers, and 1.10 to 1.54/kg for small-scale farmers.

In summary, the total average percentage of feed cost out of the total cost was 64 percent, and ensuring optimal feed quality and maximum feed efficiency should be top priority for all scale producers.

Conclusions

The total cost of production of one kilogram of chicken meat with skin was 863.69 LKR/kg for small-scale farmers, 794.95 LKR/kg for medium-scale farmers, and 731.99 LKR/kg for large-scale farmers whereas the cost for one kilogram (without skin) was 912.59 LKR/kg for small-scale farmers, 840.12 LKR/kg for medium-scale farmers and 773.14 LKR/kg for large-scale farmers. The total cost of production of one table egg was 34.82 LKR for large-scale, 39.51 LKR for medium-scale, and 43.81 LKR for small-scale producers.

The Cost of Production (COP) studies conducted by the Department of Animal Production and Health (DAPH) for chicken meat and eggs came under criticism for not adequately capturing the reasons, particularly during the price surge around September 2023. In this context, the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) made an intervention through this study. During the study, it was noted that most poultry farmer organizations and associated organizations expressed concerns that the COP conducted by the DAPH did not encompass the detailed associated costs of production, including all variable and fixed costs. The involvement of HARTI in this context reflects the recognition of the need for a thorough analysis of the COP, taking into account the detailed various cost components associated with poultry production. The ground survey identified a black market in the Day-Old Chicks (DOCs) trade, which was not captured by the DAPH pointing to a significant market failure in the poultry industry, particularly affecting

small and medium-scale farmers. Hence this approach is crucial for decision-making government bodies and also for reconstructing the procedure of calculation COP while capturing all necessary ground-level details. This approach ensured that all cost factors were considered, leading to fair pricing, improved market stability, and sustainable profitability for poultry farmers.

The poultry industry is currently operating below its full capacity as a smaller parent stock flock leading to a shortage of day-old chicks (DOC). Hence proper parental line should be maintained after importing the parent stocks.

Currently, there is an issue with the quality of DOCs as most of the hatcheries mixed up the grade 1 and grade 2 DOCs. A proper monitoring system should be established to avoid those malpractices.

The tax imposed on commercial poultry feed and feed ingredients should be reduced to a reasonable level. Improve the tendency of all producers to opt for low-cost ingredients as alternative raw materials in feed manufacturing.

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