

POULTRY FEED PRODUCTION IN SRI LANKA:

**EFFECTS OF ECONOMIC CRISIS,
RESPONSE AND THE WAY FORWARD**

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FOREWORD

Poultry sector is the leading livestock industry in Sri Lanka supplying animal proteins to the nation. Though this industry was self-sufficient before 2020 it had to face numerous issues due to COVID-19 pandemic and economic crisis in the following years, causing a slight setback in the production status of the industry which has not fully recovered. The feed industry is the key to the backward linkage of the animal-based food system. Safeguarding the animal feed manufacturing industry is a significant step in ensuring the nutrition security of the country. In this backdrop, HARTI has conducted this study with the objective to examine the status, effects and crisis management strategies adopted by poultry feed manufacturers during the economic downturn in order to suggest policy implications to strengthen the poultry feed sector.

Study found that the current economic crisis has impacted the majority of commercial feed producers' and self-mixed producers' industry performances. High price and shortage of raw materials, foreign exchange crisis, taxation policy, poor quality of ingredients are the main issues face by the feed industry. It was observed diminishing of compound feed market as most of the poultry players decided to run their own feed mixing operations to cater to meet the demand for their company requirement (meat and egg production). More than 50 percent of the self-mixed feed production operations are seriously affected. Feed prices experiencing a steady increase for last couple of years and it is a significant determinant of the production cost per kg broiler or per egg.

This study highlights, in order to reduce COP of chicken and eggs, wide availability of poultry feed at reasonable prices is crucial. Feed industry depends more on imports for raw materials and prompt decisions on import policy should play a key role. Consistent supply of maize should be assured by increasing local production and making timely decisions on imports. An appropriate institutional and policy environment for competitive domestic feed production would allow all producers and consumers to benefit from poultry sector expansion.

This research report provides valuable insights into the challenges facing the poultry feed industry in Sri Lanka and it points out areas which require policy-intervention offers recommendations for addressing these issues. This report can make a significant contribution to understanding and addressing the challenges faced by the poultry feed industry in Sri Lanka.

Prof. A.L. Sandika
Director/Chief Executive Officer

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EXECUTIVE SUMMARY

Poultry sector is one of the fastest-growing livestock sub-sectors in Sri Lanka. Its contribution to GDP showed a gradual increase until 2019, yet was highly affected by the COVID-19 pandemic and economic crisis in the following years. Due to this, the poultry industry faced numerous issues, causing a slight setback in the production status of the industry which has not fully recovered. The feed industry is the threshold to the animal-based food system. Approximately 91% of compound animal feeds produced in Sri Lanka are for poultry as poultry is the fastest growing animal production sector in the country. Safeguarding the animal feed manufacturing industry is a significant step in achieving the nutrition security of the country. In this backdrop, HARTI has conducted this study with the objective to examine the status, effects and crisis management strategies adopted by poultry feed manufacturers during the economic downturn in order to suggest policy implications to strengthen the poultry feed sector.

The research employed key Informant interviews and structured questionnaires as primary data collecting tools. The data was collected from commercial feed producers-30 (large-scale, medium-scale and small-scale registered) and 60 self-mixed feed producers (unregistered) in Kurunegala, Gampaha and Colombo districts. A growth matrix was created to identify the impact of the recession and then classified the cases into two categories: vulnerability and resilience.

Considering the entire animal feed production in Sri Lanka, 78 percent constituted commercial feed production, with the remaining 22 percent being self-mixed feed production in 2022. Approximately 91 percent of commercial animal feeds produced in Sri Lanka are for poultry as the poultry sector is the fastest growing animal production sector in the country. Self-mixed feed producers play a vital role in the poultry value chain and their livelihood mainly depends on the poultry industry. There were about 45 registered commercial feed mills operating in the country in year 2022. Top five commercial feed manufacturers are occupying 80 percent of the total market share of commercial feed production in the country. In 2023, there was only one large scale manufacturer with the operational capacity of greater than 10,000mt/month as they have halved the feed production that was recorded before the economic crisis.

The study revealed that the economic crisis has impacted the majority of commercial feed producers' (93%) and self-mixed producers' (97%) industry performances. It was observed shrinking of compound feed market as most of the poultry players decided to run their own feed mixing operations to cater to meet the demand for their company requirement (meat and egg production). Compare to the value of sales and profit margins in 2022 with 2019, the majority (63%) of the commercial firms and 68 percent self-mixed firms experienced declining margins. According to the growth matrix, the majority of firms were affected by the recession and showed a declining growth throughout the economic crisis. It indicated that most of the poultry feed producing firms are vulnerable to the economic downturn. The crisis posed major challenges to firms of all sizes, but particularly small-scale firms. Resource scarcity

coupled with high price, and high dependency on external credit particularly made small firms vulnerable during the periods of economic downturns compared to larger enterprises with resource endowment and business know-how. The study shows that more than 50 percent of the self-mixed feed production operations are gravely affected by the economic downturn.

The main problems faced by poultry feed manufacturers were the increase in the price of raw materials required for the production of poultry feed, their shortage, foreign exchange crisis, rising prices in the international market, tax policy and poor quality of raw materials. Maize is the main ingredient in poultry feed and shortage of maize in the country occurred during 2022-2023 due to yield reduction of maize as a result of fertilizer and agrochemical ban that triggered a severe shortage of animal feed needed for the poultry industry. Further, supply chain issues during the Covid-19 lockdown and subsequent dollar shortage prevent maize importation. Once Covid-19 and economic crisis hit the country, importation of maize was further restricted in year 2021 under the government policy of banning import of crops that could be produced locally. As a result, maize prices have increased by 300 percent from 2018-2022. In addition, soaring dollar rate and depletion of foreign reserves, restricted importation of maize, soyabean meal and other vitamins and premixes. Almost the entire soybean requirement 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. Therefore, the cost of manufacturing poultry feed in Sri Lanka is subject to world market price fluctuations. Lack of foreign currency at local banks, changes in LC terms, price increase in world market, rapid depreciation of LKR and difficulties in locating freight are to name a few factors that impeded the importation of raw materials.

Multiple taxations are imposed at different stages of animal feed processing. The Value Added Tax (VAT) of 15% is charged on commercial poultry feed manufacturing excluding other animal feed. VAT is charged on feed ingredients and compound feeds leading to double taxation for feed ingredients and formula/compound feeds. The tax imposed only on commercial poultry feed reduces the comparative advantage of commercial feed manufactures leaving the feed industry.

It was observed that the adulteration of feed with lower quality feed material is a common practice due to; lack of access to laboratories that ascertain the quality; deterioration in feed quality during storage is also common. This occurs especially due to negligence of self-mixed feed manufacturers adhering to good practices of feed storage.

It was revealed that different feed manufacturers have adopted strategies to maintain the business performance. Due to unavailability of sufficient stocks and high prices of maize most of the feed manufacturers have used alternative raw materials such as broken rice, rejected rice and wheat flour while balancing the nutrition level of the poultry feed. Self-mixed producers use different types of available low-cost ingredients as alternative raw materials (biscuit powder, noodles, etc). Majority of the

commercial feed producers (80%) and self-mixed producers (67%) changed their poultry feed ration using alternative raw materials. However, this is not an unacceptable practice in feed. The government in a gazette notification has banned the use of any form of rice produce or import to Sri Lanka for poultry feed production. The failure to use rice – a better substitution in the absence of maize creates difficulties in manufacturing the required amount of feed forced feed producers to turn to high-cost substitutes, which in turn saw a feed price escalation and a significant drop in feed production. When using alternative feed materials, feed manufacture faced digestibility issues for birds. A solution was to use enzymes which is a costly solution plausible only for a handful.

Feed mills regulate their production schedule according to the demand of poultry farms. Currently all commercial poultry feed mills are operating below their installed capacity mainly due to low demand for the feed manufactured, which is mainly due to increased price of commercially mixed compound feeds because of value added tax charges, shortage of ingredients and inconsistent supply of electricity. Large-scale commercial feed producers utilized only 25-40 percent of the total installed capacity in 2022 and 2023. In order to minimize the effect of the current low demand for compound feeds, some of the feed processing enterprises are practicing vertical integration, i.e., engagement in modern livestock production (fattening, dairy, poultry and/or pig farming) in conjunction with the feed processing plant.

In order to promote poultry production, proper interventions are needed to increase the feed supply, provide technical knowledge to small scale feed producers in poultry feed ration formulations and utilization and marketing of underutilized alternative (non-conventional) feed resources produced as by-products from different agro-based industries in the country. It is important to encourage and support feed manufacturers to cultivate maize and soybean by providing incentives such as credit and land available. In order to reduce COP of chicken and eggs, wide availability of poultry feed at reasonable prices is crucial. The availability and cost of maize and soybean meal generally determines feed cost. Feed industry depends more on imports for raw materials and prompt decisions on import policy should play a key role. Consistent supply of maize should be assured by increasing local production and making timely decisions on imports. Introduction of business-friendly taxation schemes that promote poultry feed production and ensures the comparative advantage of scale of production which creates a level playing field for the poultry feed players is recommended. An appropriate institutional and policy environment for competitive domestic feed production would allow all producers and consumers to benefit from poultry sector expansion.

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LIST OF ABBREVIATIONS

AAF	-	Approved Animal Feed
CBSL	-	Central Bank of Sri Lanka
COP	-	Cost of Production
DAPH	-	Department of Animal Production and Health
DCP	-	Dicalcium Phosphate
DDGS	-	Distillers Dried Grains in Soluble
DOC	-	Day Old Chicks
EDB	-	Export Development Board
GDP	-	Gross Domestic Production
GP	-	Grand Parents
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
LC	-	Letter of Credit
LKR	-	Sri Lankan Rupee
MBM	-	Meat and Bone Meal
RM	-	Rapeseed Meal
SCL	-	Special Commodity Levy
SBM	-	Soya Bean Meal
SME	-	Small and Medium sized Enterprises
VAT	-	Value Added Tax

CHAPTER ONE

Introduction

1.1 Research Background

Feed is the most important component in any type of animal production system, especially for commercial purposes. Animal feed industry in Sri Lanka developed and expanded due to the development of the poultry sector and caters mainly to that sector. Poultry feeds are animal feed used to feed poultry birds. They are formulated from a mixture of ingredients, including cereal grains, cereal byproducts, fats, plant protein sources, animal protein sources and by-products, vitamin and mineral supplements, crystalline amino acids and feed additives compounded in such a way as to provide essential nutrients for sustaining optimum growth and production (Samarasinghe, 2007).

The contribution of the livestock sector to the GDP is only about 0.9 percent in 2021 (CBSL, 2021), which is mainly from the dairy and poultry subsectors. The chicken population in the country has increased up to 34.86 million birds in 2021 with an annual average growth of 14% from 2017 to 2021. Rapid growth was not observed in any other livestock subsector in the country. Chicken meat and egg production is likely to play an increasing role in supplying animal protein for human consumption in the country. Also, they are a relatively cheap and affordable source of animal protein (Alemce and Tedelle, 1997, as cited in Zeberga, 2010).

The rapid growth of the poultry sector demands more and more high-quality concentrate feed which open new avenues for large scale feed millers and raw material importers. Feed accounts for up to 50-70 percent of the cost of poultry production (Dejene, *et al.*, 2014). There are about 47 registered commercial feed mills operating in the country in 2021 (DAPH, 2022), which produce a standard mix of feed for sale at the mill gate or sell through their agents in depots scattered around the country. At present, the animal feed industry is completely managed by the private sector. Registered animal feed manufacturers are categorized according to their production capacity as large scale (>10,000mt/month), medium scale (5,000-10,000mt/month) and small scale (<5,000mt/month) (DAPH, 2022). The commercial feed manufacturers are formally regulated. All have licenses, registrations and certifications obtained from the Registrar of Animal Feed. Commercial feed production and raw material importation are regulated by the Animal Feed Act No. 15 of 1986, which was amended in 2016 as Animal Feed (Amendment) Act, No. 15 of 2016. The Registrar of Animal Feeds of the Department of Animal Production and Health (DAPH) is the licensing authority for the purposes of the Animal Feed Act. It was observed that different types of feed manufacturers use different types of ingredients in preparation of feed formulas. Self-feed mixtures use ingredients that are affordable to create customized feed.

Poultry feed production in the country has increased from 363.74 thousand mt (2012) to 1,025.93 thousand mt (2021). However, it has decreased in 2022 to about 836,138 mt which were produced by the registered commercial feed manufacturers in the country (76% of the total). The quantity of feed produced by self-mixed feed producers was 259,846 mt which was 24 percent of the total production (DAPH, 2022). Feed provided to poultry production should be well balanced for all nutrients and carefully produced. This can be achieved only if there is an organized feed industry (Premarathne and Samarasinghe, 2020). Approximately 96 percent of compound animal feeds produced in Sri Lanka are for poultry, with the remaining four percent being for all other kinds of compound feeds (DAPH, 2021). This is because the poultry sector has been the fastest growing animal production area in the country. Feed cost has also shown an increasing trend over the years (DAPH, 2021). This shows that higher prices of poultry feed have long been a nagging issue for the poultry industry in Sri Lanka as the local production remains significantly insufficient. These trends continue to results in an increased cost of production of chicken and eggs, as feed is the biggest cost component of the cost of production of both chicken meat and eggs, thereby increasing the prices of chicken and eggs in the country. Sri Lankans rely heavily on chicken and eggs to meet their required protein needs, and an increase in prices will limit the consumption of chicken and egg to a large extent, resulting in malnutrition.

1.2 Problem Statement

The feed industry is the key to the backward linkage of the animal-based food system. Safeguarding the animal feed manufacturing industry is a significant step in ensuring the nutrition security of the country. There is a rapidly increasing demand for poultry feed due to the arising demand for livestock products as human food. The poultry sector is an important subsector in terms of agricultural growth and improvements in the diets of people, as it is a significant source for the supply of protein and nutrition in a household's nutritional intake. Per capita consumption of chicken meat and eggs has increased from 4.86kg and 29 (2010) to 10.68kg and 132 in 2021 (DAPH, 2021). During the last ten years (2011-2021), the country's chicken meat production increased from 117 thousand mt to 237 thousand mt. The egg production in the country has also increased from 1,711 million (2011) to 2,934 million (2021), which shows an increasing demand for poultry feed production in the country (DAPH, 2021).

One of the major problems in the development of the poultry sub-sector in Sri Lanka relates to the lack of sufficient and appropriate feeds. The performance of the animal feed industry has not been satisfactory, as reflected in frequent shortages and erratic fluctuations of prices of animal feed. Feed prices have been on the rise since September 2020. This feed price escalation keeps increasing the cost of production beyond market prices, especially for small and medium scale producers. Raise in cost of production will lead to a tragic result compelling the closure down of small and medium scale operations (DAPH, 2022). Requirement of commercial feed production in the country is 1.2 million mt and in 2022 the production was 836,138 mt in the country due to the impact of several factors that are associated with economic crisis.

The availability of animal feed raw materials will not be sufficient to meet the future animal feed demand. The shortage of feed raw materials will be the main constraint in the livestock and poultry industry in the future (Premarathne and Samarasinghe, 2020). Cereal grains are the main energy sources in poultry feeds and maize is the main energy supplement in commercial poultry feeds in Sri Lanka (DAPH, 2022).

Prices of chicken and eggs have risen in Sri Lanka due to limited supply. The producers highlight that the increasing cost of production is a key issue faced in the industry.

Performance of any economy depends on the performance of individual firms in the economy. If the performance of the business firms is satisfactory, it may be reflected in the national economy. The animal feed industry has sprouted as a result of the livestock industry. The demand for animal feeds is derived from the demand for livestock products as human food. Through this interaction, unsatisfactory performance of the animal feeds industry would be reflected negatively on the livestock industry and, finally on the wider economy.

A crisis is an unexpected event that causes stress, requires intervention and mandates proper planning to ensure survival and sustainability in business (Doern, 2016). Recently, Sri Lanka experienced an economic crisis which affected different industries and this had an impact on the poultry feed sector due to shortage of raw materials, increased cost of production, resulted in increased feed prices. Due to the dollar crisis, industries were unable to import required raw materials for feed processing, and local production of raw materials such as maize was affected by the drop in production caused by low availability and high prices of agricultural inputs in 2022. Lack of foreign currency at local banks, changes in LC terms, rapid depreciation of LKR are few of the financial related factors related to poor performance of industry. Further, All Island Poultry Association of Sri Lanka (in 2022) reported that farmers are culling layer chicken due to lack of feed and high prices. Some of the small players in the industry are vulnerable, which could lead to permanent closure of many such farms.

The poultry sector in Sri Lanka has potential to enhance both food and nutritional security in the country. To meet the increasing demand for feed, it is crucial to establish an effective and efficient production and marketing system. This study aims to identify the challenges related to ensuring the availability, access, and utilization of poultry feed in Sri Lanka, which are essential for increasing poultry production in the country. It intends to identify the effects of the crisis on different poultry feed players and their recession related experience and performance. Therefore, this study intends to address the information gaps on the subject and contribute to a broader understanding of the constraints, challenges and interventions in developing the poultry feed sector. This will be useful for policymakers to develop relevant policies, and interventions to develop the feed industry and would offer opportunities to address several issues in order to assure long term sustainability in chicken and egg production in the country.

1.3 Research Questions

- What is the current status of the poultry feed industry?
- How does the economic crisis affect poultry feed industry?
- What are the crisis management strategies adopted by different poultry feed manufacturers in response to crisis situation?
- What are the constraints and challenges faced by the poultry feed manufacturers?
- What are the measures to be taken to strengthen the poultry feed sector?

1.4 Objectives

Broad Objective:

The broad objective is to examine the status, effects and crisis management strategies adopted by poultry feed manufacturers during the economic downturn in order to suggest policy implications to strengthen the poultry feed sector.

Specific Objectives:

- To examine the present status of the poultry feed production sector in Sri Lanka.
- To assess the effects of the economic crisis on commercial feed manufacturers, and self-feed producers in the poultry feed production sector.
- To identify crisis management strategies adopted by commercial feed manufacturers and self-feed producers of the poultry feed production sector.
- To identify constraints, challenges, and opportunities for poultry feed production.

CHAPTER TWO

Conceptual Framework and Methodology

2.1 Introduction

The effect of an economic crisis on industry can be understood through a conceptual framework that encompasses various dimensions, including shifts in consumer demand, changes in capital availability, and adjustments in employment. Economic crises often lead to reduced consumer spending, forcing industries to adapt by altering production levels and exploring new markets. Additionally, access to credit may decline, impacting firms' investment capabilities, while job losses can decrease workforce morale and productivity. The financial crisis can also prompt governments to reassess industrial policies in an effort to stabilize and revive the economy.

2.2 Conceptual Framework

The conceptual framework presented in Figure 2.1 depicts the relationship between the economic crisis, its effects on different poultry feed manufacturers, recession related experience of firms and their performance with respect to financial and non-financial effects. It summarizes the key external influences on business performance, emphasizing the interaction between different firms and their external environment and how this trigger strategic adaptation in business firms.

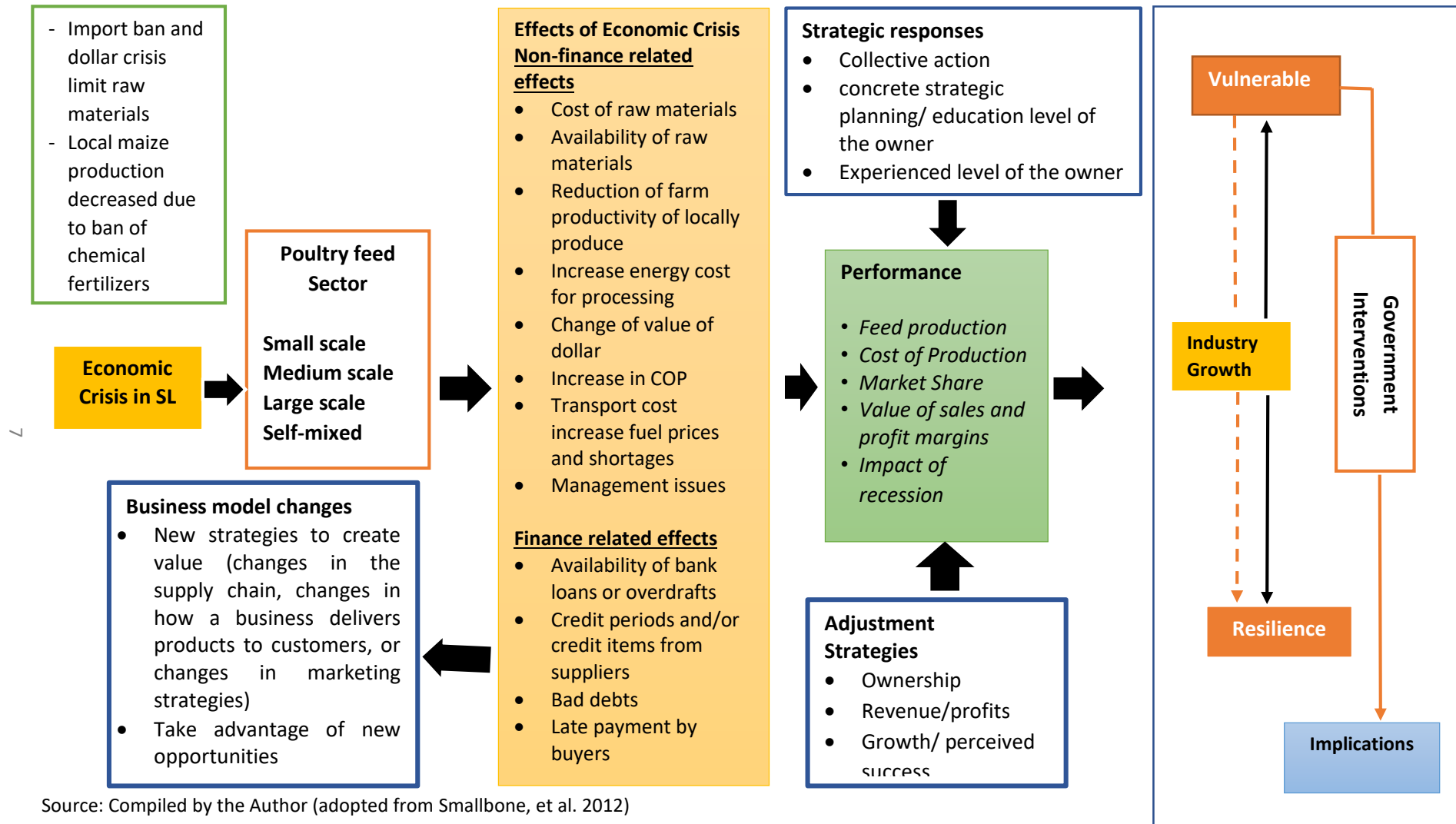
Effects of the economic crisis: Economic crises have significant effects on various industries, leading to reduced manufacturing growth, increased unemployment, inflation, and disruptions in exports and imports. For instance, banking, currency, and sovereign debt crises can particularly impact the manufacturing sector, while smaller enterprises may struggle more due to limited resources. Overall, industries face challenges in maintaining operations and growth during such times.

Business performance: During an economic contraction aggregate demand declines, translating into a drop in sales for most businesses. Cyclical industries including manufacturing, real estate, and tourism tend to experience particularly sharp declines. Companies with high fixed costs may face a disproportionate hit to the bottom line as revenue declines. Business performance during an economic crisis can experience significant challenges, such as decreased demand and higher operational costs. Companies may face performance gaps, with some struggling more than others due to various factors, including their management practices and adoption of digital technology. Small and medium-sized enterprises (SMEs) often report specific issues like high production costs and shortages of raw materials during such times. Recessions cause declines in sales that can spiral as the resulting layoffs further depress demand. Credit access tends to tighten amid rising economic uncertainty, while loan delinquencies and defaults increase alongside bankruptcies.

Adjustment Strategies: Adjustment strategies to overcome an economic crisis and enhance industry performance include understanding target audience behaviour, reducing costs by negotiating with suppliers, and adjusting marketing budgets rather than cutting them arbitrarily. The range of responses that manufacturers are likely to adopt as a result of economic crisis and stabilization policies will vary considerably across industries and among entrepreneurial groups. Coping strategies are likely to reflect, in part, the varying capacities and locations of entrepreneurs in the industrial sector.

Firms attempted to rationalize their production structures and use of inputs to overcome the constraints of raw material and foreign exchange shortages. Rationalization involved the retrenchment of workers, increasing the workload of labourers, and reducing the length of the working day and number of shifts to correspond to the availability of raw materials, in-house fabrication of spare parts, re-tuning of machinery and rehabilitation of old equipment. In addition, a number of innovative strategies were introduced in the areas of marketing, procurement and finance. These entailed new packaging, the reduction of the size and content of packages, discounts on bulk purchases, the opening of new sales points, intensive advertising, use of multiple bank accounts for foreign exchange transactions, and participation in the parallel foreign exchange market. A trend towards decentralization and flexibility in decision-making is discernible for many relatively successful firms (Olukoshi, 1996).

The study provides much needed evidence on small businesses responses to major economic crisis. Conceptually it demonstrates that although many small firms are vulnerable to changes in circumstances over which they have no control, they show underlying resilience and a high level of adaptability and flexibility. Longitudinal follow-up is necessary to show how the types of adaptive behaviour observed impact on business performance.



Source: Compiled by the Author (adopted from Smallbone, et al. 2012)

Figure 2.1: Conceptual Framework

2.3 Methodology

2.3.1 Data Collection

In this study, both primary and secondary data was collected. Primary data was collected using Key Informant guidelines and structured questionnaires from large, medium and small-scale poultry feed manufacturers (registered) and self-mixed feed producers (unregistered). Further, key informant interviews were conducted with the officers attached to different institutions such as Department of Animal Production and Health, All Island Poultry Association, etc. Secondary data was collected by reviewing different published and unpublished documents such as Department of Census and Statistics, Department of Animal Production and Health, Department of Customs, and Websites to generate data on poultry feed production and marketing.

2.3.2 Sampling Procedure

Study Locations and Sample Size

According to the registered commercial poultry feed manufacturers (large, medium and small-scale industries) and unregistered self-mixed feed manufacturers in the country, sample was selected proportionately. Registered animal feed manufacturers are categorized according to their production capacity as large scale (>10,000mt/month), medium scale (5,000-10,000mt/month) and small scale (<5,000mt/month).

Table 2.1: Study Locations and Sample Size

Poultry Feed Producers	Population	Sample	Location
Commercial poultry feed manufacturers (registered)			
Large scale (>10,000mt/month)	2	2	Kurunegala, Puttalam, Gampaha, Colombo
Medium scale (5,000-10,000mt/month)	8	6	
Small scale (<5,000mt/month)	37	22	
Self-mixed feed producers (unregistered)			
	N.A.	60	Kurunegala district (Wariapola, Kobbegane, Dummalasuriya, Kuliypitiya, Bingiriya, Pannala VS divisions)
Total		90	

Stratified purposive sampling technique was used to draw the study sample. First, large, medium and small-scale poultry feed manufacturers were selected using purposive sampling method. Majority of them are located in Kurunegala, Gampaha, Puttalam and Colombo districts. Self-mixed feed producers were selected using both purposive and snowball sampling method. According to information from DAPH, most

of the self-mixed feed producers are located in the Kurunegala district. Within the district, most of them are located in Wariapola, Kobbeigane, Dummalasuriya, Kuliypitiya, Bingiriya, Pannala Veterinary Surgeon divisions. Hence, 10 sample farms were selected from each selected VS division using the snowball sampling technique.

2.3.3 Analysis of Data

This section will explain based on the objectives in order to increase the understandability.

Objective 1: To examine the present status of the poultry feed production sector in Sri Lanka

Structure of the poultry feed manufacturers was identified using following data;

- Types of different poultry feeds produce
- Total production of different poultry feeds
- Prices of different types of poultry feed
- Usages of raw materials
- Procurement of raw materials
- Storage facilities for raw materials and poultry feed
- Distribution of poultry feed

The data was analyzed using descriptive methods, including tables, graphs and charts.

Objective 2: To assess the impact of economic crisis on large, medium and small-scale commercial feed manufacturers and self-feed producers of the poultry feed production sector

Data relevant to this objective was analyzed using descriptive methods which include tables, graphs, and charts. The selected key variables were measured to assess the effect of the crisis on the poultry feed production sector by considering the time periods of pre- and post-crisis periods.

Table 2.2: Types of Variables and Measurements

Variables	Measurements
<i>Experience of crisis-related effects</i>	
<i>Financial</i> Availability of bank loans or overdrafts Credit periods and/or credit items from suppliers Bad debts Late payment by buyers	Qualitative data – Liker Scale (1 = Strong positive effect; 5 = Strong negative effect)
<i>Non-financial</i> Cost of raw materials Availability of raw materials Energy cost Change of value of dollar Transport cost Management issues	Qualitative data – Liker Scale (1 = Strong positive effect; 5 = Strong negative effect)
<i>Performance of poultry feed industry (Vulnerability vs resilience)</i>	
Feed Production	Quantitative data and measured as quantity per month (Mt/month) (Pre/Post period)
Cost of Production	Quantitative data and measured as quantity per month (Rs/month) (Pre/Post period)
Feed Prices	Quantitative data and measured in monetary value (Rs/month) (Pre/Post period)
Feed Sales	Quantitative data and measured as quantity per year (Mt/month) (Pre/Post period)
Industry Growth	
1.Impact of Recession	Qualitative data – Likert Scale* (affected by the Recession = 1 or not = 0)
2.Value of Sales and Profit Margins	Qualitative data - Likert scale* (1 = Significantly higher; 5 = Significantly worse) (Pre/Post period)
<i>Adaptation of crisis management strategies</i>	
Business model changes	
New strategies adopted by the feed manufacturers to create value (ex. changes in the supply chain, changes in how a business delivers products to customers, or changes in marketing strategies)	Qualitative data – Likert Scale* (new strategies adopted = 1 or not = 0)
Take advantage of new opportunities (Ex. New poultry rations formulated Low-cost methodologies adopted)	Qualitative data-Likert Scale* (advantage of new opportunities taken = 1 or not = 0)
Adjustment Strategies	
Level of using household savings to raise cash Selling a family asset to run the business. borrowed funds	Qualitative data – Liker Scale (1 = Strong agree; 5 = Strong disagree)

Campaigns to raise funds to support their business. Number of days the operation of business is closed How they procured supplies	
Strategic responses	
Collective action concrete strategic planning/ education level of the owner	Qualitative data- Liker Scale (1 = Strong agree; 5 = Strong disagree)
Experience level of the owner	Quantitative data and measured as the number of years

*Qualitative data will be used in case of the reluctance of business owners to report financial data to measurement of perceived performance (Garg, et al. 2003; cited in Smallbone, et al. 2012)

Experience of recession-related effects: The respondents were asked about the extent their business had experienced recession-related effects. Different items were used to measure finance as well as non-finance-related effects, using a five-point Likert Scale (where 1 = 'strong positive effect' to 5 = 'strong negative effect').

Business performance: vulnerability vs resilience. Vulnerability/resilience was measured using a combination of two variables. The first variable, impact of the recession, measure whether respondents were affected by the recession (coded 1) or not (coded 0). Further, respondents were asked to compare the value of sales and profit margins during the pre (2019) and post crisis (present), using a five-point Likert Scale (where 1 = 'significantly higher' to 5 = 'significantly worse').

Responses from both variables were combined into a new growth variable: the labels 'significantly higher' and 'higher' sales were combined with 'significantly higher' and 'higher' profit margins, and coded as 1 = growth. 'Same', 'worse' or 'significantly worse' sales and profit margins were coded as 0 = non-growth.

From the resulting two variables*, a matrix was constructed to guide the classification of cases initially into the two categories: vulnerability and resilience. However, firms that are affected by the recession but which had grown were classified as highly resilient. Only the respondents that reported not being affected by the recession and reported no growth were excluded from the analysis.

Table 2.3: Classification Matrix

	Affected by recession	
	Yes	No
Growth	Highly resilient	Resilient
No growth	Vulnerable	Excluded

Source: adopted from Smallbone, et al. 2012

Objective 3: To identify crisis management strategies adopted by large, medium and small-scale commercial feed manufacturers and self-feed producers of the poultry feed production sector

Crisis management strategies adopted by different categories were identified through open-ended questions and the data was analyzed using descriptive methods which include tables, graphs and charts.

Objective 4: To identify constraints, challenges and opportunities in poultry feed production sector

The data was analyzed using descriptive methods, including tables, graphs and charts.

CHAPTER THREE

Current Status of Poultry Feed Industry in Sri Lanka

3.1 Introduction

This chapter reviews the poultry industry with respect to poultry population, egg and chicken meat production, animal feed production based on time series data collected by the Department of Animal Production and Health and the rest is based on the survey findings.

3.2 Poultry Industry in Sri Lanka

The contribution of the livestock sector to the GDP is only about 0.9 percent in 2021 (CBSL, 2021), which is mainly from the dairy and poultry subsectors. The chicken population in the country has increased to 34.86 million birds in 2021 with an annual average growth of 14 percent from 2017 to 2021. Such fast growth was not observed in any other livestock subsector in the country. However, it has decreased to 31.35 million in 2022 (DAPH, 2022). Chicken meat and egg production are likely to play an increasing role in supplying animal protein for human consumption in the country. Also, they are a relatively cheap and affordable source of animal protein (Alemce and Tedelle, 1997, as cited in Zeberga, 2010).

Poultry is the most developed livestock sub sector in Sri Lanka. Poultry industry includes grandparent and parent stock farms, commercial farms, processors, wholesale and retail markets, feed suppliers and other input suppliers. Commercial growers include both backyard and commercial intensive production farmers. Day Old Chicks (DOC) required for the production in commercial poultry farms are supplied by poultry parent farms (broiler and Layer).

There are two intensive poultry producing regions in the island, which include Western and North Western Provinces. The Central Province is the second intensive poultry producing area in Sri Lanka. The poultry industry, however, is successfully managed by the private organizations while the government involvement has been limited to monitoring of importation of parent/grandparent stocks and feed ingredients. The private sector provides inputs to almost all levels of the market chain as could be seen clearly in the poultry industry. Some private sector organizations are involved in production and marketing of poultry meat and eggs, hatchery operations, contract operations, manufacture and marketing of animal feed, etc. In such scenarios, large-scale private poultry farms belonging to multinational companies or large-scale national enterprises act as individual organizations in leading the market integration (Premarathne and Samarasinghe, 2020).

3.2.1 Broiler Industry

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. The main regions where the chicken meat industry prevails in Sri Lanka are the North Western, Western, and Central Provinces. Most chicken farms are located in the North Western region, with almost half of them categorized as large-scale farms (Silva, et al., 2010).

Three (3) grandparent (GP) farms and 31 broiler parent farms were functioning during 2022. About 33,564 grandparent Day Old Chicks (DOC) were imported by the GP farms. Further, 1,157,835 parent DOC were produced by GP farms supplying 93 percent of the local parent bird requirement. The rest of the parent DOC requirement (89,836) was imported from Australia (88%) and USA (12%). Total procurement of parent birds reached 1,247,671. The imported strains were Ross (77%) and Arbor Acres (23%). The local procurement consisted of Cobb (51%), Arbor Acres (28%) and Indian River (21%) (DAPH, 2022).

Parent farms produced 161.38 million broiler chicks recording 9 percent reduction in 2022 compared to 176.94 million broiler chick production in 2021. Of the total production of DOCs 160.88 (Mn) were sold for broiler meat production. Respectively chicken meat production decreased by three percent resulting 228.53 ('000MT) in year 2022 compared to 236.79 ('000MT) in 2021 (DAPH, 2022).

Broiler industry is highly integrated with input suppliers, feed suppliers, processors and marketing organizations.

3.2.2 Layer Industry

The egg production industry is highly concentrated in the Western and North Western Provinces. Compared to broiler operators, the egg industry has integrated to a much lesser extent. Most farmers are independent growers and find their own markets.

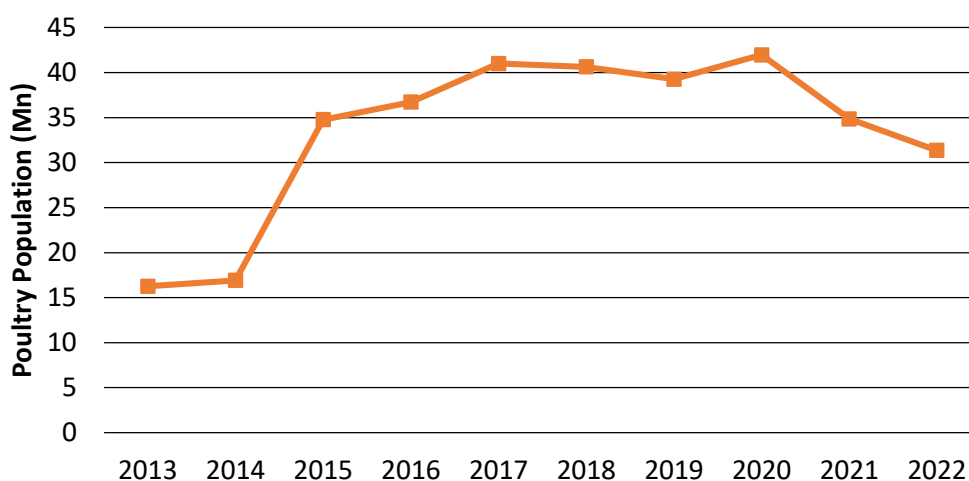
Eleven (11) layer parent farms had been functioning at the beginning of the year, 2022. Due to drastic reductions in demand for commercial layer DOC, five breeder farms suspended their operation by midyear removing the breeder flocks in production stage. Also, the importation of layer parent birds reduced to 34,351 which was less than half of the planned import of 85,000 for the year and was imported in the last quarter of the year. Demand for commercial layer DOC returned back to normal by September 2022 but the supply was insufficient by that time due to immature culling of layer parents and reductions in imports.

Average pullet chick price was recorded as Rs. 213.85 and was ranging from Rs. 62.55 in January to 425.00 in December 2022. Average retail price of white and brown eggs

at Colombo market was recorded as Rs. 38.86 and Rs. 42.63. White egg price ranged from 17.25 (February) to Rs. 53.88 (August). Brown egg price ranged from Rs. 18.63 (February) to Rs. 70.00 (December). The egg production decreased by 29% to 2089.70 Mn in 2022 (DAPH, 2022).

3.2.3 Poultry Population

According to Figure 3.1, the poultry population has exhibited a declining trend since 2020. In that year, the poultry population was approximately 45 million, decreasing to around 35 million in 2021 and further to 30 million in 2022, due to the prevailed economic crisis and shortage of input supply to livestock production. The availability of broiler day old chicks in the year 2022 has decreased by 8 percent while the production of layer day old chicks showed a significant decrease of nearly 50 percent. Furthermore, commercial poultry feed production has also decreased by 17 percent. These factors have also contributed to the reduction in the poultry population after 2020.

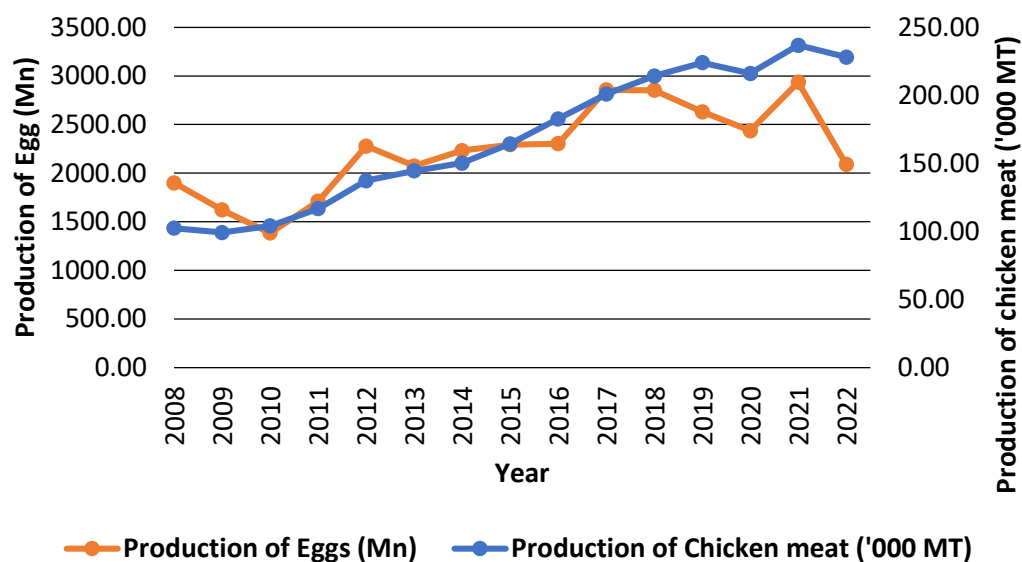


Source: Livestock Statistical Bulletins/DAPH (2013-2022)

Figure 3.1: Poultry Population in Sri Lanka (2013-2022)

3.2.4 Poultry Products and Trends in Production

Owing to the ongoing economic challenges and a scarcity of inputs crucial for livestock production, there has been a notable decline in both chicken meat and egg production in the year 2022. Chicken meat production has contracted by 3.7 percent, and egg production has seen a substantial reduction of 28.8 percent (Figure 3.2). Consequently, the per capita availability of chicken meat has experienced a decrease of 3.8 percent in 2022. Similarly, the per capita availability of eggs has witnessed a decline, dropping from 132.30 eggs per year in 2021 to 93.40 eggs per year in 2022.



Source: Livestock Statistical Bulletins/DAPH (2008-2022)

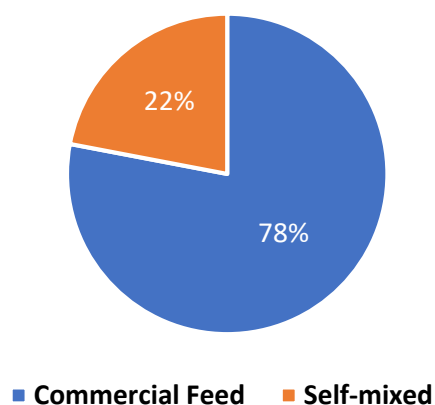
Figure 3.2: Egg and Chicken Meat Production (2008-2022)

3.3 Animal Feed Industry in Sri Lanka

The animal feed industry is an old and established industry in Sri Lanka. With its roots running deep into the mid-20th century, the animal feed sector caters to the local demand and further exports certain types of animal feed as a trusted high-quality animal feed provider. The industry is almost completely owned by private companies and the government's involvement is limited to regulatory roles. With several legislations and policies established to regulate the industry and to ensure the quality of feed produced, the government plays a limited but central role in the animal feed industry. The animal feed industry thus established in Sri Lanka was later contributed by several other major animal feed producers. Today, the local animal feed sector is made of around 50 Department (DAPH) registered manufacturers with 30 animal feed manufacturers and 20 premix producers working alongside manifold non-registered self-mixers (EDB, n.d.).

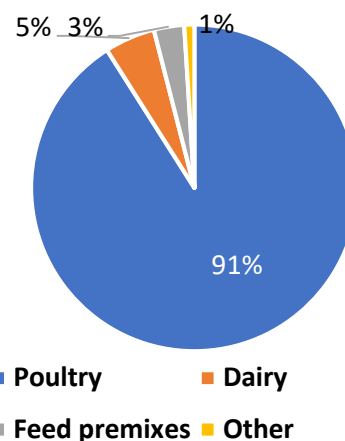
Ensminger, et al., (1990) defined animal feed industry as the operations necessary to achieve the maximum potential nutritional value of feedstuffs, i.e. changing ingredients in such a manner as to maximize their natural value and the net returns from their use.

The Sri Lankan animal feed industry caters to several species, producing poultry feed, cattle feed, swine feed, goat feed, etc. Of the entire animal feed production in Sri Lanka, 78 percent constituted commercial feed production, with the remaining 22 percent being self-mixed feed production. Within the commercial feed production segment, poultry feed accounted for 91 percent, while dairy feed represented five percent. This highlights the substantial contribution of the poultry feed sector to the overall animal feed production, as illustrated in Figure 3.3 and 3.4.



Source: Livestock Statistical Bulletin/DAPH, 2022

Figure 3.3: Animal Feed Production in 2022



Source: Livestock Statistical Bulletin/DAPH, 2022

Figure 3.4: Commercial Feed Production in 2022

3.3.1 Historical Background

Until 1955, there was no commercial poultry production, and the entire poultry sector was represented by 1.1 million village chickens reared in backyards. There was no demand for compounded feeds as the birds found their own feeds from backyards. After establishing the poultry subsector as a commercial industry in 1955, a demand was created for compounded concentrate feeds (Premarathne and Samarasinghe, 2020). Compound feed production in Sri Lanka began with the establishment of a government owned feed mill under the Ceylon Oils and Fats Corporation (OFC) at Seeduwa in the early 1960s. The main purpose of establishing this feed mill was to cater for the poultry sector, which gradually turned from a free-range back yard system to intensive deep litter production. From this time, the feed industry underwent several changes, but poultry feed production remained as the main business (Karunathilake, 2003).

In line with the open economic policy introduced to the country in 1978, the government encouraged the private sector to invest in local industries by offering various tax benefits. Consequently, the Government of Sri Lanka started a business partnership with Prima (Limited) of Singapore in 1982 to commence feed milling in large scale, thus establishing a feed industry in Sri Lanka. With the increase in demand for poultry feeds owing to expanding poultry industry, two other multinational companies came into feed milling in Sri Lanka. Gold Coin Feedmill, an Asian Multinational Company based in Singapore, started animal feed milling in Sri Lanka in 1993. Their subsidiary company, Coin Feedmill (Lanka) Limited, started to produce animal feeds. During the same year, Nutrena (Pvt) Ltd., a subsidiary company of Cargills Inc., USA, established a modern feed mill at Ekala. The Nutrena feed mill was however sold to the then CIC Group of Companies in 2002, and feed milling continued by their subsidiary company CIC Feeds (Pvt) Ltd (Premarathne and Samarasinghe, 2020).

3.3.2 Present Status

In general, the feed sub-sector is central for all livestock commodities and is a key pillar of livestock growth and transformation from various perspectives. From production point of view, animal production is essentially a conversion of feed into animal product dictating the level of production and product quality and safety. From the economic point of view, about 70 percent of the cost of animal production is feed and suggesting economic feasibility of animal agriculture is mainly a function of quantity or quality of nutrients and the science of feeding. Thus, feed is a point of convergence and a critical commodity for which all livestock species compete and it is a major pillar towards ensuring economic, social and environmental goals of livestock production (Makkar, 2016 as cited in Bediye et al., 2018).

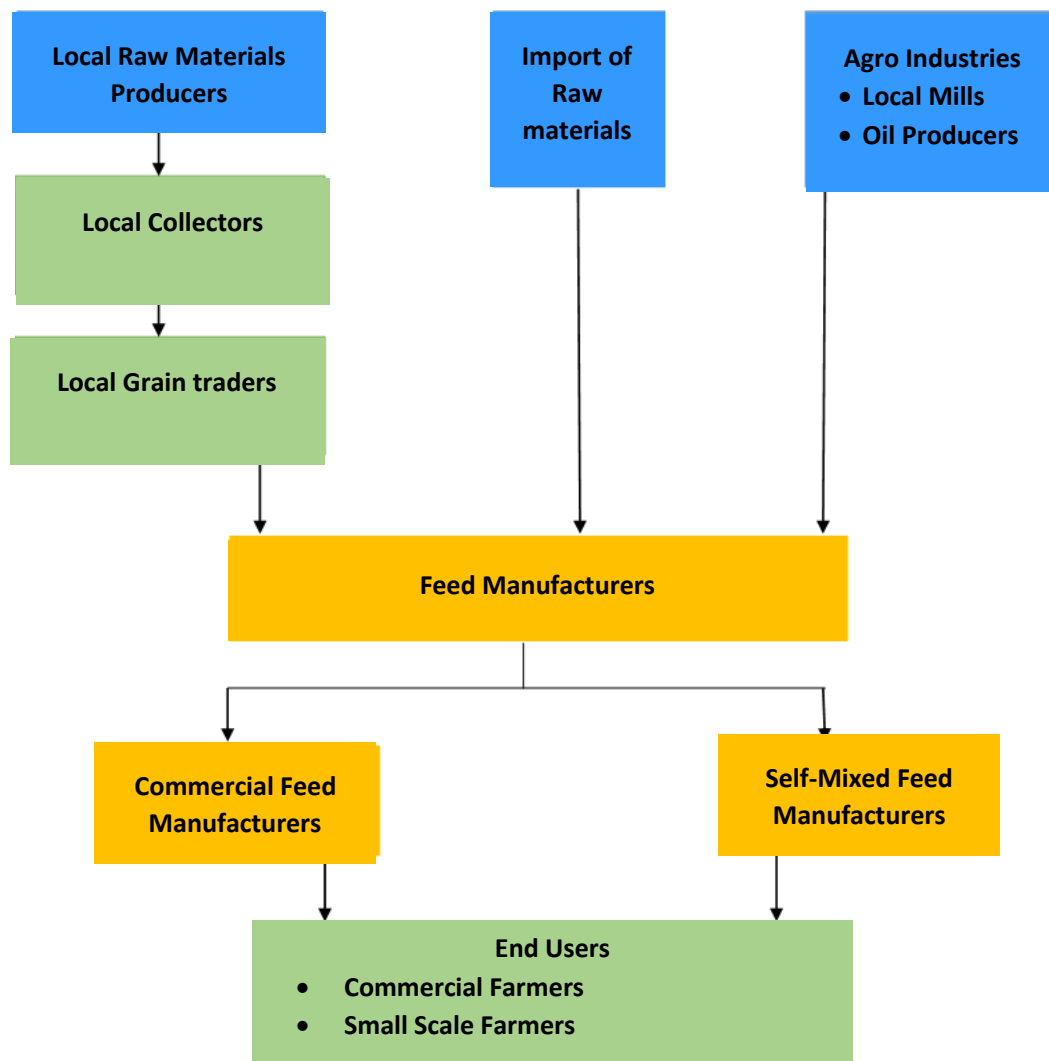
The structure of animal feed production in the country is dual in nature, with production being carried out in both, the organized and unorganized sector. The compound animal feed industry in the organised sector, comprises of commercial feed and integrators' feed. The unorganized sector includes, the customary feed preparations made by the farmers themselves and the production in unregistered feed factories.

The rapid growth of the poultry sector demanded more high-quality concentrate feeds, which opened new avenues for large scale feed millers and raw material importers. Feed is the most important input for poultry production in terms of cost, and the availability of low-priced, high-quality feeds is critical if poultry production is to remain competitive and continue to grow to meet the demand for animal protein (Velmurugu, 2013).

Commercial poultry systems are characterized by large vertically integrated production units and use high-producing modern strains of birds. In these systems, feed is the most important variable cost component, accounting for 65 to 70 percent of production costs. High productivity and efficiency depend on feeding nutritionally balanced feeds that are formulated to meet the birds' nutritional requirements (Velmurugu, 2013).

Nutrient requirements for maximum growth and good health, intensively reared poultry need a balanced array of nutrients in their diet. The nutrients required by birds vary according to species, age and the purpose of production – whether the birds are kept for meat or egg production (Velmurugu, 2013). Poultry require nutrients to maintain their current state (maintenance) and to enable body growth (weight gain) or egg production. Birds need a steady supply of energy, protein, essential amino acids, essential fatty acids, minerals, vitamins and, most important, water. Poultry obtains energy and required nutrients through digestion of natural feedstuffs, but minerals, vitamins and some key essential amino acids (Lysine, Methionine, Threonine and Tryptophan) are often offered as synthetic supplements (Velmurugu, 2013).

In the case of monogastric animals, it is necessary to feed the animals with concentrates. Even though the pig production is not expanded and developed, the poultry industry the most developed sector in Sri Lanka consists of flocks of modern commercial strains. Unlike village chicken, these strains require extremely high-quality feeds for a satisfactory performance as they are highly sensitive for the plane of nutrition. A modern broiler chick under local conditions grows to about 1.8 kg body weight in about 35 days, thus having an average weight gain of about 51 g/day (feed conversion ratio of about 1.7-1.8). In the case of layers, a laying rate of about 95 percent is achieved during the peak production while having an average laying rate of about 80–85 percent (over 300 eggs per year). Such high performance can be achieved only under proper feeding management conditions. Deficiency of a single nutrient in feed can cause a significant reduction in the performance of birds. Therefore, the feeds provided to poultry should be properly balanced for all nutrients and carefully produced. This can be achieved only if there is an organized feed industry (Premarathne and Samarasinghe, 2020).



Source: Adopted from DAPH information

Figure 3.5: Poultry Feed Industry at present

3.3.3 Poultry Feed Products

I. Commercial Feed Production

They are formulated from a mixture of ingredients, including cereal grains, cereal by-products, fats, plant protein sources, animal protein sources and by-products, vitamin and mineral supplements, crystalline amino acids and feed additives compounded in such a way as to provide essential nutrients for sustaining optimum growth and production.

Ninety three percent of the total animal feed produced in the country is used in the poultry industry. Forty-Seven registered poultry feed manufacturers were in operation during the year. The commercial poultry feed production in the country was estimated as 836,138.22 mt in 2022 which is an 18% reduction compared to 1,025,932.54 mt in year 2021.

II. Self-mixed Feed Production

Commercial feeds are relatively costly as most of the feed raw materials are imported. Therefore, there had been a growing tendency for poultry farmers to mix their own feeds. A study conducted by Jayaweera and Samarasinghe (2002) (as cited Samarasinghe, 2007) found that self-mixed feeds are not up to the standards in terms of nutrient levels and hygienic conditions.

3.3.4 Raw Material Usage

Similar to other Asian countries, the two main feed raw materials used in producing compounded feeds in Sri Lanka are maize and soybean meal. In a traditional feed formula, the content of maize is about 40–50 percent. Locally produced rice polish/rice bran and coconut poonac had been in use in the feed industry in Sri Lanka from the beginning. Even though the country was successful in establishing modern feed mills to produce animal feeds, until recently, sufficient attention has not been paid to produce feed raw materials locally. As a result, the local compounded feed industry has been heavily dependent on imported raw materials, thus making the feed expensive.

Poultry feed composition consists of 50-65 percent grains and their bi-products, 10-15 percent animal protein sources, vitamins, minerals and amino acids. Though grains constitute major part of poultry rations, the feed milling industry depend on both local and imported grains (maize and SBM) while broken rice and rice polish are locally purchased. More than 90 percent of the local maize produced in the country is used in poultry feed. Micro ingredients (vitamins, minerals, amino acids and additives) used in poultry feeds are totally imported.

Table 3.1: Ingredient Use in Poultry Feed Manufacturing and Feed Formula

	Ingredients	Poultry Ration
Energy	Cereals (Maize, wheat, rice)	40%
	Cereal by products (rice bran, rice polish, broken rice, wheat bran/flour)	20%
Protein	Soyabean meal, Coconut poonac	20-25%
	Animal products (Fish meal, meat meal, poultry offal meal)	5-10%
Minerals	Bone meal, limestone, dicalcium phosphate (DCP), shell grit	2-3%
Additives		1-2%

Source: DAPH, 2020

Cereal grains are the main energy sources in poultry feeds and constitute the bulk of the feed. They are rich in starch and easy to digest. Lipid and protein levels of cereal grains are usually low. Almost all cereal proteins are deficient in one or more essential amino acids. However, oils of cereal are good sources of essential fatty acids and other polyenes.

The move to large-scale imports of raw materials began with the rapid expansion of broiler production in the mid-1980s, which coincided with the privatization of the government owned feed mills (Karunathilake, 2003).

Maize

Maize is the main energy supplement used in commercial poultry feeds in Sri Lanka. It is low in fibre and minerals. Yellow maize contains a pigment, cryptoxanthin, which is a precursor of vitamin A. This pigment is valuable in poultry diets as it gives the broiler skin and egg yolks a desirable colour.

Maize usage in poultry feed varies according to its use. In Sri Lanka, 30-60 percent maize is allowed in broiler feed and 30-50 percent in layer feed (DAPH, 2021). Domestic maize production, which is largely used as the primary ingredient in domestic poultry feed production, is still insufficient to fulfill the total demand. Country's maize requirement for animal feed production is estimated as 550,000mt annually (DAPH, 2022). However, in 2022 the aggregate maize output is estimated at about 187,000mt, over 60 percent below the 2021 level and 40 percent below the previous five-year average. A sharp decline in domestic production with the ban of importing fertilizers and agrochemicals and the country's inability to import to fill the gap, where poultry feed industry fulfills 60 percent of maize requirement for animal feed production from imports, had a severe negative impact on the poultry and livestock industries (FAO and WFP, 2022).

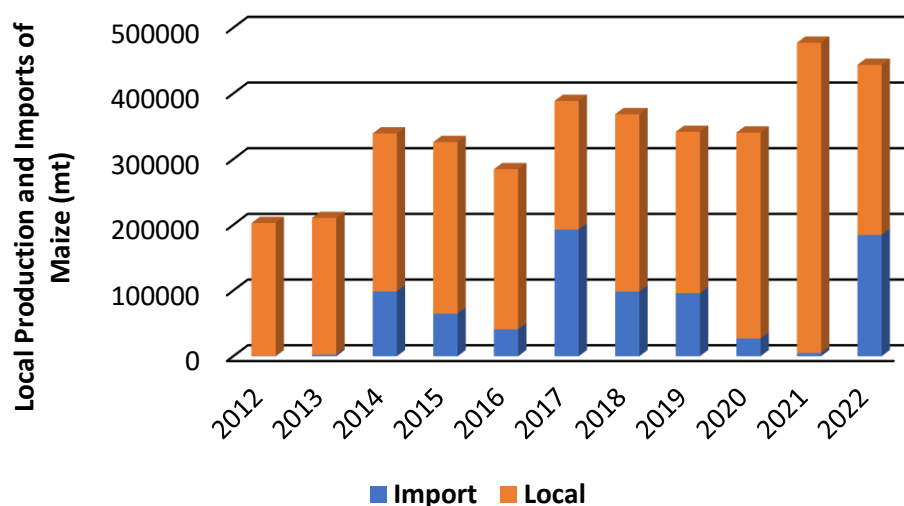
Farmers are the primary producers of maize. They also perform other activities like harvesting, shelling, drying and marketing of maize. After harvesting, most of the small and marginal farmers sell at their farm gates. Most farmers sell their produce at the farm gate to get quick cash. Also, they do not have adequate storage facilities. They

mainly sell to the collectors who are ready to pick the maize of any quality and standards. Three types of farmers cultivate maize in the major producing areas: independent farmers, out-growers and contract farmers. Farmers cultivate maize on a contract basis, and receive inputs and seeds of specific maize varieties/hybrids from another party (food retailers, feed manufacturer, poultry industry, etc.). They sign Forward Sales Contract Agreements with the buying company. Out-grower farmers are supplied with seeds and other inputs by the large-scale traders, and there are no agreements between farmers and buyers.

Most of the maize collectors are dependent collectors, and they are financed by the traders. They set up farmer networks in major producing areas, as they are responsible for the collection of maize. They receive commissions for procurement either from one or more maize wholesale traders. They receive money from the traders to supply the required seeds and other inputs to farmers. They receive instructions on maize prices, quantities and quality from the traders. These collectors collect maize at the farm gate, and farmers sometimes bring their harvested stocks to the collecting centres of collectors. There are no formal contracts between them, but they maintain relationships with farmers based on mutual understanding and trust.

Traders are the most important and influential players in the maize-marketing system of Sri Lanka. They can influence the prices to a considerable extent. Large-scale maize traders are involved in buying, drying and selling of maize to food and feed processors. Large-scale traders collect, assemble, store and transport from production zone to factories of processors. They have their own trucks for maize collection and transportation. Large-scale traders have warehouses and silos established in major producing areas. The storage duration is highly variable depending on demand and prices. Sometimes they store maize over a long period (5 to 6 months), and then sell at higher prices to the processors to take advantage of market opportunities.

Large-scale feed manufacturers buy feed ingredients of maize during the peak harvesting period, storing them to be used in the lean-supply season of maize. They have silos in the processing centres to store maize. Also, they have contract farmers in major producing areas, to whom they provide credit and other inputs to farmers. Feed manufacturers have relationship with maize traders/importers to meet their grain demand. They have processing units for milling and get their supplies from traders. They set quality standard for purchasing grains and when they are buying their agents negotiate prices based on the quality requirements which include cleanliness, absence of foreign matters, absence of mold and moisture in the grains. There are informal or formal contracts exist between traders and feed manufacturers.



Source: DAPH and DCS (2012-2022)

Figure 3.6: Local Production and Imports of Maize (2012-2022)

Wheat

Until recently wheat was not used for poultry feeding in Sri Lanka though it is the main cereal grain fed to poultry in the Europe. Wheat is not grown in Sri Lanka but the whole grain is imported and milled to produce wheat flour for human consumption. Resulting by-product wheat bran is available for animal feeding. However, because of the high prices of maize, feed manufacturers in Sri Lanka have started to use wheat as an energy feed. Wheat contains slightly less energy but more protein as compared to maize. It does not contain cryptoxanthin pigments. Wheat may totally replace maize if available and economical. However, because wheat is gelatinous, high wheat diets should be pelleted. If wheat is used to replace maize in layer rations, a source of pigments should be added to the feed in order to maintain the desired yolk colour (Samarasinghe, 2007).

Soybean Meal

Soybean meal is the most widely used protein source in animal feeds in Sri Lanka as in other countries in the world. It is the best source of plant protein for poultry feeding. It contains all the essential amino acids except methionine. Therefore, soybean rich diets should be supplemented with adequate methionine. Almost the entire amount of soybean meal required for the feed industry is imported at present. From the limited data available, it appears that Sri Lanka has used locally produced soybean meal until late 1970s when soybeans were produced and used for oil extraction by the former Ceylon Oils and Fats Corporation. The importation of soybean meal for animal feed industry started in 1979 and boosted up in mid-1980s as a result of the expanding poultry industry. Thereafter, the importation of soybean meal was annually increased at a higher rate.

It is important to note that the total requirement of soybean meal for animal feed is imported because there is no soybean processing facility available in Sri Lanka to process soybean for animal feeds. Owing to the absence of local production of soybean meal to cater to the needs, the feed millers had to depend totally on imports. The limited amounts of soybeans produced in Sri Lanka was totally used for human food industry and not available for animal feeding. However, until late 1970s, soybean was a major rainfed crop grown in highlands during the wet season and used for oil extraction, thus supplying some soybean meal for the feed industry. In mid 1970s, the local soybean production rapidly declined due to the lower demand caused by the closure of the government-owned major oil extraction facility (former Ceylon Oils and Fats Corporation). However, currently there is a move to cultivate soybeans locally, and facilities for oil extraction are already established by the private sector.

Rice Polish/Rice Bran

Paddy is the main cereal crop grown in Sri Lanka for centuries as it provides the staple food, rice. When rough rice is milled to produce edible rice, valuable by-products are obtained which are extensively used in the animal feed industry. Rice polish/bran is a major constituent in compounded animal feeds while a small amount of broken rice is also used depending on the availability. Rice is processed in large-scale and small-scale millers, currently by using roller type mills. In both situations, rough rice may be processed either raw or after steaming or parboiling, thus producing raw rice, steamed rice, or parboiled rice, respectively. Roller type rice mills are efficient as the amount of broken rice produced is low. At present, there is almost no broken rice reaching the feed industry from local rice mills, but feed millers use to import broken rice whenever it is cost-effective. However, a large quantity of rice bran/polish is produced as a valuable by-product, which is efficiently used by feed millers.

Traditionally, the bran produced from the milling of raw rice is referred to as rice polish, while the other is named as rice bran. Usually, the extraction rate of rice bran/polish is about 10 percent of rough rice milled. Rice polish includes layers of inner seed coat and some endosperm material. It is low in fibre and high in starch and fat. A fraction of rice bran/polish produced in the country is exported, not due to a surplus but for economic reasons. Accordingly, the actual availability of rice bran/polish in the country would be lower than the estimated values.

Rice bran/polish is high in fat therefore palatable to animals. Quality of rice bran gets deteriorated very rapidly during storage because of high fat content mainly due to rancidity. The level of rice bran/polish that can be incorporated in poultry rations depend on their quality, primarily the husk level. Good quality rice polish can be used up to about 20-30 percent for poultry (Samarasinghe, 2007).

Feed manufactures complained that the quality of rice polish is not good due to mixing with impurities like sand.

Cereal milling by-products such as rice polish/bran are the secondary energy sources available for poultry feeding in Sri Lanka. Quality of these by-products can vary very widely depending on the milling conditions and the degree of adulteration. Therefore, when milling by-products are incorporated into feed rations, special attention must be given to their quality.

Coconut Poonac

Coconut poonac (coconut oil meal, copra meal, or coconut oil cake) is the only oil cake which is produced locally in considerable amounts and used for animal feed in Sri Lanka. As coconut is one of the main three plantation crops grown in the country, a large quantity of coconuts is produced annually. While a part of the nuts is consumed fresh in cooking, the other part is processed to produce either desiccated coconut, coconut milk powder, or copra which is used for oil extraction.

Coconut poonac is a major agro-industrial by-product available in Sri Lanka. After oil extraction, 35 – 40 percent of copra (by weight) remains as poonac. Coconut poonac contains 20 – 22 percent crude protein with low concentration of essential amino acids. From the coconut oil industry, poonac is obtained as a by-product which is used in animal feeds as a protein supplement. The quality of coconut poonac varies marginally depending on the method of oil extraction, solvent extraction, or expeller extraction. Solvent-extracted poonac contains relatively low fat and little more protein, whereas expeller poonac contains low protein (20%) and more fat (approx. 12%). Sri Lanka mostly produces expeller poonac having a low quality. Though it contains more gross energy due to high fat content, the metabolizable energy value for monogastric animals is rather low (about 1,700 kcal/kg) due to the high fiber content (12–14%) in poonac. Expeller coconut poonac also has a poor keeping quality. Coconut fat is also prone to rapid rancidity resulting in poor feeding value. The feed millers are thus reluctant to incorporate coconut poonac in pig and poultry feeds. Locally produced coconut poonac is therefore used mainly for the production of dairy cattle feed.

Because of high fat content coconut poonac is prone to rancidity. Therefore, coconut poonac must be used without prolonged storage and antioxidants should be included in feeds containing coconut poonac.

Other Feed Raw Materials

There are various other types of feed raw materials used for the production of compounded feeds. The amount of type and quantity of these raw materials depend on the availability and price, and the competitiveness with maize and soya bean. Other cereals such as rice and wheat are used as alternatives to maize whenever maize is not available or expensive. A considerable amount of wheat bran is produced in Sri Lanka as wheat milling is done using imported grains to produce wheat flour. Poultry by-product meal produced locally is also available to some of the feed millers. Imported raw materials such as fish meal, meat and bone meal, gingerly poonac, and

maize gluten meal are used in varying quantities depending on their availability and price. All vitamin mineral supplements, amino acid supplements, calcium and phosphorus supplements (mainly calcium carbonate and di-calcium phosphate), and various types of non-nutritive additives required for feed milling are imported.

Fish meal

Poultry meals are used as an ingredient to make up for deficiencies of essential amino acids. The amount of fish meal to be added depends on the composition of other ingredients of the diet. There is fish meal of different qualities in the market. The quality of fish meal depends primarily on the type of raw materials used to produce it.

Only few producers are engaged in production of fish meal for animal feed in Sri Lanka. However, due to high prices and quality issues, the commercial feed manufactures depend on imported fish meal. Since fish meal is imported to Sri Lanka from various countries, the protein value of fish meals in the market varies from about 60 to 70% and the prices as well.

Meat and Bone Meal

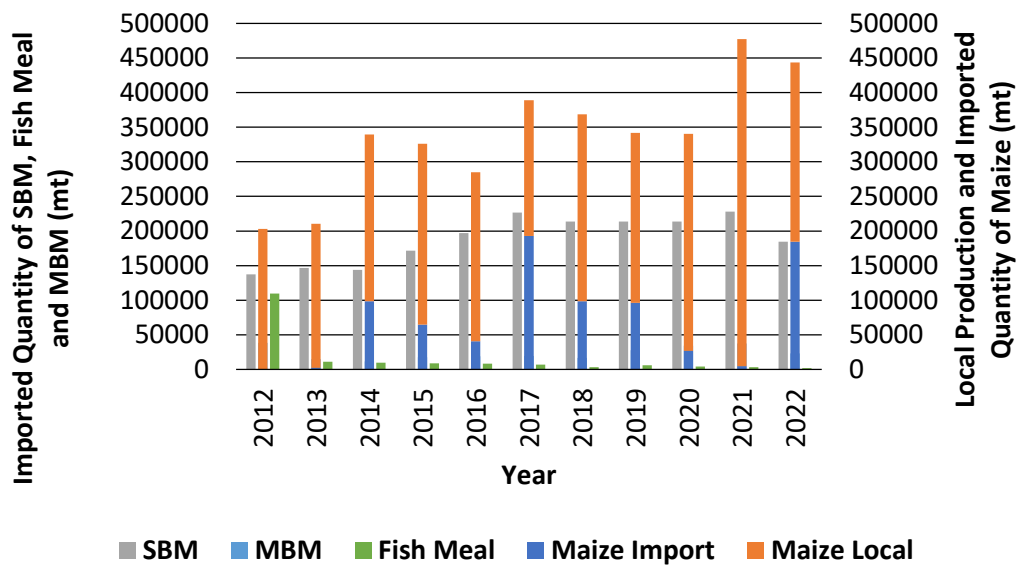
Meat and bone meal is prepared from the waste materials associated with slaughtering operations. In addition to protein (amino acid), meat and bone meal is an excellent source of calcium and phosphorus.

Broken Rice and Rejected Rice

Some feed manufactures used rejected rice instead of broken rice.

Except for rice milling by-products and coconut poonac, we have not made an attempt to utilize various other agro-industrial by-products and lesser-known feedstuffs that are available relatively at a low price. Ultimate result of not producing feed raw materials locally is the high dependence on imports which has led to high feed prices hampering the industry (Samarasinghe, 2007).

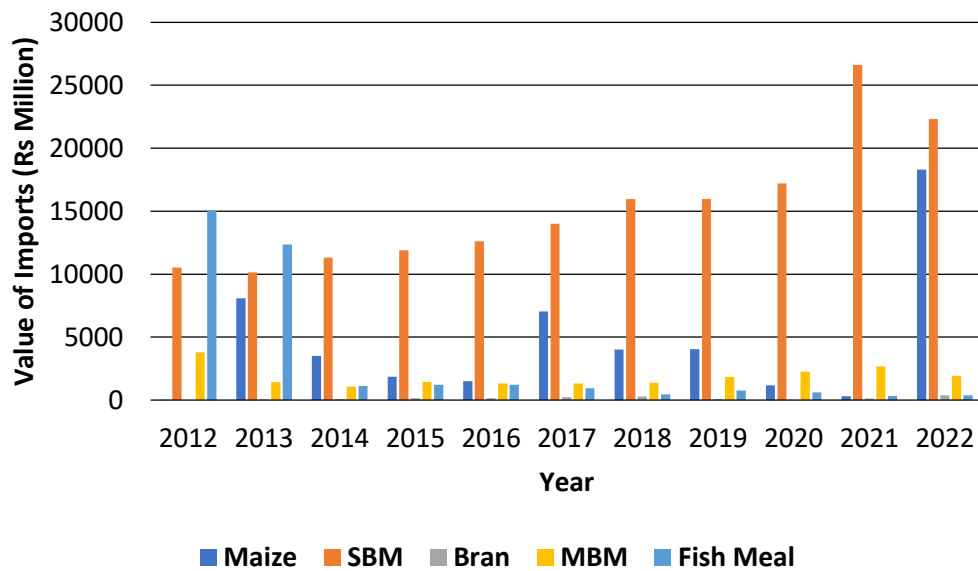
Figure 3.7 illustrates the quantity of raw materials utilized in feed production from 2012 to 2022. It indicates that maize is the primary raw material for feed production, and in 2021, it exclusively comprises of local production due to import restrictions. Other raw materials, such as SBM, MBM, and Fish meal, are entirely dependent on imports, and their quantities are also very limited.



Source: Livestock Statistical Bulletins/DAPH (2012-2022)

Figure 3.7: Quantity of Raw Materials used for Feed Production (2012-2022)

When examining the imported value of poultry feed raw materials, SBM reported the highest value, followed by maize in 2022. However, in 2021 the imported stocks of maize were severely restricted due to import constraints.



Source: Livestock Statistical Bulletins/DAPH (2012-2022)

Figure 3.8: Value of Imports of Key Raw Materials (2012-2022)

3.4 Roles Play by the Private Sector in Feed Production

3.4.1 Compound Feed Manufacturers

There are about 45 registered commercial feed mills operating in the country in 2022 (DAPH, 2022), which produce a standard mix of feed for sale at the mill gate or sell through their agents in depots scattered around the country. At present, the animal feed industry is completely managed by the private sector. Registered animal feed manufacturers are categorized according to their production capacity as large scale (>10,000mt/month), medium scale (5,000-10,000mt/month) and small scale (<5,000mt/month). Compound animal feed production in Sri Lanka is totally handled by the private sector. All large-scale manufacturers are equipped with modern feed milling facilities. Even the needs of feeds by the government-own livestock farms are supplied by the private feed millers. It was the private sector that started large-scale feed milling in Sri Lanka. Feed raw materials are either directly imported by the feed millers themselves or purchased through local raw material suppliers. Quality control of the raw materials as well as the finished products is done at the feed mill using their own laboratories and trial farms. In addition, to large-scale feed manufacturers, there are four medium-scale feed millers and 25 small-scale feed producers out of the 30 registered manufacturers interviewed. The commercial feed millers have established their own marketing network through wholesale and retail dealers.

Table 3.2: Classification of Commercial Feed Manufacturers

Classification	No. of Companies	
	2019	2023
Large (>10,000mt/month)	3	1
Medium (5000-10,000mt/month)	4	4
Small (<5000nut/month)	23	25

Source: HARTI Survey Data, 2023

3.4.2 Year of Registration and Operations

Majority of the commercial feed manufacturers (73%) have started their operations after 2008 (less than 15 years of operation). There are 5 companies run their operations with greater than 25 years.

Table 3.3: Year of Registration and Operations

Years of Operations (Years)	Commercial (N = 30)	Percentage
< 5	6	20
5-10	10	33
10-15	6	20
15-20	1	3
20-25	2	7
>25	5	17

Source: HARTI Survey Data, 2023

3.4.3 Capacity of Production

Commercial feed manufacturers are classified as large, medium and small scale depending on the quantity of feed produced per month. There were three large scale feed manufacturers (Ceylon Grain Elevators, Fortune Agro and Gold Coin) produce >10,000mt of feed per month in 2019. However, in 2023, there was only one large scale manufacturer operated in the country as the other players have reduced the feed production by around 50 percent compared to the production recorded before the economic crisis.

Table 3.4 illustrates the decline in feed production by various feed manufacturers during an economic crisis. Large-scale feed manufacturers have reduced their feed production by 25-75 percent, while medium-scale manufacturers have witnessed a decrease of 40-50 percent. Similarly, small-scale feed manufacturers have experienced a substantial drop in feed production, ranging from 40-75 percent during the economic crisis.

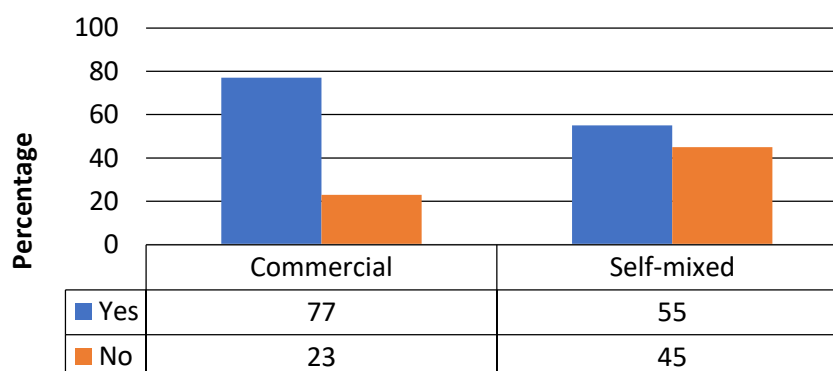
Table 3.4: Percentage of Reduction of Feed Production by Different Feed Manufacturers with Economic Crisis

Type of Feed Manufacturer	Reduction in Operational Capacities
Large (N=3)	25-75%
Medium (N=4)	40-50%
Small (N=23)	40-75%

Source: HARTI Survey Data, 2023

3.4.4 Involvement with Business Associations

Certain organizational bodies have been created by involving poultry sector manufacturers. All Island Poultry Association, All Island Egg Producer's Association, Lanka Poultry Processor's Forum and World Poultry Science Associations are such organizations. Among the commercial feed manufacturers, 77 percent are engaged with either one or more such organizations, whereas only 55 percent of self-mixed manufacturers are part of such associations.



Source: HARTI Survey Data, 2023

Figure 3.9: Engagement with Business Associations

About 82 percentage of the commercial feed manufacturers revealed that they have received benefits by being part of different associations. When importing raw materials such as maize those associations helped convince to obtain government approval to import maize. Some associations are collectively deciding the prices of feed for sale, egg prices and meat prices. Some manufacturers received training on issues relating to poultry business and gain new knowledge. However, the majority of self-mixed manufacturers (70%) revealed that they have not received any benefits.

Table 3.5: Benefits Received by Poultry Sector Associations

Response	Commercial		Self - mixed	
	(N=23)	%	(N=33)	%
Yes	18	82	10	33
No	4	18	23	70

Source: HARTI Survey Data, 2023

3.4.5 Frequency of Procurement and Storage Facilities

Large and medium scale manufacturers those own silos, procure maize locally during the peak production period and store in silos. Also, the other imported grains are stored in silos. In addition to silos, they have large pack houses to store the other types of raw materials and finished poultry feed. However, small scale commercial feed manufacturers and self-mixed feed manufacturers do not have silos to store grains and they procure them once a month and store in pack houses. Also, they store other types of raw materials and finished poultry feed in pack houses. Majority of the self-mixed manufacturers have small size pack houses to store raw materials and poultry feed.

Table 3.6: Storage Facilities to Store Raw Materials and Poultry Feed

Types of storage facilities	Commercial (N=30)			Self – mixed (N=60)
	L	M	S	
1. Silos to store grains	3	5	0	0
2. Pack house to store raw materials and poultry feed	3	5	17	60

Source: HARTI Survey Data, 2023



Source: Images from HARTI Survey, 2023

Figure 3.10: Silos to Store Grains (Fortune Agro Industries Pvt Ltd., Kurunegala)

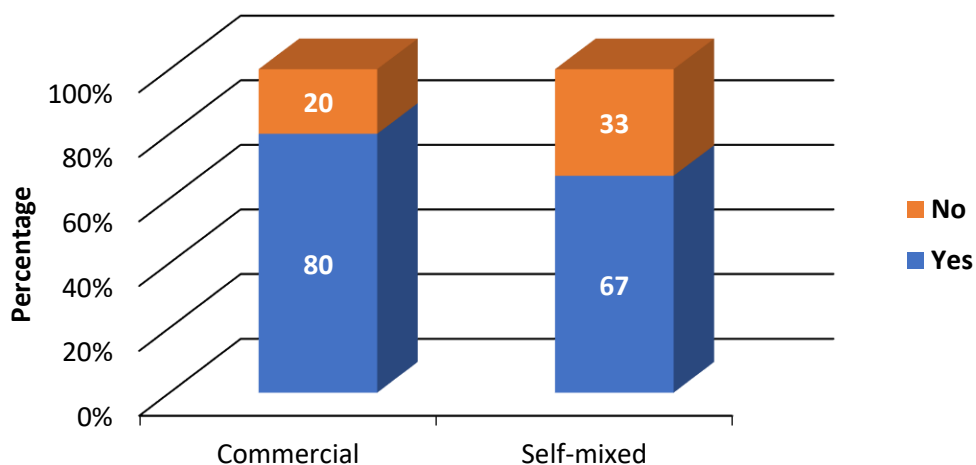
Large scale ingredient suppliers who import bulk volumes from other countries have storage facilities. Also, there are grain traders in the country where they store the stocks of local production during harvesting period. They have constructed silos to store grains in major producing areas. In addition, commercial feed manufacturers themselves are involved in storing and selling feed ingredients.

3.4.6 Alternative Raw Materials and Their Issues

Due to unavailability of sufficient stocks and high prices of maize most of the feed manufacturers have used alternative raw materials such as broken rice, rejected rice, wheat flour etc. while balancing the nutrition level of the poultry feed. Self-mixed producers use different types of available low-cost ingredients as alternative raw materials (biscuit powder, noodles). The government in a gazette notification has banned the use of any form of rice produce or such imports for poultry feed production. The failure to use rice – a viable substitution for maize-- creates difficulties in manufacturing the required amount of feed. This force feed producers to turn to high-cost substitutes, resulting in feed price escalation and a significant drop in feed production.

When using alternative feed materials, feed manufacturers faced digestibility issues for birds. As a solution to that they had to use enzyme technology and due to high cost only few commercial feed manufactures practiced this.

As depicted in Figure 3.11, about 80 percent of commercial-level companies have adjusted their poultry feed rations in response to the insufficient availability and elevated prices of certain raw materials, notably maize. Among self-mixed feed producers, 67 percent have similarly altered their poultry feed rations for the same reasons.



Source: HARTI Survey Data, 2023

Figure 3.11: Change of Poultry Feed Rations

Commercial-level companies have selected for the utilization of the following raw materials as substitutes in lieu of maize;

- Broken/Rejected rice
- Wheat bran
- DDGS
- Peacock rice

However, self-mixed feed producers have employed the following alternative raw materials instead of maize;

- Broken/Rejected rice
- Dhal bran
- DDGS
- Biscuit powder

Following the alteration of feed rations, 67 percent of commercial-level feed producers encountered challenges, while 80 percent of self-mixed feed producers also experienced issues resulting from the change.

Table 3.7: Issues Faced by the Feed Manufacturers by Changing the Feed Ration

Response	Commercial		Self - mixed	
	N=24	%	N=40	%
Yes	16	67	32	80
No	8	33	8	20
Total	24	100	40	100

Source: HARTI Survey Data, 2023

3.5 Feed Mills

3.5.1 Ownerships

Based on Table 3.8, it is evident that every commercial-level feed producer operates its own feed mills. Similarly, 62 percent of self-mixed feed millers also possess feed making mills.

Table 3.8: Manufacturers Having Their Own Feed Mills

Response	Commercial		Self-mixed	
	N=30	%	N=60	%
Yes	30	100	37	62
No	0	0	23	38

Source: HARTI Survey Data, 2023

When examining the milling processes employed, it is notable that most small-scale commercial-level feed producers (16) and the majority of self-mixed feed producers (58) opt for the mash type of milling process. Among large-scale commercial feed producers, four companies utilize both mash and pellet milling processes. Additionally, five medium-scale commercial-level feed producers and four small-scale ones employ both mash and pellet milling methods (Table 3.9).

Table 3.9: Type of Milling Process

Milling Process	Commercial		Self - mixed	
	L	M	S	
Mash	0	0	16	58
Pellet	0	1	0	0
Both	4	5	4	2

Source: HARTI Survey Data, 2023

3.5.2 Facilities and Capacities of Feed Processing Plants (Installed vs Operational)

In terms of facilities, all the commercial feed processing plants have feed mill, mixer and storage places for ingredients and for processed feeds. Only few plants mill limestone and make multi-nutrient blocks. Pellet maker is limited to ten feed processing plants. Feed mills regulate their production schedule according to the demand of poultry farms. Currently all the commercial poultry feed mills are operating below their installed capacity mainly due to low demand for the product, shortage of ingredients and inconsistent supply of electricity.

As indicated in Table 3.10, large-scale commercial feed producers utilize a range of 25-40 percent of the total installed capacity. In comparison, medium-scale commercial feed producers operate in the range of 25-50 percent of the total installed capacity. Similarly, small-scale commercial feed producers demonstrate an operational capacity of 30-70 percent of the installed capacity.

Table 3.10: Operational: Installed Capacity of Commercial Feed Manufacturers

Type of Feed Manufacturer	Operational: Installed Capacity
Large (N=3)	25-40%
Medium (N=4)	25-50%
Small (N=23)	30-70%

Source: HARTI Survey Data, 2023

3.6 Feed Formulations

Manufactured feeds are produced in feed mill that have equipment to process feedstuff e.g. “grinding and extruding” for mixing in the desired proportion and for mixing the ingredients to produce the finished product (Cheeke, 2005), often the mixed feed is pelleted or it may be marketed as a meal type (mash feed).

Modern feed mills are largely computer controlled. The process begins with the company nutritionist who computer formulates diets, using recognized requirements figures and tables of feed composition and current prices of ingredient. Many diets are least cost formulas, in which the ingredients are selected to meet the prescribed nutrient requirement figures at the lowest cost. There may be factors such as palatability and physical texture that reduce animal performance.

3.6.1 Decision of Feed Ration

According to the data presented in the following table, majority of commercial-level feed producers (77%) independently formulate their poultry feed ration. Similarly, 42 percent of self-mixed feed producers also adopt their unique formulations. About 23 percent of commercial feed producers and 33 percent of self-mixed feed producers rely on external agencies for assistance in determining their feed ration. However, only 25 percent of self-mixed feed producers seek guidance from government agencies in formulating their poultry feed ration.

Table 3.11: Way of Deciding the Poultry Feed Ration

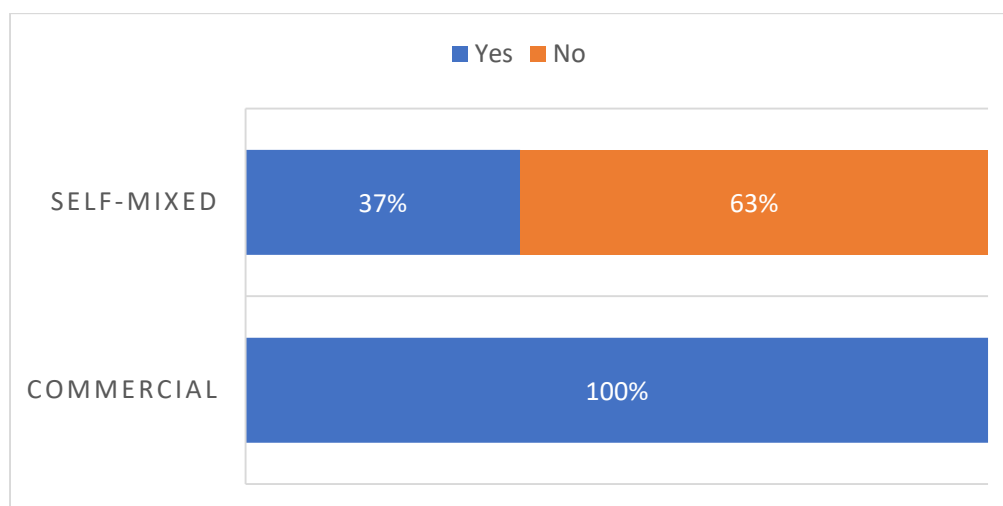
Response	Commercial		Self - mixed	
	N=30	%	N=60	%
1 Using own formula	23	77	25	42
2 With assistance of another agency	7	23	20	33
3 With assistance of government agency	0	0	15	25

Source: HARTI Survey Data, 2023

3.6.2 Quality of Raw Materials and Feed

Every commercial poultry feed producer consistently monitors the quality of both raw materials and poultry feed. In contrast, 37 percent of self-mixed feed producers engage in regular quality checks. However, most self-mixed feed producers (63%) do

not prioritize the quality assessment of raw materials or poultry feed in their practices (Figure 3.12).



Source: HARTI Survey Data, 2023

Figure 3.12: Response of Feed Manufacturers Regarding the Checking of Quality of Raw Materials and Poultry Feed

When evaluating quality assurance practices among various commercial feed producers, it is observed that four large-scale, six medium-scale, and four small-scale producers employ in-house laboratory facilities for the quality assessment of both raw materials and the feeds they manufacture. In contrast, 16 small-scale commercial feed producers and 22 self-mixed feed producers opt to send their samples to external agencies' laboratories for quality checking, as they lack their own laboratory infrastructure (Table 3.12).

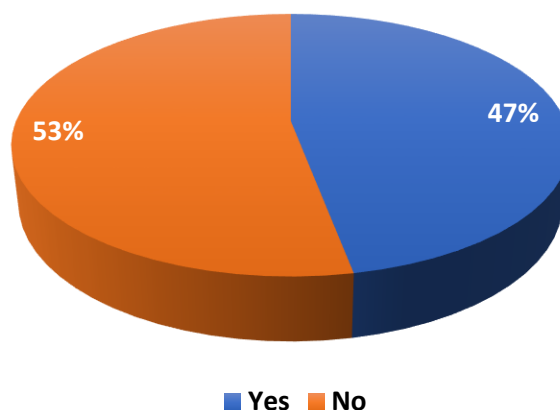
Table 3.12: Ways of Checking the Quality

Response	Commercial			Self - mixed
	L	M	S	
Own laboratory facilities	4	6	4	0
Send samples to other agencies	0	0	16	22

Source: HARTI Survey Data, 2023

3.7 Sales and Marketing of Commercial Feed

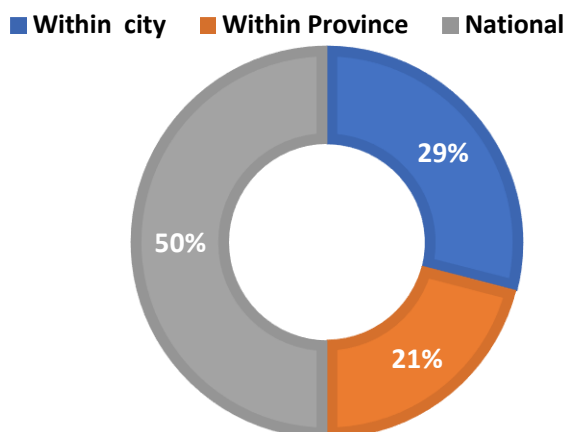
As depicted in the Figure below, majority (53%) of commercial feed producers are not involved in selling poultry feed; rather, they utilize it exclusively for in-house company purposes. The remaining 47 percent of producers, however, engage in selling poultry feed to external customers.



Source: HARTI Survey Data, 2023

Figure 3.13: Commercial Feed Manufacturers Engaged in Selling of Poultry Feed

Among the commercial feed producers engaging in selling poultry feeds to external customers, sell their feed nationwide. They have dealer network for that. Furthermore, 29 percent of commercial feed producers limit their sales within the city, while 21 percent confine their sales within the province (Figure 3.14).



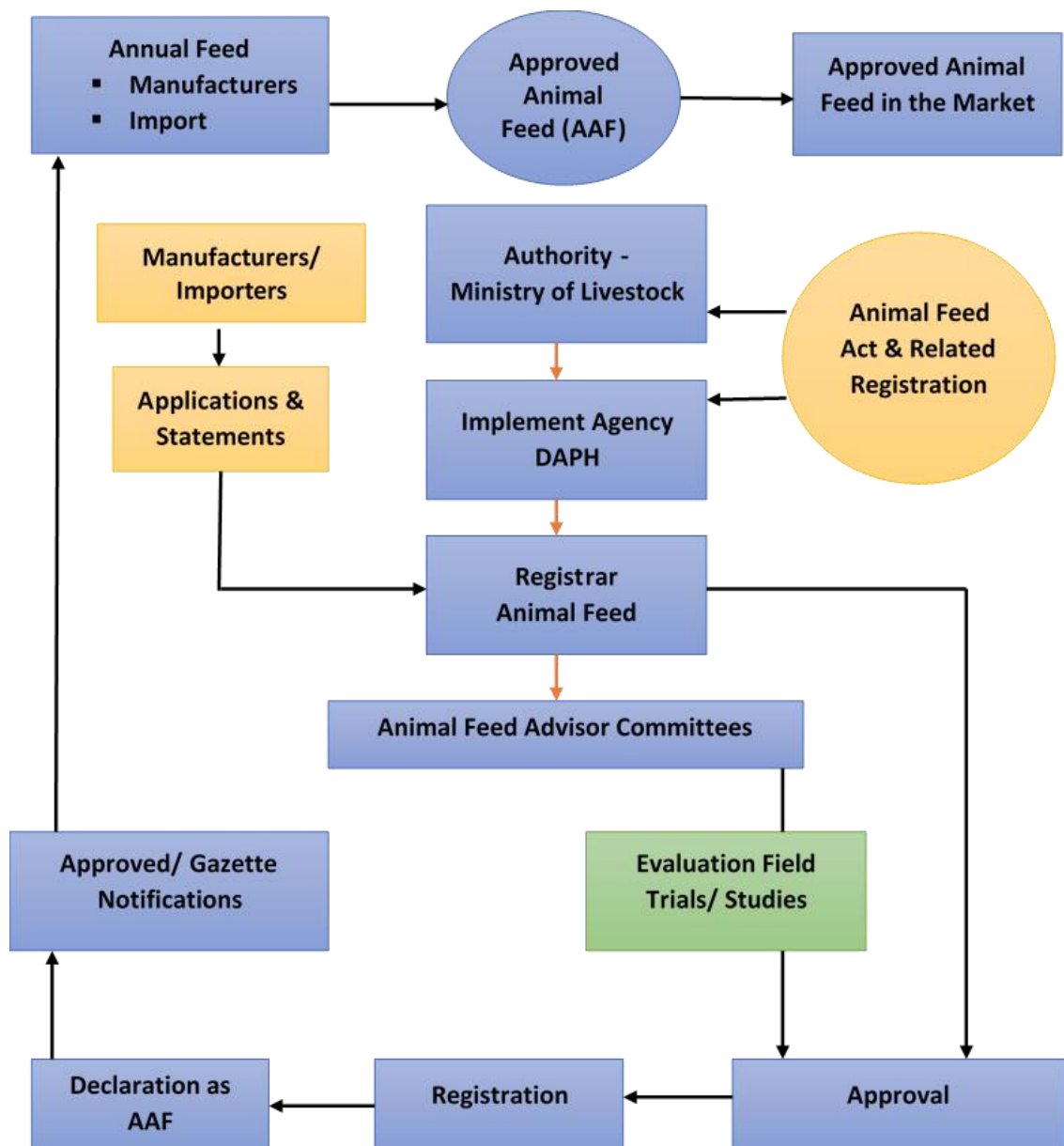
Source: HARTI Survey Data, 2023

Figure 3.14: Place of Selling Poultry Feed

3.8 Role Played by the Public Sector in Feed Production

Government’s role in the rapidly expanding poultry sector is restricted to monitoring and regulation. It implements a range of statutes that govern the quarantine of chick imports, control of disease outbreaks, registration of hatcheries, preparation and sale of feeds and import and manufacture of drugs. All production activities, including the importation of feed ingredients and manufacture of feeds, production of day-old chicks, provision of drugs and vaccines and commercial poultry production are in the hands of the private sector.

The role of the government in animal feed production is limited to a regulatory work. The commercial feed production and raw material importation are regulated by Animal Feed Act No. 15 of 1986, which was amended in 2016 as Animal Feed (Amendment) Act, No. 15 of 2016. The Registrar of Animal Feeds of the Department of Animal Production and Health (DAPH) is the licensing authority for the purposes of the Animal Feed Act. According to the Act, all feed manufacturers, sellers, and importers should have a license from the Feed Registrar to perform their activities. The Act also has given provision to establish a Feed Advisory Committee comprising of experts from different sectors to advise the line Ministry on issues related to animal feeds. Feed millers are also benefitted from tax relaxations on importation of feed raw materials.



Source: DAPH, n.d.

Figure 3.15: Animal Feed Registration Flow

3.8.1 Legislation on Feed Production

There is legislation to regulate, supervise and control the manufacture, sale, importation and distribution of animal feed/feed ingredients in Sri Lanka.

Main legislative documents

- Animal Feed Act No.15 of 1986
- Regulations to the Act (1996.04.25)
- Amendments to the Animal Feed Act No.15 of 1986
- Amendments to the Animal Feed Act No.15 of 2016

3.8.2 Animal Feed Act No 15 of 1986

This act regulates, supervise and control the manufacture, sale and distribution of Animal Feed.

As a pre requisite manufacturers desirous of registering manufactured compound feed under the meaning of the Act, should register their company/business in the respective local authority to get the entitlement for registration of their feeds. Even the applicants from foreign countries need to comply with this requirement. Applicant who submits an application should either be in a senior executive level.

Separate applications should be made for different feeds. When the nutrient composition of one feed differs from one to another, those are considered as different feeds. Upon receiving an application if the regulatory requirements are fulfilled and products coming within the purview of Registrar/Animal Feed he/she could decide on the registration or may be rejected.

Once the Registrar of Animal Feed is satisfied the manufacturers are licensed, thus manufactured products are declared as Approved Animal Feeds (AAF) under the meaning of the Act and are assigned a AAF numbers. AAF can be offered for sale with the approved Animal Feed number and the logo and label details in Sinhala/Tamil and English according to the statement appearing / or affixed to the outer package.

The Act stipulates guidelines to manufacturers for importation of raw materials for animal feed as well. Licensed manufacturers of animal feed get automatically entitled to import permitted raw materials to the country, for their own feed mixing operations, but are refrained from selling these products in the local market. Under no circumstances feed or pet food samples are allowed to be imported to the country prior to registration. To get the pre clearance to import raw materials for the purpose of manufacturing the licensed animal feed, manufacturer should submit the request letter with the proforma invoice and veterinary health certificate for specified products.

Other acts/ gazette notifications with indirect effect on the poultry feed production includes,

- Ban on import of fertilizers and agrochemicals
- Import and local use banning of glyphosate
- Importation restriction of maize as animal feed
- Restriction of use paddy or rice as feed

Ban on import of fertilizers and agrochemicals

Under the May 6, 2021 Special gazette, the Sri Lankan government restricted and ban the import of fertilizers and agrochemicals (including insecticides and herbicides). Due to forex shortage and fertilizer ban, fertilizer required for maize cultivation was scarce in the market. The local fertilizer price also escalated due to increased exchange rates and high inflation. However, as an alternative to this shortage, importation of maize is also not an answer as the required foreign exchange is also short. This vicious cycle of forex shortage, exchange rate increase and high inflation has created a massive shortage of poultry feed in the market.

Due to fertilizer ban, maize cultivation has reduced and forex shortage curtailed the importation. The same had happened to soya beans too. The Regulations prescribed in this Gazette shall only be applicable to the importation of goods which have the date of on or after 06 May 2021.

Import and local use banning of Glyphosate

Under the June, 11, 2015 Special gazette Sri Lanka government banned the import of Glyphosate which has heavily affected the maize production in Sri Lanka. According to Abeywickrama, et al. 2017 (as cited in Marambe and Herath, 2019), small holder maize feed producers and poultry producers were comparatively highly affected over time.

Importation restriction of maize as animal feed

- **Levy on importation of maize**

SCL of Rs. 10 per kg was imposed on maize imports for a period of 6 months with effect from 01st August 2017. The SCL is a composite levy i.e. it replaces all other applicable import duties and taxes. Earlier, maize attracted a customs duty of 15 percent, a 15 percent VAT, a 7.5 percent Port and Airport Levy, 2 percent Nation Building Tax and 35 percent cess per kilogram of maize. Further, the SCL on maize extended for a period of 31 days commencing 1st February 2018 through Extraordinary Gazette No. 2056/33 and the SCL levy on importation of maize remained till 03 Mar 2018.

- **Gazette Notification No. 2269/48 of 03.03.2022**

Introduced a concessionary rate of Rs.10 per kg on maize and sorghum for a period of 6 months, considering the raw material requirements of small-scale animal feed manufactures and poultry product prices.

- **Gazette Notification No. 2295/44 of 03.09.2022**

Extended the SCL on importation of maize and Sorghum at the prevailing rates until 31.12.2022, considering the raw material requirement of small-scale animal feed manufactures and to stabilize the poultry product prices.

▪ **Gazette Notification No. 2345/64 of 17.08.2023**

Sri Lanka cut an import tax on maize, which has kept domestic prices artificially high, made eggs and chicken more expensive than the world, and given large profits to collectors, which poultry farmers refer to as the 'maize mafia' and the import tax which was at Rs.75 a kilo was lowered to Rs.25.

Restriction of use paddy or rice as feed: Consumer Affairs Authority Act, no. 09 of 2003

Direction under Section 10(1)(b)(ii)

The Consumer Affairs Authority directs that no manufacturer, trader or distributor shall sell, expose or offer for sale, store, transport, distribute or buy or purchase any locally produced rice or paddy directly for the manufacture of animal feed or otherwise as an ingredient for the manufacture of animal feed with effect from 23rd July 2020 with Special Gazette Notification.

Quality Assurance of Animal Feed and Feed Ingredients

Monitor and maintain the standards of animal feed and feed ingredients which has direct influences on safety of animal originated food which is the main public health concerns

Register

- Animal feed manufacturers
- Animal Feed/Raw material Importers
- Dealers AF & RM
- Sellers
- Exporters

Every person desirous of selling animal feed whether manufactured or imported should register their animal feeds by the Registrar of Animal Feeds.

Responsibilities

Minister of Livestock Development

Implementing Authority

- Director General, Department of Animal Production & Health
- Registrar/Animal Feeds
- Animal Feed Advisory Committee
- Authorized Officers
- Authorized Analyst & Referee Analyst

Registrar/Animal Feeds - Licensing authority for the purposes of the Act.

Animal Feed Advisory Committee (AFAC)

Appointed by the Minister under Section 8 of the Act.

Main Functions

- Advice Registrar
- Recommendations to Controller of Imports and Exports
- Proposals to the Minister in the interest of national economy.
- To furnish publications/study reports

Authorized officers

- Nominates by DG/AP&HA
- Attend to complaints
- Contravention of the provisions
- Procure samples for analysis when in doubt
- Inspections of feed mills, importers, dealers - (authorized officers)
- Assure the quality of feeds available for sale. Other related activities

CHAPTER FOUR

Effects of COVID-19 Pandemic and Economic Crisis on Poultry Feed Production in Sri Lanka

Poultry is one of the fastest-growing livestock sub-sectors in Sri Lanka. The poultry sector's contribution to GDP showed a gradual increase until 2019, yet was highly affected by the COVID-19 pandemic and economic crisis in the following years. With the impact of COVID-19 and control-related trade issues in 2020, the poultry industry had to face numerous issues, which caused a slight setback in the production status of the industry. Unfortunately, the industry was not fully recovered from COVID-19 control-related trade issues when it had to face the economic crisis in 2022. We can expect differences in its effects across markets depending on their relative exposure to the crisis as well as differences in firm responses. This chapter investigates firms' responses to a major economic downturn and the factors influencing it by contrasting two sectors: commercial and self-mixed poultry feed production.

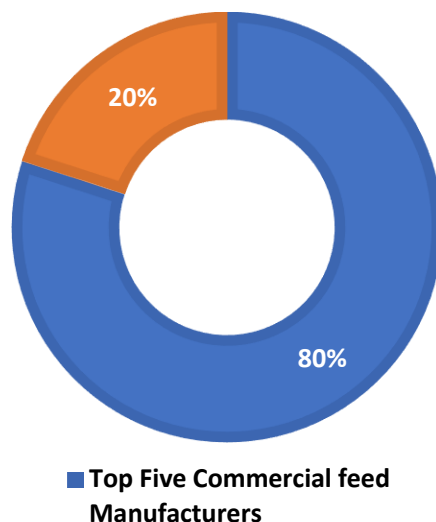
4.1 Business Performance: Effects of Economic Crisis and COVID-19 Pandemic

Before 2021, the poultry industry was the only flourishing animal industry in Sri Lanka that was competitive and comparable in quality to global standards. Though the country was self-sufficient in egg and chicken meat production before 2021, experience a decline in both sectors due to COVID-19 pandemic and the economic crisis. The current economic crisis in Sri Lanka exacerbates the vulnerability of the poultry feed production sector and had a significant impact on the growth and performance of the poultry industry. This effect could last long and substantially impede the country's economic growth.

4.2 Commercial and Self-Mixed Poultry Feed Production

Considering the entire animal feed production in Sri Lanka, 78 percent constituted commercial feed production, with the remaining 22 percent being self-mixed feed production in 2022. There are about 45 registered commercial feed mills operating in the country in year 2022. Approximately 96 percent of commercial animal feeds produced in Sri Lanka are for poultry as the poultry sector is the fastest growing animal production sector in the country. Self-mixed feed producers play a vital role in the poultry value chain and their livelihood mainly depend on the poultry industry.

Top five commercial feed manufacturers are occupying 80 percent of total market share of commercial feed production in the country (Figure 4.1).

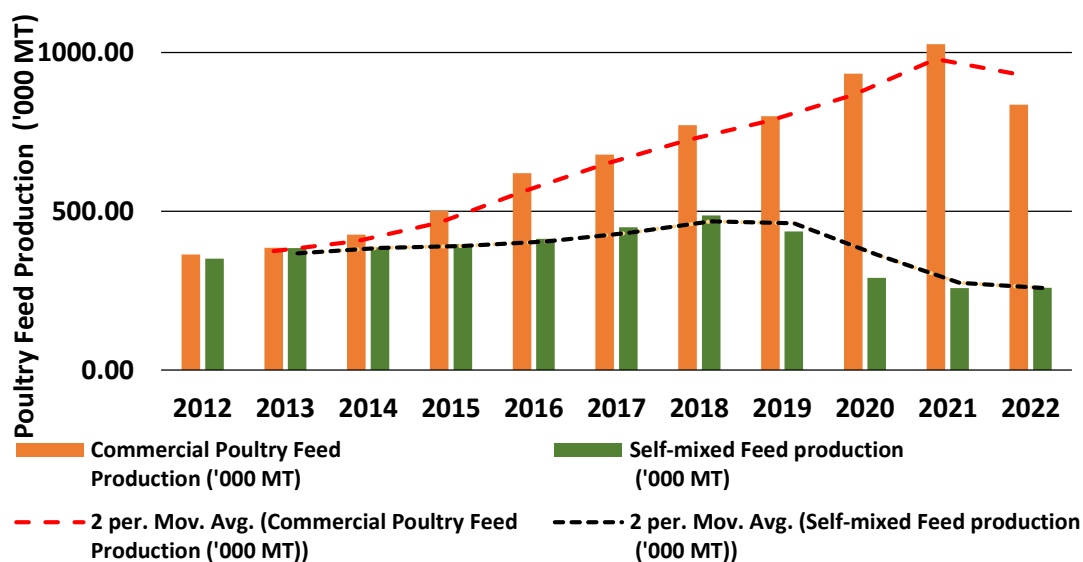


Source: HARTI Survey Data, 2023

Figure 4.1: Commercial Feed Production in 2022

In 2023, there are only one large scale manufacturer with the operational capacity of greater than 10,000mt/month as they have reduced the feed production by around 50 percent compared to the production recorded before the economic crisis.

Year 2021 *Maha* season recorded the highest maize yield for last decade reducing import of cereals for feed production. This increase in maize production act as the main contributory factor on securing the production of required quantity of poultry feed in year 2021. However, as illustrated in Figure 4.2, both commercial and self-mixed poultry feed production is declining. It also clearly demonstrates the precipitous drop in self-mixed feed production after 2019.



Source: Livestock Statistical Bulletins/DAPH (2012-2022)

Figure 4.2: Commercial and Self-Mixed Feed Production

4.2.1 Business Performance: Vulnerability vs Resilience

It was observed diminishing of compound feed market as most of the poultry players decided to run their own feed mixing operations to cater to meet the demand for their company requirement (meat and egg production). Only few players are engaged in selling poultry feed to the market at present. Vulnerability or resilience was measured using a combination of three variables. The first variable, impact of the recession measured whether the respondents were affected by the recession. According to Table 4.1, the current economic crisis has impacted the majority of commercial feed producers' (93%) and self-mixed producers' (97%) industry performances.

Table 4.1: Impact of Poultry Feed Production under Recession

Whether the Industry Affected by the Recession	Commercial (N=30)		Self - mixed (N=60)	
	Frequency	Percentage	Frequency	Percentage
Yes	28	93	58	97
No	2	7	2	3

Source: HARTI Survey Data, 2023

The reluctance of business owners to report financial data in a questionnaire survey led to measurement of perceived performance as advised by Garg, et al. 2003 (cited in Smallbone, et al. 2012). Therefore, respondents were asked to compare the value of sales and profit margins in 2022 with the 12 months previously, using a five-point Likert Scale (where 1 = 'significantly higher' to 5 = 'significantly worse'). Responses from both variables were combined into a new growth variable: the labels 'significantly higher' and 'higher' sales were combined and coded as increase in growth. Likewise, growth maintain as same level and growth at decrease or worse or sales and profit margins was coded shown in Table 4.2.

Table 4.2: Growth of the Industry during the Economic Crisis

	Growth					
	Increase		Maintain/Same		Decrease/Worse	
	Frequency	%	Frequency	%	Frequency	%
Commercial Poultry Feed Production (N=30)	1	3.33	10	33.33	19	63.34
Self-Mixed (N=60)	0	0	19	31.67	41	68.33

Source: Authors own calculation HARTI Survey 2023

Only three percent of the commercial firms reported growth in the sector and the majority (63%) of the firms and 68 percent self-mixed firms experienced declining margins. However, 33 percent of commercial producers and 32 percent of the self-mixed producers maintain their business growth at same levels during the crisis period. A matrix was created from the resulting two variables; the impact of the recession and growth to guide the initial classification of cases into two categories: vulnerability and resilience. According to the growth matrix, the majority of firms were affected by the recession and showed declining growth throughout the economic

crisis. It indicated that most of the poultry feed producing firms are vulnerable to economic downturn.

The crisis presented major challenges to firms of all sizes, but particularly smaller firms. A combination of resource-related constraints and tendency to rely on bank credit when external finance is used emphasized that small firms are particularly vulnerable during the periods of economic downturns compared with larger enterprises that control more substantial recourses. The study shows that more than 50 percent of the self-mixed feed production operations are seriously affected due to economic downturn.

Table 4.3: Factors Influenced Decisions to Increase, Maintain or Decrease the Poultry Feed Production in the Last Two Years

Factor	Commercial (N=30) (%)			Self-mixed (N=60) (%)		
	P	No	N	P	No	N
<i>The markets</i> The influence of the demands of customers/ suppliers for production	65	5	30	2	3	48
<i>Business Status</i> The influence of the size, type or status of your firm	53	8	39	33	7	33
<i>Labour costs</i> The influence of the labour costs had upon your decision to increase/decrease production	19	11	70	30	5	40
<i>Access to finance business</i> How opportunities you have/not have had to obtain finance affect the production	19	23	58	53	5	15
<i>Limited access to resources</i> How access to raw materials, equipment, technology has affected production	13	8	79	52	7	15
<i>Taxation</i> How personal tax, company tax or any other tax impositions had an effect for production	13	37	50	0	58	42
<i>Government policies and practices</i> How government support, restrictions or attitudes affect production	20	7	73	4	36	60

Code: (P) Positive Effect; (No) No Effect; (N) Negative Effect

Source: HARTI Survey, 2023

Although negative effects are usually highlighted recession conditions can provide business opportunities for firms. In commercial feed producers' positive effects were most commonly reported in relation market demand and status of their business. Type and size of the business created opportunities to at least maintain their growth. Tax

impositions and ad hoc policies of the government have negatively influenced the growth of feed industry during the economic downturn. Specially, respondents were more troubled about the Value Added Tax (VAT) implementation to the commercial poultry feed production and government policy on import restriction of maize. Under the economic crisis, self-mixed producers followed the strategy of replacement of hired labour from family labour. However, commercial producers especially large and medium scale producers do not consider labour cost as a burden for maintain their industry growth. They had to keep price margins in line with rising costs.

4.3 Experience of Recession Related Effects

Eleven different items were used to measure finance as well as non-finance-related effects, using a five-point Likert Scale. The results highlighted some interesting differences and similarities in how the economic crisis has had an impact on commercial and self-mixed poultry feed production.

Table 4.4: Experience of Recession Related Effects (Percentage of Firms)

Recession Related Effects	Commercial (N=30)			Self-mixed (N=60)		
	High Effect	No Effect	Low Effect	High Effect	No Effect	Low Effect
<i>Financial related effects</i>						
Availability of bank loans or overdrafts	23	24	53	62	5	33
Credit periods and/or credit items from suppliers	25	9	66	52	8	40
Bad debts	25	5	70	20	17	63
Late payment by buyers	35	18	47	20	10	70
Interest rates for loans	56	0	44	48	7	45
<i>Non-financial related effects</i>						
Cost of raw materials	100	0	0	87	5	8
Availability of raw materials	100	0	0	90	1	9
Energy cost	96	0	4	92	0	8
Availability of electricity/fuel	91	0	9	87	7	7
Exchange Rate	93	0	7	87	1	12
Transport cost	83	5	12	77	18	5
Management issues	39	0	61	15	18	67

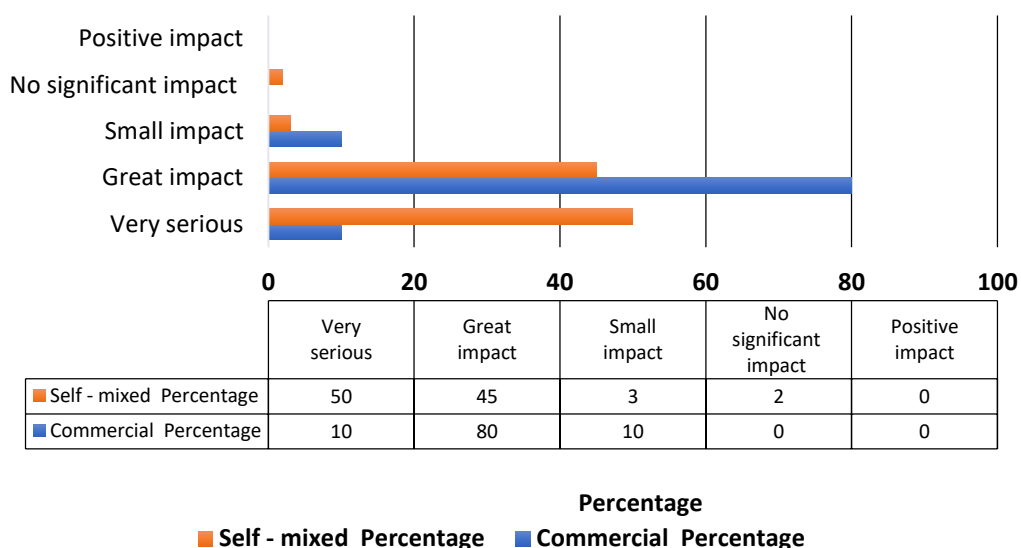
Source: Authors own calculation HARTI Survey, 2023

As given in Table 4.4, survey results show that commercial feed producers were less likely to report negative finance-related effects than the self-mixed feed producers. Late payments do not appear to be a significant issue for feed producers, as the vast majority of them only accept cash payments. The availability of bank loans or overdrafts, credit periods, and/or credit items from suppliers appears to have high financial-related effects for self-mixed producers. However, both commercial and self-mixed feed producers reported being affected by the financial effects due to high interest rates for loans. Overall, all the firms were more likely to be affected by non-

finance related effects. The highly rated non-financial effects were the unavailability of electricity or fuel and volatility of exchange rate.

4.3.1 Extent to which the Poultry Production Operations were Affected

Sri Lanka is currently battling with what is being described as the worst economic crisis since the country’s Independence in 1948. In March 2022, Sri Lanka declared itself bankrupt, having defaulted its foreign debts of over 55 billion dollars. The crisis presented major challenges to firms of all sizes, but particularly smaller firms. A combination of resource related constraints and tendency to rely on bank credit when external finance is used emphasized that small firms are particularly vulnerable during the periods of economic downturns compared with larger enterprises that control more substantial resources. According to the results of Figure 4.3, it clearly shows that more than 50 percent of the self-mixed feed production operations are seriously affected due to economic downturn.



Source: HARTI Survey Data, 2023

Figure 4.3: Extent to which the Poultry Feed Production Operations Affected

4.4 Cost of Production of Poultry Feed

The term cost generally refers to outlay funds for poultry feed mill. Cost items are classified into two major groups e.g., fixed cost and variable cost and these together equaled total cost. The feed cost accounts for 68-75 percent of broiler and 75-80 percent of layer production cost. The feed cost is a major means of manipulating the production cost for higher profitability. Therefore, the feed-cost efficient poultry production is the major constraint in poultry production. The cost of feed depends upon the availability of feedstuffs and local tariff rates. The cost, easy availability and nutritional as well as physical quality of feed are important factors for their selection in feed formulation. The availability and cost of maize and soybean meal generally

determines feed cost. The countries producing maize and soybean meal produce broilers and eggs at low cost.

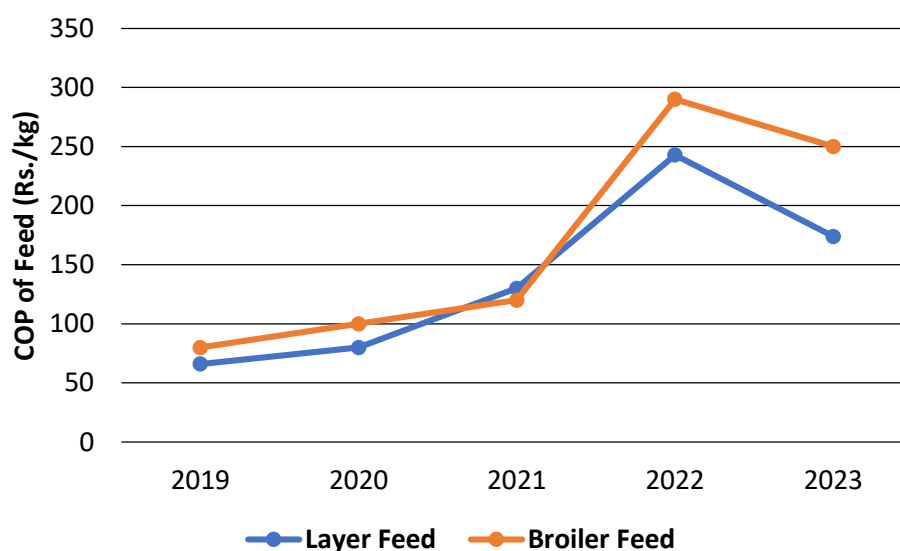
The cost of feed is a significant determinant of production cost per kg broiler or per egg, with feed prices experiencing a steady increase for more than a year. The disappointing harvests due to climate change, and increased demand for animal feed production have increased the poultry feed cost.

Table 4.5: Average Cost of Production of Commercial Layer Feed (Grower) and Broiler Feed (Finisher) (Rs. /50kg bag)

Item	Layer Feed	Broiler Feed
Raw material cost	8,657.30 (89%)	9,836.30 (87%)
Maize	2,593.00	2,325.00
SBM	2,069.25	2,937.50
Packing cost (5%) 120/bag	483.55	690.00
Labour and factory overheads	530.15	750.00
Total production cost	9,671.00	11,276.30
VAT (15%)	1,450.00	1,691.00
Selling price (Ex-mill)	11,122.00	13,910.00

Source: Calculated based on HARTI Survey Data, 2023

It was recorded that the average cost of production of both commercial layer feed and broiler feed have increased by 3 to 4 times in 2022 compared to 2019.

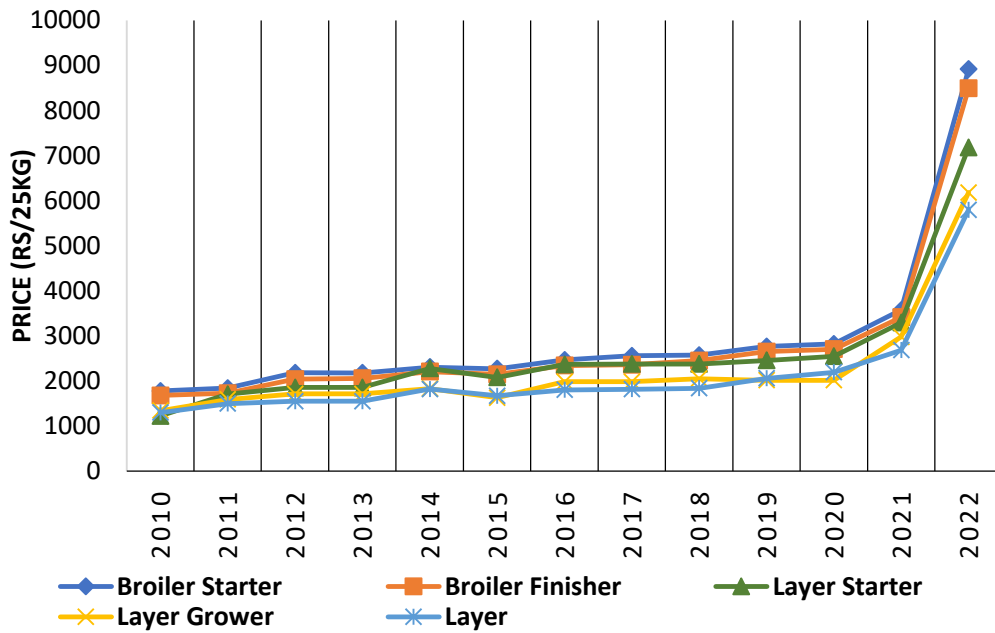


Source: Calculated based on HARTI Survey Data, 2023

Figure 4.4: COP of Layer Feed and Broiler Feed by Commercial Feed Manufacturers

Prices of poultry feed in Sri Lanka have risen beyond the global average due to a high levy on the importation of a crucial feed ingredient of corn. It was recorded that the

average cost of production of both commercial layer feed and broiler feed have increased by three to four times in 2022 compared to 2019.



Source: Livestock Statistical Bulletins/DAPH (2011-2023)

Figure 4.5: Changes in Prices (Rs./25kg) of Key Types of Poultry Feed (2010-2022)

CHAPTER FIVE

Constraints, Adoptive Strategies and Potentials

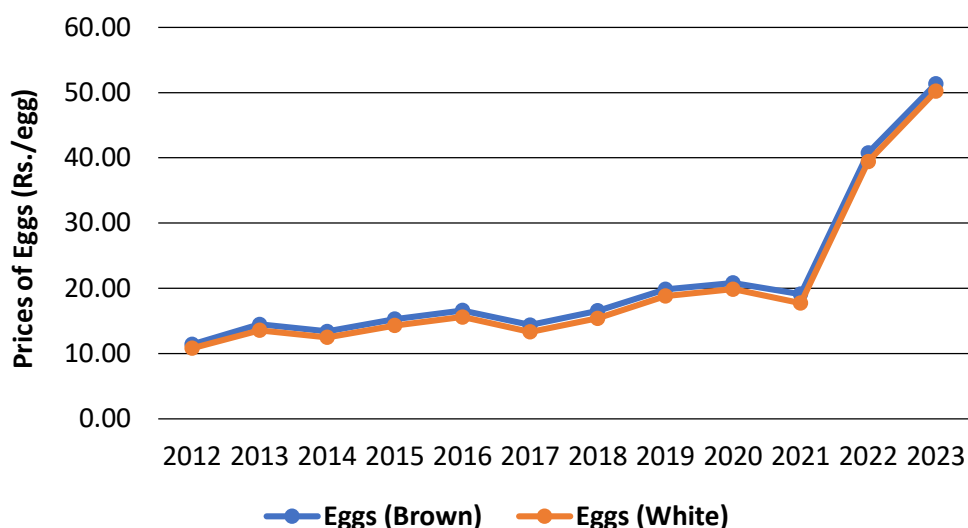
5.1 Introduction

Since chicken meat and eggs play an important role in the food system of Sri Lanka which is one of the main protein sources supplying food items of the society, if chicken meat and eggs are available at a reasonable market price, consumers could afford them. The producers highlight that the increasing cost of production is one of the key issues faced in the industry.

As we are aware, the egg market shortage and higher price for eggs in Sri Lanka have emerged as significant concerns in recent months. It has been impacting the livelihoods of farmers, consumers and the overall economy of the country. Indeed, eggs are a crucial source of protein for the food requirements of many Sri Lankans, making the current egg market shortage a significant challenge for families across the country. With the shortage leading to higher egg prices, people are facing difficulties in purchasing an essential dietary component that contributes to their overall nutrition and well-being.

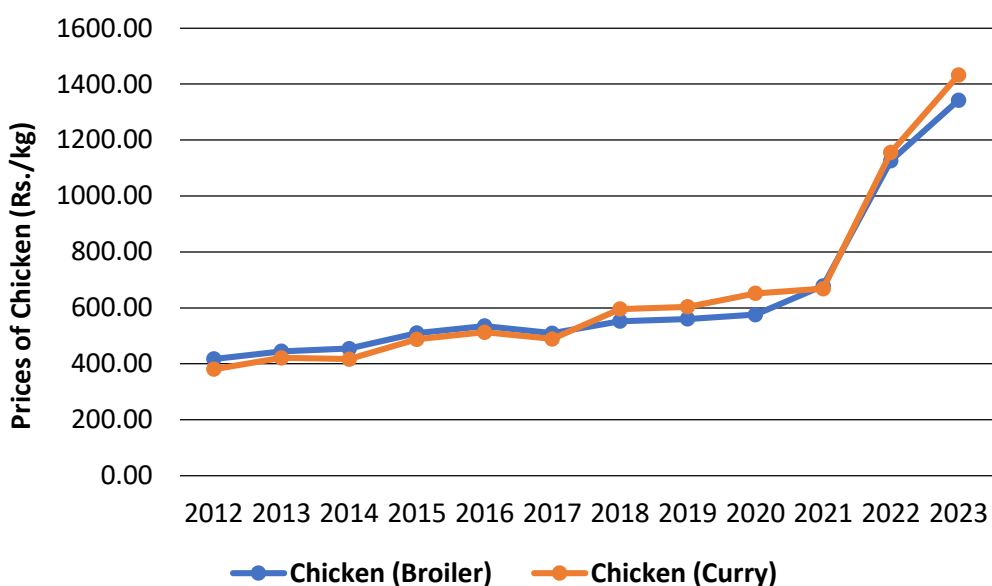
The egg market shortage in Sri Lanka has indeed affected low-income and middle-income families, as eggs are an affordable and valuable protein source compared to meat and fish. With scarcity of eggs, consumers are forced to turn to more expensive alternatives for their protein needs, which worsened the economic burdens faced by people in the country.

When it comes to the supply of eggs to local market, All Ceylon Egg Producers Association plays a significant role where they have authority to set prices of eggs. This Association consists of a few large-scale egg producers, and they control the larger share of market supply of eggs. This means that if they do not possess a larger market share of eggs, they cannot decide prices per eggs.



Source: Data Management Division/HARTI (2012-2023)

Figure 5.1: Price Changes for Brown and White Eggs (2012-2023)



Source: Data Management Division/HARTI (2012-2023)

Figure 5.2: Price Changes for Broiler and Curry Chicken (2012-2023)

A recent rapid assessment conducted by HARTI in 2023 (Annex I), shown that feed cost is the biggest cost component of the COP of both eggs and chicken. The following table analyzed the significance of feed cost in COP of eggs and chicken according to that survey data.

Table 5.1: Significance of Feed Cost to COP of Eggs and Chicken Meat

Variable (Egg)	Correlation Coefficient (r)	R-Square
COP for One Egg	.783**	.613
COP for 1 kg of Chicken Meat (with skin)	.900**	.810

**Correlation is significant at the 0.01 level (2-tailed)

Source: Author's Own Calculation, 2023

The correlation coefficient of the COP for one egg and feed cost was 0.783 ($P < 0.0001$) at 95% confidence level. Also, that was 0.900 ($P < 0.0001$) for one kilo of chicken meat (with skin) and feed cost at 95% confidence level.

When comparing the coefficient of determination (R^2) for this scenario, 61.3 percent of the variability in the COP for one egg can be predicted by the feed cost while 81 percent of the variability in the COP for one kilo (with skin) can be predicted by the feed cost at 95% confidence level.

As explained in Chapter 4, prices of different types of layer feed and broiler feed have increased with a marked-up increase recorded in 2022 and 2023 due to shortage and high prices of feed ingredients. As feed cost is a significant factor in the COP of both eggs and chicken, the significance of feed prices was analyzed and results are described in Table 5.2 and 5.3.

Table 5.2: Relationship between Egg Price and Layer Grower Feed

Variable (Egg)	Correlation Coefficient (r)	R-Square
Layer Grower	.937**	0.878

**Correlation is significant at the 0.01 level (2-tailed)

Source: Author's Own Calculation, 2023

The correlation coefficient (r) measures the strength and direction of the linear relationship between two variables. It ranges from -1 to +1. A positive value indicates a positive linear relationship, while a negative value indicates a negative linear relationship. The closer the absolute value of r is to 1, the stronger the relationship.

In this case, since $r = 0.937$, it suggested a strong positive linear relationship between the layer grower feed costs and egg price. The correlation coefficient of the layer grower feed for egg price was 0.937 ($P < 0.0001$, 95% CI 0.1 to 0.2).

In the above case, since $R\text{-squared} = 0.878$, it means that approximately 87.8 percent of the variance in the egg price can be explained by the layer grower feed price. This indicates the nature of the relationship between variables, suggesting that about a percentage of the variability in the egg price can be predicted by the layer grower feed cost. Hence, 87.8 percent of the variability in the egg price can be predicted by the layer grower feed cost at 95% confidence level.

Table 5.3: Relationship between Chicken Meat Price and Broiler Finisher

Variable (Meat)	Correlation Coefficient (r)	R-Square
Broiler Finisher	.974**	.949

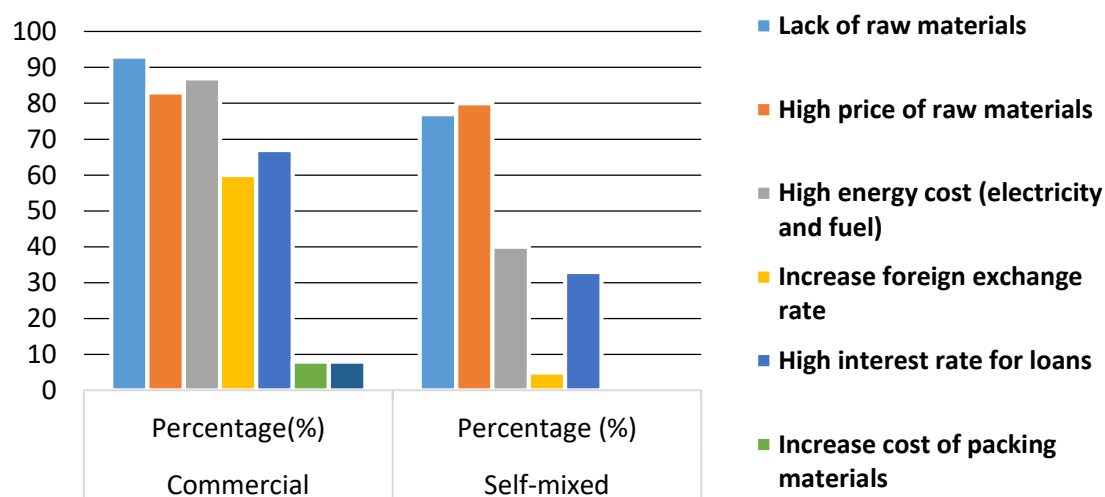
**Correlation is significant at the 0.01 level (2-tailed)

Source: Author's Own Calculation, 2023

The correlation coefficient of the broiler finisher and meat price was 0.974 ($P < 0.0001$, 95% CI 2.6 to 3.6). 94.9 percent of the variability in the meat price can be predicted by the broiler finisher feed cost at 95% confidence level.

5.2 Constraints and Challenges in Sri Lankan Poultry Feed Industry

Policy missteps thereafter relating to the importation of agrochemicals, management of the exchange rate and external debt repayment generated multiple economic crises in the country, which were further aggravated by the Ukrainian conflict. Supply-side factors, such as shortages and the rise in prices of local and imported raw materials appear to have made poultry feed production more vulnerable to the crisis. Much of the impact of the crisis on the supply of raw materials has likely heavily affected the operations of feed production. Furthermore, given that feed production relies on imported raw material, an increased concern was the ability of Sri Lankan manufacturers to afford the foreign currency reserves required to purchase raw material to fulfil orders. Further, industry also is particularly vulnerable to shortages in imported raw materials and energy cost of electricity and fuel. A lack of steady supply of fuel and electricity was also affecting the smooth operations of the feed production industry.



Source: HARTI Survey Data, 2023

Figure 5.3: Main Constraints Face by the Feed Manufacturers

The factor ranking method was applied to identify the key problems faced by the firms due to the prevailing economic crisis. According to the results, key problems faced by the firms included: shortage of required raw materials, high cost of production and

demand decline due to inflation, continuous power cuts, working capital and liquidity problems, and breakdown of their supply chain due to fuel issues. All these key issues affect diminish the capacity utilization rate and lower the business performance of many feeds production firms. Lack of raw materials and high price of raw materials made a significant impact on the sector and more focus is given to these two factors.

5.2.1 Lack of Raw Materials

Feed mills require a high amount of at least the main ingredients in a feed formula and a large variety of micronutrients (vitamins, minerals, additives). Major components of the formula (grains, oil meals, industrial by-products) are not always available at the right time and at the right place.

Availability of low-priced, high-quality feeds is critical for domestic poultry production to remain competitive and meet consumer demand. Maize is considered one of the high-quality cereals for poultry feed which production could be produced at a comparatively low cost. Insufficiency of maize for poultry feed production had been one of the major problems and only 40 percent of the requirement is produced locally. Further, locally produced maize does not meet the quality requirement of feed manufacturers in most cases. In 2022, the maize production was over 60 percent below the 2021 level and 40 percent below the previous five-year average due to the policy decision to ban import of fertilizer and agrochemicals. The import ban on maize in 2020 amplifies the shortage. Due to those maize prices have increased by 300 percent from 2018 -2022. Increased international price of maize and war in Ukrain and Russia disturbed the import of maize from those countries.

With the intention of protecting local farmers, successive governments have continuously imposed bans on maize imports. Although domestic maize producers may gain from higher prices associated with import restrictions, these gains must be weighed against losses to producers and consumers of poultry meat and eggs, as well as to the potential international competitiveness of Sri Lankan poultry production. According to the poultry industry stakeholders, this strategy has not been well through as a number of traders (intermediaries) are using this decision to manipulate the availability and price of maize. The time lag in decision making and offering of the quota to maize imports also has contributed to price escalation.

The following table describes the current situation of raw material supply. When evaluating local raw material supply during the survey period, about 25 commercial-level feed-producing companies have faced shortage of supplying maize. Further, 46 self-mixed feed producers have encountered a shortage of maize. However, most of the commercial (23 companies) and self-mixed producers (40) did not experience a shortage of supply with respect to supply of other local ingredients and 7 commercial-level companies have experienced a shortage of other local raw materials. Regarding imported raw materials, both commercial-level feed producers and self-mixed feed producers have not encountered disruptions in raw material supply.

Concerning feed production, 22 commercial-level feed-producing companies have reported shortages, and this shortage has been observed in 45 self-mixed feed producers. At the current situation, both commercial-level feed companies and self-mixed feed producers have not experienced any disruptions in feed production.

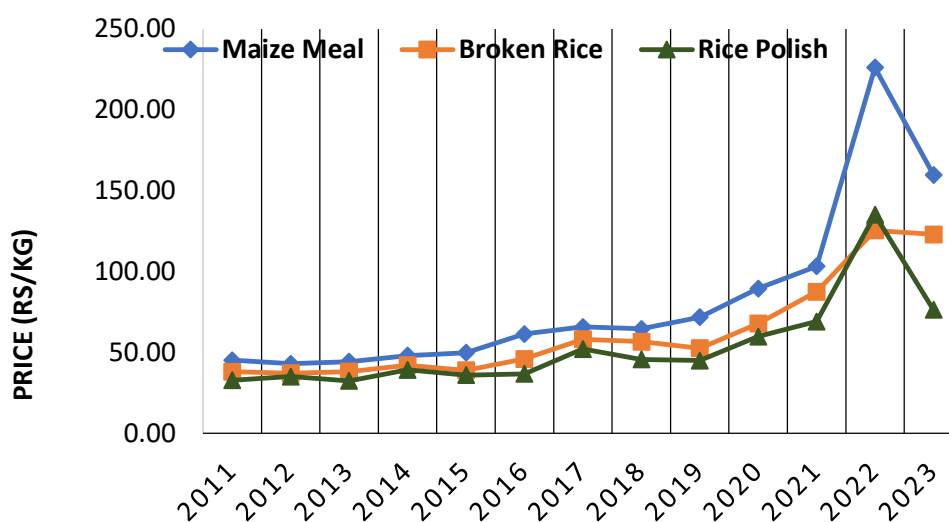
Table 5.4: Supply of Raw Materials in 2023

Raw material		Commercial			Self-mixed		
		Normal	Shortage	Disrupt	Normal	Shortage	Disrupt
Local	- Maize	5	25	0	14	46	0
	- Other	23	7	0	40	20	0
	Imports	28	2	0	42	18	0
Feed production		8	22	0	15	45	0

Source: HARTI Survey Data, 2023

5.2.2 High Price of Raw Materials

Obtaining USD through private money exchanges was the only viable option to import the raw materials but increased the exchange rate. World market prices of raw materials also on an inclining trend. As a result, continuous increases of feed prices were observed within the year 2021.



Source: Livestock Statistical Bulletins/DAPH (2011-2021); HARTI Survey Data (2022 & 2023)

Figure 5.4: Changes in Prices of Energy Source Raw Materials used in Poultry Feed Industry

According to Figure 5.4, the highest price increment was reported for maize in 2022. The average maize price was Rs.55.50/kg in 2019. In comparison to 2019, maize prices have increased by 56 percent, 307 percent, and 188 percent in 2021, 2022, and 2023, respectively. Due to limitation of maize supply the demand for broken rice also

increased. Considering the broken rice prices, the highest price increment was reported in the year 2022 and it was a 260 percent price increment compared to 2019.

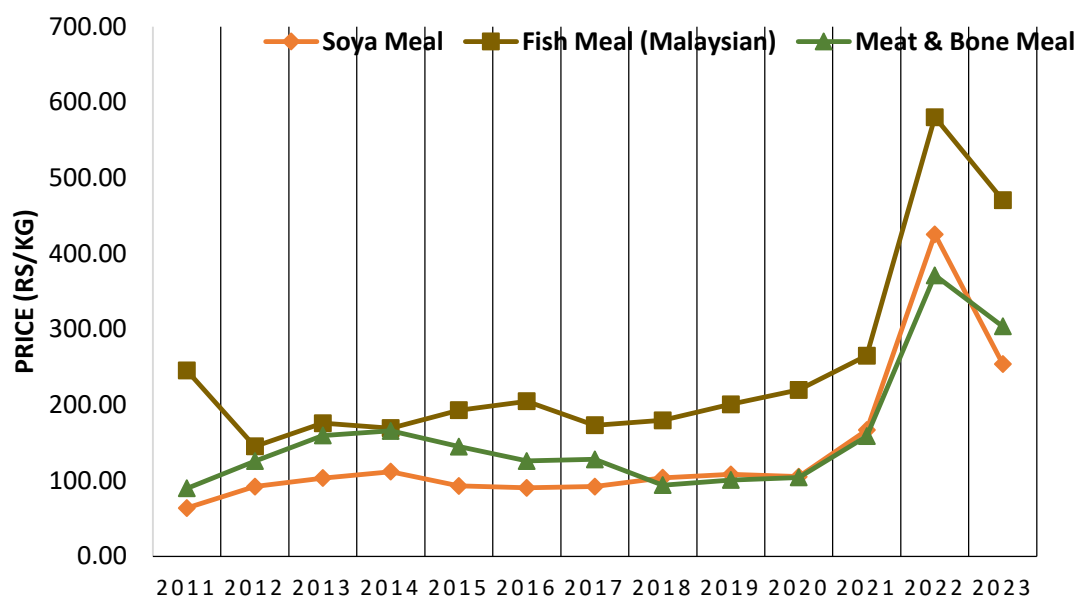
Table 5.5: Significance of Maize Prices to Different Poultry Feeds

Variable	Correlation Coefficient (r)	Interpretation	R-Square
Broiler Starter	.954**	A strong positive linear relationship	.911
Broiler Finisher	.953**	A strong positive linear relationship	.908
Layer Starter	.966**	A strong positive linear relationship	.934
Layer Grower	.973**	A strong positive linear relationship	.946
Layer	.979**	A strong positive linear relationship	.958

Note: **. Correlation is significant at the 0.01 level (2-tailed)

Source: Author's Own Calculation, 2023

The above table explains the correlation coefficient and regression coefficient between the price of different types of poultry feed with maize used to produce 1 kg of each type of feed. Accordingly, there are strong positive linear relationships in every case, and maize price describes 91.1%, 90.8%, 93.4%, 94.6%, and 95.8% of Broiler Starter, Broiler Finisher, Layer Starter, Layer Grower, and Layer Feed prices respectively at 95% confidence level.



Source: Livestock Statistical Bulletins/DAPH (2011-2021); HARTI Survey Data (2022 & 2023)

Figure 5.5: Changes in Prices of Protein Source Raw Materials Used in Poultry Feed Industry

Soybean meal is the dominant protein supplement used in poultry diets and is the standard to which alternative protein sources are compared. Soybeans can be fed to poultry whole or as soybean meal, a by-product of oil extraction. Because of the

relatively good amino acid profile, it is usually used to balance the dietary amino acid levels with cereal grains and their by-products in poultry feeds. The price of soybeans, a major ingredient used for poultry feeds, has almost quadrupled in the last year when compared to 2019.

Table 5.6: Significance of Soybean Prices to Different Poultry Feeds

Variable	Correlation Coefficient	Interpretation	R Square
Broiler Starter	.934**	A strong positive linear relationship	.873
Broiler finisher	.932**	A strong positive linear relationship	.868
Layer starter	.945**	A strong positive linear relationship	.892
Layer grower	.780**	A strong positive linear relationship	.922
Layer	.959**	A strong positive linear relationship	.920

Note: **. Correlation is significant at the 0.01 level (2-tailed)

Source: Author's Own Calculation, 2023

Table 5.6 depicts the correlation coefficient and regression coefficient between the price of different types of poultry feed with soybean used to produce 1 kg of each type of feed. Accordingly, here too, there are strong positive linear relationships in every case, and soya price describes 87.3%, 86.8%, 89.2%, 92.2%, and 92.0% of Broiler Starter, Broiler Finisher, Layer Starter, Layer Grower, and Layer feed prices respectively at 95% confidence level.

Among various inputs, premixes, minerals and vitamins are critical in supporting the desired level of animal productivity. Unavailability of local sources of vitamins, amino acids, macro and micro-minerals, and the comparatively high price of imported premixes, minerals and vitamins contributed to subsequent increase in the price of mixed feeds.

5.2.3 Foreign Exchange Crisis

Increased dollar price and shortage of currency, restricted importation of maize, soybean meal and other vitamins and premixes. Almost the entire amount of soybean 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. Therefore, the cost of manufacturing poultry feed in Sri Lanka is subject to price fluctuations occurring in the world market.

Although the production was secured through various means the producers have to struggle for obtaining foreign currency for importation. The foreign currency supply issue further worsened in 2022. Lack of foreign currency at local banks, changes in LC terms, price increase in world market, rapid depreciation of LKR and difficulties in locating freight are few of the factors that hinder import of raw materials.

5.2.4 Taxation Policy

Multiple taxations are imposed at different stages of animal feed processing. The Value Added Tax (VAT) of 15% is charged on commercial poultry feed manufacturing excluding other animal feed. VAT is charged on feed ingredients and compound feeds leading to double taxation for feed ingredients and formula/compound feeds. The tax imposed only on commercial poultry feed reduces the comparative advantage of commercial feed manufactures quitting the feed industry. In effect, it is a tax on the increase in the sales price of the poultry feed as they pass through that chain. Ultimately, the VAT will be borne by the final consumer and, therefore, VAT will operate basically as a tax on the domestic consumption of egg and meat.

5.2.5 Research and Extension Support for Commercial Feed Sector

Technical services (research and extension) in promoting the commercial feed sector (use of alternative feeds for compound feeds; use of innovative approaches in import substitution via local production of feed supplements; research, extension and infrastructure development support in feed processing machineries; on-farm testing and promotion of compound feeds, and technical support for feed safety and quality regulation) are poorly operated or non-existent.

5.2.6 Issues Related to Processing

According to the key informant interviews with key officers of different poultry feed production in the country, the following issues are highlighted by them;

- ✓ Many of the feed mills are older than 20 years and thus utilizing old technology. This has its own implications on the quality of compound feed produced
- ✓ Lack of expertise in commercial methods of compound feed manufacturing
- ✓ Inadequate extension and technical support services to the feed milling industry by government, research, and international agencies.
- ✓ Inadequate research information on the use of local by-product feed ingredients and reliable information on composition
- ✓ Lack of appropriate credit facilities
- ✓ The industry's dependence on imported equipment and machinery and associated high investment cost
- ✓ Insufficient storage capacity of annual crops or by-products produced seasonally
- ✓ Very limited effort/attempt to go into diversified forms of feed products such as pellets and mineral licks
- ✓ Many feed mills are currently producing much lower than installed capacity.

Poor Quality of Ingredients

Adulteration of feed with lower quality feed material is a common practice. Feed ingredients that should be rejected on quality grounds are often used by millers due to the lower cost of such ingredients;

- Lack of access to feed laboratories resulting in no possibilities for checking on quality; due to lack of accredited nutrition laboratories, quality assurance and residue analysis cannot be performed as expected.
- Deterioration in feed quality during storage is also common. This occurs due to negligence of especially self-mixed feed manufacturers on those aspects.

Other issues;

- ✓ High transport costs and delays
- ✓ Lack of lands and a proper location to construct a feed mill and to expand the business.
- ✓ Environmental pollution issues.
- ✓ Insufficient storage capacity of annual crops or by-products produced seasonally;
- ✓ Lack of market information like ingredient prices, mixed feed prices, etc
- ✓ Limitations like power interruptions and lack of spare parts for maintaining existing equipment among the most frequent causes of low output or insufficient quality of feed produced by the feed milling industry;

Main issues faced by the industry could be cited as inadequacy of feed raw materials, lack of foreign currency for importation of inputs, frequent power cuts and insufficient fuel supply which led to continuous rise of cost of production and market price.

5.3 Adoptive Strategies to Maintain the Business Performance**5.3.1 Strategies Used to Minimize COP**

With production and profitability disrupted and the bottom line in flux, cutting business costs rapidly becomes a priority during a crisis. Both commercial and self-mixed feed producers moved to use alternative raw materials due to high prices and shortage of what they usually used. Due to excessive pricing and a scarcity of the raw materials they traditionally used, both commercial and self-mixed feed producers began to use alternative raw materials.

Due to unavailability of sufficient stocks and high prices of maize most of the feed manufacturers have used alternative raw materials such as broken rice, rejected rice, wheat flour etc. while balancing the nutrition level of the poultry feed. Self-mixed producers use different types of available low-cost ingredients as alternative raw materials. The government in a gazette notification has banned the use of any form of rice produce or import to Sri Lanka for poultry feed production. The failure to use rice

– a better substitution in the absence of maize-creates difficulties in manufacturing the required amount of feed. This forces feed producers to turn to high-cost substitutes and resulting in feed price escalation and a significant drop in feed production. Accordingly, small scale poultry producers have become more vulnerable to market pressures and move to self-mixing. However, lack of laboratory facilities for testing the quality of raw materials and feed formulation is a big challenge for self-mix small and medium scale farmers.

Table 5.7: Strategies Used to Minimize COP

Adoptive strategies	Commercial		Self - mixed	
	Frequency	Percentage	Frequency	Percentage
1. Use of alternative raw materials	24	80	40	67
2. Employee trainings	3	10	0	0
3. Reduce employees	5	17	15	25
4. Selling birds	0	0	10	17
5. Reduce quantity of feed production	10	33	12	20
6. Make new investments	2	7	2	3
7. Alternative energy sources	1	3	0	0
8. Labor optimization	2	7	8	13

Source: HARTI Survey Data, 2023

Majority of the commercial feed producers (80%) and self-mixed producers (67%) changed their poultry feed ration using alternative raw materials. They mostly altered the proportions of important elements. The customary maize content of 40-60% was reduced to 20-25%, and broken rice/bol rice was utilized as an alternative.

Table 5.8: Change of Poultry Feed Ration

Response	Commercial		Self - mixed	
	No	%	No	%
Yes	24	80	40	67
No	6	20	20	33

Source: HARTI Survey, 2023

However, issues are reported in poultry husbandry against sudden feed changes. Birds went off feed and suffer an interruption in the rate of growth and that laying hens suffer a loss in egg production as the result of sudden feed changes. Specially, change in yolk colour was done by self-mixed producers engaging in egg production.

Table 5.9: Important Raw Materials and Their Usage Level

Class	Material	Usage Limit		Usage Limit (Crisis)					
		Broiler	Layer	Broiler*	Layer*				
Cereals	Maize	40-60	30-50	25-30	25-30				
	Wheat								
Cereal by-products	Rice polish	10-20	20-40	5-10	10-25				
	Broken rice	5-10	10-20	25-30	10-20				
	Wheat bran								
	Wheat flour								
Oil meals	Coconut meal	1-5	10-20	1-2	10-15				
	SBM	20-30	15-20	20-30	15-20				
Animal by products	Fish meal	2-5		2-3					
	MBM								
Mineral supplements	Di-calcium phosphate	}	}	}	}				
	Sodium Bicarbonate								
Additives Vitamins						1	1	1	1
Amino acids	L-Lysine								
	DI-Methionine								
Antioxidants									

Source: Registrar of Animal Feed/DAPH, 2022

*HARTI Survey Data, 2023

5.3.2 Actions Taken to Increase or Maintain Business Performance

This research found that several firms were capable to protect as survivors even during the economic crisis period due to their dynamic capabilities and their entrepreneurial orientation. According to Table 5.10 both similarities and differences between commercial and self-mixed feed producers were evident in the actions taken in response to the crisis. In terms of similarities, in both parties the most common response was changes in products and/or services provided and at a more detailed level there was considerable heterogeneity in the pattern of responses.

Table 5.10: Action Taken to Increase or Maintain Business Performance since the Beginning of the Economic Crisis

Action Taken	Commercial (N=30)	Self-mixed (N=60)
a) Changes in sales and marketing	65.20	20.40
<i>Increased sales efforts</i>	20.83	4.23
<i>Increased price margins</i>	59.17	5.77
<i>Only accept cash payments</i>	53.33	11.54
b) Changes in markets	45.00	35.25
<i>Selling to new types of customers</i>	25.00	48.08
<i>Selling more to existing customers</i>	20.83	5.77
<i>Selling in new geographic market</i>	8.33	7.69
c) Changes in employment	20.46	52.00
<i>Reduce numbers employed</i>	25.00	58.08
<i>Introduced wage/salary freeze</i>	4.17	5.77
<i>Introduced new working practices</i>	37.50	7.69
<i>Increased use of external labour</i>	12.50	15.38
<i>Taken greater care in recruitment of staff</i>	33.33	19.23
<i>Increased employee training</i>	12.50	1.92
<i>Increased use of unpaid family labour</i>	4.17	15.77
<i>Reduced employee training</i>	20.83	5.77
d) Changes in products and/ services offered	30.25	52.00
<i>Introduced new or improved products/services</i>	12.50	7.69
<i>Reduced the range of products/services offered</i>	53.33	9.62
<i>Selling raw materials rather than feed produced</i>	18.33	1.92
e) Changes in finance	36.33	48.00
<i>Renegotiated the cost of supplies</i>	16.67	11.54
<i>Invested personal savings</i>	12.50	53.85
<i>Invest in other businesses</i>	4.17	7.69
<i>Shortened payment periods from customers/creditors</i>	16.67	3.85
<i>Extended payment periods for customers</i>	20.83	1.92
<i>Reduce debt to external sources</i>	12.50	9.62
<i>Extended payment periods to suppliers</i>	12.50	0.00
<i>Reduced investment expenditure</i>	53.33	41.15
<i>Increased debt financing</i>	0.00	7.69
f) Changes in owner/manager behaviour	16.00	45.00
<i>Personally worked longer hours</i>	20.83	42.31
<i>Cancelled personal holidays</i>	8.33	23.08
<i>Sold personal assets to compensate for poor business performance</i>	16.67	42.69
<i>Other changes in owner-manager behaviour</i>	16.67	1.92
g) Changes in production/business process	57.00	58.44
<i>Used new suppliers</i>	45.83	21.15
<i>Invested in new equipment</i>	12.50	13.46
h) Changes in business organization	38.45	26.00
<i>Made changes in managerial roles/functions</i>	22.50	3.85
<i>Made changes in the management team</i>	12.50	1.92

Note: Respondents were asked to report action from a prompt list, could indicate all, some or none from the list. Italicized figures refer to those reporting any of the actions within each of the eight categories.

Source: HARTI Survey Data, 2023

While firms in both commercial and self-mixed responded with a mixture of revenue-generating and cost-cutting measures, there were stark differences in the nature of management responses, reflecting differences in the opportunity structures related to the size and diversity of their markets. As a result, self-mixed firms were more likely to have undertaken cost-cutting and retrenchment activities. This is reflected in higher propensity of self-mixed firms to reduce employment, introduce wage or salary freezes, increase the use of unpaid family labour, reduce the range of products and services offered, increase external debt and to have sold personal assets (Table 5.10). The resilience and recovery of business is the primary preoccupation of nation-states and capitalists when a crisis occurs. For that purpose, government should prioritize business demands and desires, with greater concessions provided to business owners in order to mitigate the crisis.

5.4 Future Expectations of the Business

Most of the commercial feed manufacturers (67%) wish to expand their business operations in future as they have experienced lower production during the crisis period. Further, 50 percent reported that they wish to expand the range of new products. Those produce only mash feed reported that they wish to expand their processing to pellet feed and some of them have mills which were imported before the crisis period. However, the majority (75%) of the self-mixed feed manufacturers wish to continue with the present business without changing their operations.

Table 5.11: Future Expectations of Different Poultry Feed Manufacturers

Response	Commercial	%	Self-mixed	%
Continue with present business and no change is anticipated	10	33	45	75
Expand business operation	20	67	10	17
Make new investment in the business	9	30	15	25
Expand the range of new products/ services	15	50	2	3

*Multiple responses

Source: HARTI Survey Data, 2023

Poultry industry is a great example of self-developed agricultural sub sector in Sri Lanka. However, during the recent years this sector also faces several challenges and barriers created by several external factors. With industry facing more challenges the government's timely intervention in development of the poultry sector is vital. According to the survey the following was expected from the government by poultry industry players.

Table 5.12: Support Expect from Government

Response	Commercial		Self - mixed	
	No	%	No	%
1. Import required raw materials at correct time	25	83	35	58
2. Reduce tax and VAT	18	60	8	13
3. Increase local raw material production	10	33	30	50
4. Reduce loan interest rate	15	50	40	67
5. Introduce new technology and trainings	8	27	15	25
6. Reduce government involvement	12	40	30	50
7. Control cost of raw materials	20	67	40	67
8. Alternative energy	8	27	10	17
9. Control black market prices	10	33	15	25

*Multiple responses

Source: HARTI Survey Data, 2023

5.5 Potentials and the Way Forward for the Sri Lankan Feed Industry

Besides the above challenges the key concern in commercial feed sector is resourcing of the quality ingredients throughout the year at an affordable price. Hence the following issues need to be addressed.

1. Feed Ingredients (maize and soya bean)

Adequate opportunities currently exist to produce maize and soya bean for feed production in the country. Additionally, a huge extent of land is available for commercial production of these commodities. These offer opportunities to enhance their production.

2. By-products of agro-industry

Moreover, ways should be devised for better conservation, utilization and marketing of underutilized alternative (non-conventional) feed resources produced as by-products from different agro-based industries in the country.

3. Laboratory service delivery in feed quality and safety

Commercial feed sub-sector is currently encountering lack of laboratory service delivery system for feed quality and safety assessment. Labs rendering such services are very limited in number and scope, and mode of service delivery needs to be efficient and reliable. Taking into account the future growth of the feed industry, establishment of laboratory service delivery system by commercial labs is an opportunity for investment.

CHAPTER SIX

Findings, Conclusions and Way Forward

6.1 Findings

- ✓ Considering the entire animal feed production in Sri Lanka, 78 percent constituted commercial feed production, with the remaining 22 percent being self-mixed feed production in 2022. Approximately 96 percent of commercial animal feeds produced in Sri Lanka are for poultry as the poultry sector is the fastest growing animal production sector in the country. Self-mixed feed producers play a vital role in the poultry value chain and their livelihood mainly depend on the poultry industry.
- ✓ There are about 45 registered commercial feed mills operating in the country in year 2022. Top five commercial feed manufacturers are occupying 80 percent of total market share of commercial feed production in the country.
- ✓ Majority of the registered feed manufacturers are private operators and individuals. There was only one joint-venture. About 73 percent commercial feed manufacturers have started their operations after 2008 (less than 15 years of operation). Five companies run their operations with experience greater than 25 years.
- ✓ Commercial feed manufacturers are classified as large, medium and small scale depending on the quantity of feed produced per month. There were three large scale feed manufacturers producing >10,000mt of feed per month in 2019. However, in 2023, there are only one large scale manufacturer with the operational capacity of >10,000mt/month as they have reduced the feed production by around 50 percent compared to the production recorded before the economic crisis.
- ✓ All Island Poultry Association, All Island Egg Producer's Association, Lanka Poultry Processor's Forum and World Poultry Science Associations are some relevant organizations of which poultry sector manufacturers are members. Among the commercial feed manufacturers, about 77 percent are associated with either one or more such organizations, whereas only 55 percent of self-mixed manufacturers are engaged in such associations. About 80 percent of the commercial feed manufacturers revealed that they have received benefits in engaging with different associations. However, the majority of self-mixed manufacturers (70%) revealed that they haven't received any benefits.
- ✓ Modern feed mills are largely computer controlled. The process begins with the company nutritionist whose computer formulates diets, using recognized requirements figures and tables of feed composition and current prices of

ingredient. Many diets are least cost formulas, in which the ingredients are selected to meet the prescribed nutrient requirement figures at the lowest cost. When examining the milling processes, it is notable that most small-scale commercial-level feed producers (16) and the majority of self-mixed feed producers (58) opt for the mash type of milling. Among large-scale commercial feed producers, four companies utilize both mash and pellet milling processes. Additionally, five medium-scale commercial-level feed producers and four small-scale ones employ both mash and pellet milling methods.

- ✓ Majority of commercial-level feed producers (77%) independently formulate their poultry feed ration. As well, 42 percent of self-mixed feed producers also adopt their unique formulations. About 23 percent of commercial feed producers and 33 percent of self-mixed feed producers rely on external agencies for assistance in determining their feed ration.
- ✓ Every commercial poultry feed producer consistently monitors the quality of both raw materials and poultry feed. However, most self-mixed feed producers (63%) do not prioritize the quality assessment of raw materials or poultry feed in their practices. It is observed that large-scale (4), medium-scale (6), and small-scale (4) producers employ in-house laboratory facilities for the quality assessment of both raw materials and the feeds they manufacture. In contrast, the rest of the small-scale commercial feed producers and self-mixed feed producers opt to send their samples to external agencies' laboratories for quality checking.
- ✓ Feed mills regulate their production according to the demand of poultry farms. Currently all the commercial poultry feed mills are operating below their installed capacity mainly due to low demand for the product, which could be due to increased price of factory mixed compound feeds because of value added tax charges, shortage of ingredients and inconsistent supply of electricity. Large-scale commercial feed producers utilized only 25-40 percent of the total installed capacity in 2022 and 2023. For minimizing the effect of the current low demand for compound feeds, some of the feed processing enterprises are practicing vertical integration, i.e., engagement in modern livestock production (fattening, dairy, poultry and/or pig farming) in conjunction with the feed processing plant.
- ✓ Maize is the primary raw material for feed production, and in 2021, it exclusively comprised local production due to import restrictions. Other raw materials, such as SBM, MBM, and Fish meal, are entirely dependent on imports, and their quantities are also very limited. When examining the imported value of poultry feed raw materials, SBM reported the highest value, followed by maize in 2022. However, in 2021, the imported stocks of maize were severely restricted due to import constraints.
- ✓ Due to unavailability of sufficient stocks and high prices of maize most of the feed manufacturers have used alternative raw materials such as broken rice, rejected rice, wheat flour etc. while balancing the nutrition level of the poultry feed. Self-

mixed producers use different types of available low-cost ingredients as alternative raw materials (biscuit powder, noodles, etc). About 80 percent of commercial-level companies have adjusted their poultry feed rations in response to the insufficient availability and elevated prices of certain raw materials, notably maize. Among self-mixed feed producers, 67 percent have similarly altered their poultry feed rations for the same reasons. The government in a gazette notification has banned the use of any form of rice produce or import to Sri Lanka for poultry feed production. The failure to use rice – a better substitution in the absence of maize-creates difficulties in manufacturing the required amount of feed. This forces feed producers to turn to high-cost substitutes and resulting in feed price escalation and a significant drop in feed production. When using alternative feed materials, feed manufacturers faced digestibility issues in birds. As a solution to that they had to use enzyme technology and due to high cost only few commercial feed manufactures practiced this.

- ✓ About 47 percent of commercial feed producers, engage in selling poultry feed to external customers. The rest (53%) utilize it exclusively for in-house company purposes. Among the commercial feed producers who engage in selling poultry feeds to external customers, sell their feed nationwide. They have dealer network for that. Furthermore, 29 percent of commercial feed producers limit their sales within the city, while 21 percent confine their sales within the province.
- ✓ The current economic crisis has impacted the majority of commercial feed producers' (93%) and self-mixed producers' (97%) industry performances. It was observed that diminishing of compound feed market as most of the poultry players decided to run their own feed mixing operations to cater to meet the demand for their company requirement (meat and egg production).
- ✓ Majority (63%) of the commercial firms and 68 percent self-mixed firms experienced declining margins. At the same time, 33 percent commercial producers and 32 percent self-mixed producers maintain their business growth at same levels during the crisis period. A matrix was created from the resulting two variables; the impact of the recession and growth to guide the initial classification of cases into two categories: vulnerability and resilience. According to the growth matrix, the majority of firms were affected by the recession and showed declining growth throughout the economic crisis. It indicated that most of the poultry feed producing firms are vulnerable to economic downturn.
- ✓ The crisis presented major challenges to firms of all sizes, but particularly smaller firms. A combination of resource-related constraints and tendency to rely on bank credit when external finance is used emphasized that small firms are particularly vulnerable during the periods of economic downturns compared with larger enterprises that control more substantial resources. The study shows that more than 50 percent of the self-mixed feed production operations are seriously affected due to economic downturn.

- ✓ Key problems faced by the firms included: shortage of required raw materials, high cost of production and demand decline due to inflation, continuous power cuts, working capital and liquidity problems, and breakdown of their supply chain due to fuel issues. All these key issues diminish the capacity utilization rate and lower the business performance of many feeds production firms. Lack of raw materials and high price of raw materials made a significant impact on the sector and more focus is on these two factors.

6.2 Conclusions

Feed cost accounts for 60 to 70 percent of the total cost of livestock production. As a result, shortage of feed and escalating price of feeds is adversely affecting the productivity and profitability of commercial livestock operations. The situation also has a far-reaching effect on the business and profitability of feed industries as their operations would become irregular with frequent disruption by shortage and escalating price of feed ingredients, which would raise their cost of production beyond the livestock producers' affordability level.

Shortages and price fluctuations of animal feeds could be as a result of unavailability and price increases of raw materials and nutrients, failure to obtain the required raw materials due to limited foreign exchange allocation. Unavailability of raw materials and nutrients would directly result in shortages and then lead to increase in price of animal feeds. Alternatively, it would escalate the cost of production of animal feeds, which the manufacturers would transfer to buyers of animal feeds as higher prices.

The role of the animal feeds industry in livestock production cannot be overemphasized. The performance is unsatisfactory and a cause of concern. The manufacturers of the animal feeds in Sri Lanka claim that shortages and price fluctuations observed are due to erratic fluctuations in the availability of raw materials both in quality and quantity.

6.3 Recommendations to Strengthen the Feed Industry

- In order to promote poultry production, proper interventions are needed to increase the feed supply, provide technical knowledge to small scale feed producers in poultry feed ration formulations and utilization and marketing of underutilized alternative (non-conventional) feed resources produced as by-products from different agro-based industries in the country.
- Encourage and support feed manufacturers to cultivate maize and soybean by providing incentives such as credit and land available.
- In order to reduce COP of chicken and eggs, wide availability of poultry feed at reasonable prices is crucial. The availability and cost of maize and soybean meal generally determines feed cost. Feed industry depends more on imports for raw materials and prompt decisions on import policy should play a key role. Consistent

supply of maize should be assured by increasing local production and making timely decisions on imports.

- Increase local production of grains.
- For maize;
- ✓ Increase the extent of cultivation in the *Yala* season
 - ✓ Improve access to quality farm inputs (hybrid seeds, fertilizers)
 - ✓ Facilitate credit access
 - ✓ Encourage more contract farming: Forward Sales Contracts (FSCs) which are currently practiced at a low level should be promoted with traders, feed manufacturers and food processors
 - ✓ It is important to encourage and promote smallholder out-grower models which have had success in other countries
 - ✓ Explore and facilitate land consolidation especially those left fallow.
 - ✓ Farmers should be provided with community (village-level) storage facilities. The non-availability of proper storage facilities at the farmer level affects quality deterioration. Farmers do not have enough storage space to store bulk harvests of maize and other grains.
- Introduction of business-friendly taxation schemes that promote poultry feed production and ensure the comparative advantage of scale of production which creates a level playing field for the poultry feed players is recommended.
 - An appropriate institutional and policy environment for competitive domestic feed production would allow all producers and consumers to benefit from poultry sector expansion.

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ANNEX I: Cost of Production of Table Eggs and Chicken Meat

Table 1: Cost of Production of Table Eggs (Rs/egg)

Cost Items	Large		Medium		Small	
	Rs/egg	%	Rs/egg	%	Rs/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
Labour cost - Female	0.80	2.169	1.63	3.851	2.85	6.147
Labour 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	100.000	42.30	100.000	46.40	100.000
Income received from curry chicken (-)	-2.16		-2.78		-2.59	
Net Cost of Production	34.82		39.51		43.81	

Source: Wijesinghe, I.P.P.M., Fernando, S.P., and Hitihamu, H.M.S.J.M. (2024).

Table 2: Cost of Production of Chicken Meat (Rs/kg)

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
Labour 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: Wijesinghe, I.P.P.M., Fernando, S.P., and Hitihamu, H.M.S.J.M. (2024).

ANNEX II: Cost for different Types of Raw Materials used in Poultry Feed Production

Table 1: Cost for different types of Raw Materials used to make Layer Feed in 2022 and 2023

Types of Raw Materials	2022			2023		
	Price/kg	Total Cost	%	Price/kg	Total Cost	%
Maize	220	65,560	32	174	51,852	30
SBM	430	66,650	32	267	41,385	24
Rice polish	120	32,160	16	84	22,512	13
Broken rice	160	12,320	6	124	9,548	6
Poonac	150	3,000	1	106	2,120	1
DDGS/Fish meal	130	11,050	5	136	11,560	7
Calcite	20	1,000	0	40	760	0
DCP	200	1,800	1	380	3,420	2
DL	2,400	6,000	3	1,700	4,250	2
Lycine	1,200	1,200	1	1,280	1,280	1
Vit E		0	0	10,000	3,000	2
Salt	70	140	0	42	84	0
Acidifier		0	0	2,485	2,485	1
Vitamins	1,500	1,500	1	2,350	2,350	1
Toxic binders		0	0	1,250	10,000	6
Primixes	1,500	3,750	2	1,800	4,500	3
Calcide				30	1,500	1
Enzymes	2,200	660	0	1,800	540	0
Total Cost of RM/1mt of Feed		206,790			173,146	100

Source: Calculated based on HARTI Survey Data, 2023

Table 2: Cost for Different Types of Raw Materials used to Make Commercial Broiler Feed in 2022 and 2023

Types of Raw Materials	2022			2023		
	Price/kg	Total Cost	%	Price/kg	Total Cost	%
Maize	280	84,000	25	155	46,500	24
SBM	450	112,500	34	240	60,000	31
Broken rice	230	46,000	14	120	24,000	12
Rice polish	110	11,000	3	135	13,500	7
Fish meal	500	40,000	12			
MBM	420	12,600	4	230	16,100	8
Oil	550	22,000	7	560	16,800	9
DL		0	0	920	4,140	2
DCP	470	470	0	300	1,050	1
Calcite	42	420	0	18	288	0
Salt	42	126	0	80	240	0
Vitamin premix	2,200	4,400	1	1,800	6,300	3
Mineral premix		0	0		0	0
Shell grid		0	0	4,800	4,800	2
Acidifier		0	0	1,320	1,980	1
Total Cost of RM/1mt of Feed		333,516	100		195,698	100

Source: Calculated based on HARTI Survey Data, 2023