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Value chain mapping of layer poultry: A SWOC analysis of farm operations in Bengaluru rural

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Abstract
Layer poultry farming in Bengaluru Rural features "Multiple batch" rearing and "Cage system" of housing, maintaining an average of three birds per cage. With a substantial flock size of 35,427 birds, the study focuses on large-scale commercial egg production. Farmers market birds after 72 weeks, emphasizing meat potential, and achieve an efficient Feed Conversion Ratio of 0.15. Self-preparation of poultry feed underlines the region's commitment to cost-effective and quality-controlled practices. The Value Chain Mapping illustrated the layer poultry industry's journey from production to consumption. Key aspects include strategic sourcing of Day Old Chicks, adopting efficient production practices like the "Multiple batch" rearing system and the "Cage system,", Value-added processing transforms raw eggs into diverse products, meeting consumer preferences. Eggs, central to the local diet, are staples in traditional dishes, street food, and fast food, with processed products further diversifying consumption. The success of the industry hinges on thoughtful sourcing decisions, efficient production cycles, effective marketing, and understanding local preferences. SWOC analysis of Layer Poultry Farms indicated that Layer Poultry sector create more employment opportunities over other livestock sectors. Layer Poultry farming is found to be labour intensive compared to other livestock sectors. Consumption of Layer Poultry eggs and meat exhibit an increasing trend compared to other livestock sectors. However, Layer Poultry Farming is hindered by contagious diseases compared to other livestock sectors. Layer poultry farming in Bengaluru Rural demonstrates impressive returns with efficient management, making it feasible for even small farms to achieve high production and profitability in the study area.

Keywords: Layer poultry farming, value chain mapping, SWOC analysis, feed conversion ratio

Introduction
The poultry sector in India has undergone a significant transformation, revolutionizing egg and poultry meat production and marketing through a nationwide commercial network. This evolution includes the utilization of native and indigenous breeds, along with the introduction of high-quality chicks, specialized feed, advanced equipment, vaccines, and sophisticated management practices. What was once a mere backyard farming activity has evolved into a fully developed techno-commercial industry, offering extensive opportunities for entrepreneurs interested in venturing into commercial layer poultry farming. Central to this transformation has been the active involvement of the private sector, which has played a crucial role in supplying efficient varieties of both broilers and layers tailored for commercial farming. Across India, a diverse range of fowls, varying in size and color and reminiscent of desi fowls, can be found. Bengaluru rural district in Karnataka state is in alignment with this diverse and evolving status within the poultry industry.

In India, broiler crosses that have been imported and successfully stabilized include well-known breeds such as Cobb, Ross, Hubbard, Marshall, Lohman, Anak 2000, Avian-34, Shaver Starbro, and Samrat, among others. When it comes to layers, they are classified into two categories based on the nature and color of their eggs: brown egg laying hens and white egg laying hens. Some examples of brown egg layers include Isa brown, Hi sex brown, Sever 579, Lehman brown, Hyline brown, BV-380, Gold line, Bablona Tetra, and Harvard brown. White egg laying hens comprise breeds like Isa white, Lehman white, Babcock, BV-300, Harvard white, Hi sex white, Sever white, Bovans white, Hyline, H & N nick, and Dekalb Lohman, among others. (Source: https://dahd.nic.in).

In Bengaluru rural district, sample farmers have been rearing breeds such as BV-300, Bhovans White, Venkobb 400, and 430 Y, which were supplied by Venkateshwara Research and Breeding Farm Pvt. Ltd., commonly known as Venky's. Other prominent integrators operating in the study area include Nutri Feeds and Farms Pvt. Ltd., Venkateshwara Hatcheries Pvt. Ltd.

Sri Krishna Poultry Farms and Feeds Pvt. Ltd., Diamond Hatcheries Pvt. Ltd., Aishwarya Farms and Feeds Pvt. Ltd., and Erets Agro Pvt. Ltd.

The management practices followed by layer poultry farmers in Bengaluru Rural district are presented in Table 1

Table 1: Management practices followed by layer poultry farmers in Bengaluru Rural district

Sl. No.	Particulars	Unit	Number
1.	**Rearing system**		
	a) All-in all-out		Nil
	b) Multiple batch	Number	30
2.	**Housing system**		
	a) Deep litter		Nil
	b) Cage system	Number	30
3.	Birds per cage	Number	3
4.	Average flock size	Number	35,427*
5.	Mortality rate	Per cent	12
6.	Average No. of batches reared annually	Number	7
7.	Average age of birds at marketing	Weeks	72
8.	Live bird weight at the time of culling	Kilograms	2.15
9.	Feed Conversion Ratio (FCR) for each egg	Ratio	0.15*
10.	**Number of times birds fed in a day**		
	a) Chicks/brooders (Up to 5 weeks)	Number	3
	b) Growers (5-16 weeks)	Number	2-3
	c) Free Breeders (16-22 weeks)	Numbers	2
	d) Layers (22-68 weeks)	Numbers	2
11.	**Source of poultry feed**		
	a) Own preparation	Number	30
	b) Readymade feed	Number	Nil

Note: * rounded-off average

Feed Conversion Ratio (FCR) is the mass of the input divided by the output, viz., the mass of feed per mass of layer meat.

Rearing System: None of the farmers in the study area employed the "All-in all-out" rearing system. Instead, all 30 farmers practiced "Multiple batch" rearing. This choice was driven by the need to maximize space utilization and maintain continuous egg production, given the commercial nature of layer poultry farming in the region.

Housing System: All 30 farmers used the "Cage system" for housing their layer poultry, and none employed "Deep litter" housing. The cage system's space efficiency, better disease control, and ease of egg collection influenced this choice. These factors aligned with the region's emphasis on efficient and hygienic egg production.

Birds per cage: Each cage housed an average of three birds, ensuring proper ventilation, feeding, and waste management. This practice aimed to maintain optimal conditions for layer poultry, ensuring egg quality and productivity.

Average Flock Size: The substantial average flock size of 35,427 birds reflected the region's focus on large-scale commercial egg production. The local and regional markets demanded a significant supply of eggs, encouraging farmers to maintain huge flocks.

Mortality Rate: The 12 per cent mortality rate highlighted the importance of vigilant disease management and health care practices in the study area. Disease control and health management were crucial, given the high economic value placed on egg production.

Average Number of Batches Rearing Annually: With an average of seven batches reared annually, farmers maintained a continuous production cycle, ensuring a year-round supply of eggs to meet market demand, making it an economically viable choice in the region.

Average Age of Birds at Marketing: Birds were typically marketed at 72 weeks of age, emphasizing the region's focus on maximizing egg production before culling for meat, aligning with the economic value attributed to egg production.

Live Bird Weight at Culling: The average live bird weight at culling was 2.15 kilograms, emphasizing the importance of optimizing the growth and meat potential of layers after their egg-laying cycle to maximize returns on investment.

Feed Conversion Ratio (FCR) for Each Egg: Feed Conversion Ratio (FCR) of 0.15 implying that by consuming 150 grams of feed, a layer bird will produce one egg. The low FCR ratio of 0.15 signified efficient feed utilization, reflecting cost-effectiveness and efficient resource use, an important economic consideration for egg production.

Number of Times Birds Fed in a Day: The feeding frequency for birds varied depending on their age and growth stage in the study area. Chicks or brooders, up to five weeks old, were provided with feed three times a day, ensuring they received adequate nutrition for their early development. Growers, aged 5-16 weeks, were fed 2-3 times a day to support their growth phase. Free breeders, aged 16-22 weeks, were fed twice daily, and layers, aged 22-68 weeks, were also fed twice daily to maintain their egg-laying productivity. These feeding schedules were adapted to meet the specific nutritional requirements of birds at different stages of development and egg production.

Source of Poultry Feed: All sample farmers prepared their own poultry feed. This practice was influenced by the availability of feed ingredients, cost considerations, and the desire to customize feed formulations, providing more control over feed quality. Self-prepared feed was a cost-effective choice for commercial layer poultry farming in the region.

Materials and Methods

Value Chain Mapping was used in identifying various players involved, *viz*., input suppliers, producers, integrators, processors, traders, butchers, and consumers. The method gives a clear indication of the role of each player in the value chain and throws light on how they can be improved to make the system more profitable. SWOC (Strengths, Weaknesses, Opportunities, and Challenges) analysis is a method for identifying and analyzing internal strengths and weaknesses and external opportunities and threats that shape current and future operations and help develop strategic goals.

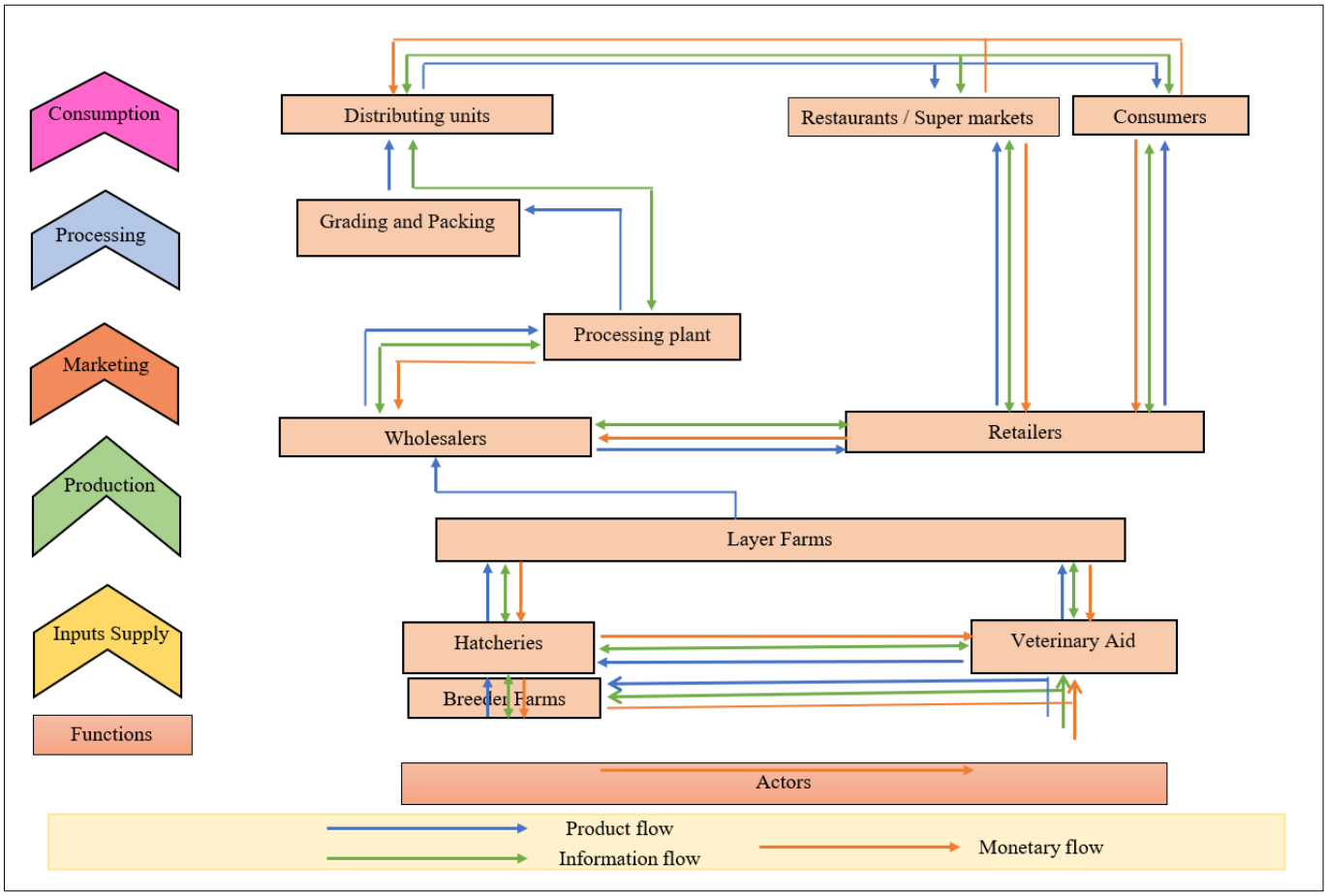

Fig 1: Layer Poultry Value Chain in Bengaluru Rural District

Layer poultry value chain

A Value Chain Map (Fig.1) serves as a visual representation of the Layer poultry value chain, illustrating the journey of the product from producers to consumers through various stages. The linkages are presented vertically, from bottom to top. The major functions of the chain, listed on the left, encompass input supply, production, marketing, processing, and consumption. The vertical flow delineates the actors involved in executing these functions.

Input Supply: Input Supply factor plays a pivotal role, particularly in the procurement of crucial resources such as Day Old Chicks. Farmers source chicks from Venkateshwara Hatcheries Limited. This strategic choice of supplier suggested a preference for a reputable hatchery known for its reliability and the quality of chicks it produced. The cost of Day Old Chicks is Rs.39/- per chick, encompassing not only the purchase price but also associated expenses like transportation and biosecurity measures. Additionally, the selection of a supplier, such as Venkateshwara Hatcheries Limited, had implications for the genetic characteristics, health, and overall performance of the layer birds throughout their productive life. In hindsight, the Input Supply factor, especially the sourcing of day-old chicks, played a crucial role in shaping the economic and operational dimensions of layer poultry farming, underscoring the importance of thoughtful sourcing decisions for a successful venture.

Production: The production aspects of layer poultry farming in the study area are characterized by the prevalent use of the "Multiple batch" rearing system to maximize space utilization and ensure continuous egg production. The "Cage system" is found to be universally adopted, emphasizing space efficiency, disease control, and ease of egg collection. Each cage houses an average of three birds, contributing to optimal conditions for layer poultry and supporting egg quality. Farmers in the study area were found to be rearing seven batches annually and maintained a continuous production cycle to supply eggs year-round. Farmers tailored feeding schedules based on birds' age and growth stage, preparing their own poultry feed for cost-effectiveness and quality control. These production aspects in the past collectively highlighted the region's commitment to efficient, large-scale, and economically viable layer poultry farming.

Marketing: Birds were marketed at 72 weeks of age, emphasizing the region's focus on maximizing egg production before culling for meat, aligning with the economic value attributed to egg production. Farmers in the study area were found to be selling birds through three different marketing Channels as listed under:

Channel I: Producer - Consumer / Local vendors (Direct Marketing)

Channel II: Producer – Wholesaler – Retailer - Consumer

Channel III: Producer - Retailer (Sales Representatives of VHL) - Consumer

Processing: Value-added processing in the egg industry involves transforming raw eggs into diverse products to meet consumer preferences. This included liquid egg products like whole liquid eggs, egg whites, and yolks for commercial use.

Pre-packaged options such as hard-boiled or peeled eggs offered convenience, while egg-based sauces and condiments, like mayonnaise, enhanced flavor in culinary applications. Frozen egg products, egg powder, and egg-based snacks provide extended shelf life and versatility. Additionally, flavored and seasoned egg products, along with customized blends, cater to diverse consumer tastes. Value-added processing not only add convenience but also tap into the evolving demands of the food industry, emphasizing versatility and nutritional benefits. Success relies on effective marketing, quality control, and understanding local consumer preferences.

Consumption: Egg consumption was characterized by its versatility and widespread integration into local culinary practices. Eggs are staples in traditional dishes, street food, and fast-food options, offering a quick and affordable source of protein. The nutritional awareness among consumers emphasizes egg as a valuable component of a balanced diet, contributing to health-conscious choices. Processed egg products, available in local bakeries, further diversify the ways eggs are consumed. The retail distribution network ensures widespread accessibility, making eggs readily available and culturally significant. Their adaptability to various cultural and religious practices, along with educational initiatives promoting their nutritional benefits, further enhance their consumption across diverse demographics. Eggs, therefore, held a central place in the local diet, catering to both daily meals and special occasions in the past.

Strengths of layer poultry farming

Bengaluru Rural District's climate and natural wealth are conducive to layer poultry farming, providing an optimal environment for birds' health and productivity. The region boasts a skilled and unskilled labour force, contributing to efficient farm operations, including tasks related to bird care, feeding, and general management. Bengaluru Rural district has a high level of technological expertise and access to modern equipment, enhancing the efficiency and productivity of layer poultry farms.

Significant infrastructure development, including good road networks and connectivity, facilitates the transportation of inputs and outputs, reducing logistical challenges for poultry farmers. Farmers have access to advanced equipment for automation, including modern cage systems and brooder-cum-grower equipment, streamlining operations and improving overall efficiency.

There is an ongoing availability of quality feed at competitive prices, positively impacting the cost structure of layer poultry farming and contributing to overall profitability. Farmers have access to diverse and improved strains of chicks, enhancing the genetic potential of the layers and leading to higher egg production.

There is a strong and consistent market demand for eggs in both local and regional markets, coupled with the economic viability of layer poultry farming, motivating farmers to invest and thrive in this sector.

Farmers in the area exhibit strong financial management skills, including effective cost control, investment planning, and risk management, contributing to the sustainability and growth of layer poultry enterprises. There is an awareness and adoption of sustainable farming practices, such as proper waste management and eco-friendly approaches, contributing to the overall positive image of layer poultry farming in the region.

Layer poultry farming contributes significantly to meeting protein requirements, with both eggs and broilers serving as valuable sources. Layer poultry farming enhances income levels in rural areas, uplifting the socio-economic status of the rural population. Layer poultry farming efficiently converts plant products and waste into edible food, offering a practical solution to malnutrition challenges, particularly in regions like India.

Unlike meats with religious taboos, such as beef or pork, chicken from layer poultry is widely accepted in India and is economically more accessible than alternatives like goat meat.

The litter from layer poultry farming, rich in nutrients, adds value to agriculture activities and soil health. Layer poultry farming has the potential to create non-farm employment opportunities, acting as a deterrent to rural-to-urban migration. Layer poultry farming offers relatively quick returns with low initial investment requirements, making it an attractive and economically viable option for sustainable development.

Weaknesses of layer poultry farming

Bengaluru rural district is susceptible to climate vulnerabilities, such as extreme weather conditions or seasonal changes, which can impact the health and productivity of layer birds. Limited access to training programs and educational resources on modern poultry farming practices may hinder farmers from adopting the latest technologies and best practices. Insufficient or inadequate infrastructure, including transportation facilities and storage options, could pose logistical challenges in the supply chain and distribution of poultry products.

High dependency on external inputs, such as feed and equipment, may make farmers vulnerable to price fluctuations and supply chain disruptions, affecting overall profitability. Intense market competition and price fluctuations in the egg market may impact the revenue of layer poultry farmers, especially if they lack strategies for market diversification. The risk of disease outbreaks among layer birds could pose a significant threat, leading to production losses and increased veterinary costs, particularly if biosecurity measures are not effectively implemented.

Limited access to financial resources and credit facilities may impede farmers' ability to make necessary investments in infrastructure, technology, and flock management. Land use restrictions and urbanization pressures in Bengaluru Rural District may limit the expansion and scalability of layer poultry farms, particularly if zoning regulations become more restrictive.

Challenges in waste management, particularly the disposal of poultry waste, could arise, leading to environmental concerns and potential regulatory issues if not managed effectively. Insufficient government support in the form of subsidies, technical assistance, and extension services for layer poultry farmers may hinder their ability to adopt sustainable practices and modern technologies.

Layer poultry farming requires significant labour input, involving tasks such as feeding, care, and management of the birds. Layer poultry farming exhibits a distinctive characteristic of being highly fragmented, with numerous small-scale operations rather than consolidated large-scale entities. The low charges for growing layers, combined with the considerable costs of investing in essential infrastructure

like sheds, feeders, breeders, and climate control systems, result in a scenario where farmers face challenges in achieving substantial income.

Opportunities of layer poultry farming

The current trend of rising demand for poultry products, especially eggs, both locally and regionally, offers a significant opportunity for layer poultry farmers to meet market needs and increase profitability. Ongoing technological advancements in poultry farming, such as improved breeding techniques, automated systems, and precision farming, provide opportunities for farmers in Bengaluru Rural District to enhance efficiency and productivity.

Existing and potential government initiatives, subsidies, and support programs for the poultry sector present opportunities for farmers to access financial assistance, technical expertise, and resources for sustainable development. The opportunity to diversify poultry products, such as exploring value-added products or organic eggs, allows farmers to cater to niche markets and potentially increase revenue streams.

Improved access to quality inputs, including high-grade feed and modern farming equipment, enhances the overall health and performance of layer birds, providing opportunities for better production outcomes. Growing awareness and emphasis on sustainable farming practices present opportunities for layer poultry farmers to adopt eco-friendly measures, promoting environmental stewardship and enhancing the market appeal of their products.

Building strategic market linkages and collaborations with local businesses, retailers, and processors provides opportunities for layer poultry farmers to strengthen their market presence and secure stable outlets for their products. Increasing consumer preferences for local and organic poultry products create opportunities for farmers to position their products as premium offerings, catering to health-conscious and environmentally aware consumers.

Participation in training and skill development programs allows farmers to stay updated on the latest farming practices, technology, and management strategies, enhancing their capacity for efficient poultry farming. The integration of digital marketing and sales channels offers opportunities for farmers to reach a wider consumer base, showcase their products, and establish a direct connection with end consumers, potentially increasing sales and brand visibility. India holds significant potential to tap into the international market for poultry products, presenting an opportunity for export and economic growth.

Growing awareness of the importance of balanced nutrition has resulted in a shift in dietary habits. Vegetarians are increasingly accepting eggs as a valuable and protein-rich part of their diet, marking a significant change in traditional eating patterns.

Challenges of layer poultry farming

The ongoing risk of disease outbreaks among layer birds remains a significant challenge, requiring continuous vigilance and strict biosecurity measures to prevent and manage potential outbreaks. Continued market price volatility for eggs and poultry products poses challenges for farmers in managing their revenue streams and adapting to fluctuations in market demand and pricing.

Farmers continue to face challenges related to limited access to finance, hindering their ability to make essential investments in infrastructure, technology, and flock management for sustainable poultry farming. The impact of climate change, including unpredictable weather patterns, poses challenges to the overall health and productivity of layer birds, necessitating adaptive farming practices and infrastructure.

Persistent high input costs, particularly for feed and equipment, contribute to the overall cost of production, affecting the profitability of layer poultry farming operations. Ongoing zoning and land use restrictions may limit the expansion and scalability of layer poultry farms, posing challenges for farmers looking to optimize their production capacity.

Challenges related to effective waste management, especially the disposal of poultry waste, continue to be a concern, requiring farmers to implement sustainable waste management practices. Some farmers may face challenges in adopting and integrating modern technologies, automation, and precision farming methods into their operations due to factors such as resource constraints or lack of awareness.

A shortage of skilled labour in the poultry farming sector poses challenges for farmers in efficiently managing day-to-day operations, including bird care, feeding, and farm management. Despite growing emphasis on sustainability, a lack of awareness or adoption of sustainable farming practices among some farmers may hinder the sector's overall progress toward environmentally friendly and socially responsible practices.

Challenges in transportation and inadequate infrastructure, coupled with a lack of cold chain facilities, currently hinder the efficient handling of substantial volumes of chilled or frozen layer poultry products. Layer poultry farming is susceptible to the impact of natural calamities, such as floods, earthquakes, or cyclones, which can disrupt operations and cause significant losses.

Inadequate health precautions can lead to the spread of infectious or contagious diseases among layer birds. Recent global health concerns, including avian flu, SARS, and Ebola, along with longstanding diseases like tuberculosis and malaria, have posed challenges to the poultry industry.

A critical challenge in layer poultry farming is the shortage of major feed ingredients, especially maize, which constitutes over 50 percent of feed rations. Even a small increase in the cost of these ingredients can have a substantial impact, potentially erasing profits for farmers.

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