CHALLENGES AND PROSPECTS OF LAYER FARMING IN PUNAKHA AND TSIRANG DISTRICTS

JIGME LHENDUP[1*], NEDUP DORJI[2] AND JANGA BDR GAYLAL[3]

[1]Dzongkhag Livestock Sector, Punakha.
[2]College of Natural Resources, Royal University of Bhutan, Lobesa, Punakha.
[3]National Livestock Research Centre, Bumthang.

*Author for correspondence: jigslen@gmail.com

ABSTRACT: This study examines the challenges and prospects of layer farming in Tsirang and Punakha districts of Bhutan. Layer farming, primarily focused on egg production, plays a crucial role in enhancing food security, generating income, and promoting economic development in rural communities. The research employs a mixed-methods approach, combining quantitative analysis of survey data with qualitative insights from interviews with layer farmers. Findings reveal several challenges faced by farmers, including market constraints, feed availability issues, labor shortages, and health-related concerns such as high mortality rates. Despite these challenges, the study identifies promising prospects for the sector, including growing demand for eggs, supportive government policies, access to technology and resources, and opportunities for market diversification and export. Recommendations are provided to address the challenges and leverage the opportunities, emphasizing the importance of market development, capacity building, input accessibility, research and innovation, infrastructure improvement, policy support, and extension services. By implementing these recommendations in collaboration with stakeholders, layer farming in Tsirang and Punakha can realize its full potential, contributing to sustainable growth and development of the poultry sector and rural livelihoods in Bhutan.

Keywords: Challenges; commercial layers; eggs; market; prospects.

1. INTRODUCTION

Poultry such as chickens, turkeys, and ducks are reared for meat, eggs, and feathers, and are also for manure to maintain soil fertility to support sustainable agriculture (Rao 2015). In Bhutan, the majority of the farmers keep chickens (*Gallus gallus domesticus*), while a few farmers also keep ducks, especially in the southern region of the country (Tshering and Nidup 2007). So, it may be assumed that the chicken has a greater role in supporting the livelihoods of rural farmers in Bhutan. Present-day chickens were domesticated around 3200 B.C. in India and around 1400 B.C. in China, which then spread to the rest of the continents (Al-Nasser et al. 2007). Chicken is considered to be one of the best and most easily accessible sources of nutrients (e.g. protein, minerals) that help maintain the nourishment of low-income rural communities (Chambers et al. 2017).

Layer farming plays an important role in improving food and nutrition security, employment generation and economic development of the country (Das et al. 2008). The Bhutanese farmers rear chickens primarily for eggs, meat and manure (Tshering and Nidup 2007) and also a source of income for rural communities through the sale of chicken products (Acharya and Kaphle 2015). In addition to economic benefits, chickens are slaughtered to please local deities, feed guests and revive the health of pregnant women during and after the delivery (Dorji et al, 2012). The Bhutanese government initiated a

poultry development plan in 1961 with the launch of the first five-year development plan, and the aim was to improve the nutrition of rural households through egg and meat supplements (Nidup and Dorji 2009).

The National Poultry and Research Development Centre (NPRDC) was established in 2009 to supply day-old chicks and pullets to poultry farmers (NPRDC 2020). In Bhutan, recent parent stocks such as Hy-line Brown layer, BV 380 (layer) and Ross 308 (Broiler) for hatching and supplying day-old chicks to farmers to encourage them to take up poultry farming (NPRDC 2020). In addition, the Bhutanese government imposed a ban on the import of eggs to encourage farmers to take up layer farming (Renewable Natural Resources Newspaper [RNR Newsletter] 2013). Also, the government provided farmers with subsidies (e.g. feeders, drinkers, cements corrugated galvanised iron [CGI] sheets) and tax-exemption on imports of poultry equipment (e.g. auto feeder and drinker, egg incubator) to encourage to farmers take up layer farming (Ministry of Finance [MoF] 2017). These several strategies seem to have encouraged farmers to take up layer farming in Bhutan. The egg production in Bhutan has increased from 42 million eggs in 2010 to 133 million eggs in 2020 (NSB 2010, NSB 2021). Although the egg production has increased over the years, the Bhutanese people still experience egg shortages (Jamtso 2020).

The demand for eggs has increased over the years in Bhutan (Bhujel et al. 2019) mainly due to an increase in the human population, awareness of the importance of better nutrition, and improved living lifestyles (NSB 2017). With the increased economic opportunity, many farmers have ventured into small-scale layer farming (those farmers owning ≤100 layers are classified as small-scale layer farmers) (NPDC 2012). But, it is unsure whether this increasing number of layer farms in the country will be sustained in future because of several factors such as feed price, health-related issues, market situation, and constraints of labour availability (Acharya and Kaphle 2015). The increase in the price of raw materials for processing feeds has led to an increase in feed price, and Bhutan imports substantial amount of animal feed raw materials from neighbouring countries to formulate feed (Wangmo 2021).

Therefore, no empirical study has beeen done to assess the challenges and prospects of layer farming in Bhutan. Therefore, the study aimed to assess the factors that pose challenges and prospects of layer farming in Bhutan

2. MATERIALS AND METHODS

2.1 Study area

The study was conducted in Punakha and Tsirang districts from January 2022 to March 2022. Punakha is located in the western part of the country and Tsirang is located in the southwest. Punakha is located at latitude of 27.5921° N, and longitude of 89.8797° E with altitude ranging from 1200 masl to 5400 masl. Tsirang is located at latitude of 27.0322° N, and longitude 90.1870° E with altitude ranging from 500 masl to 1900 masl (NSB 2021 NCHM 2021).

2.2 Data collection

The total layer farmers to be interviewed in two districts covering all the geogs and villages were selected using the Yammene formula:

$$n=N/1+N(e)2$$

Where n=sample size, N=population sizes and e=level of precision).

Amongst the top ten egg-producing districts, two districts were randomly selected for this study. A total of 140 layer farmers from Punakha and Tsirang were interviewed. The farmers were interviewed face to face by using a set of structured and semi-structured questionnaires. The questionnaire comprised various sections

such as; respondents' basic characteristics (gender, age, level of education, main source of income, flock size), respondents' experience on factors that influence layer farming (feed and water, health-related issues, marketing, social and religious challenges, labour shortage, skills and knowledge), and prospects of layer farming.

2.3 Data analysis

The data collected were entered into Microsoft Excel (2016) and exported to International Business Machines Corporation, Statistical Product and Service Solutions [IBM SPSS], Version 23 for statistical analysis. Data collected were checked for typographical errors and then coded for further analysis in SPSS. The normality of the data was checked using the Shapiro-Wilk test. Respondents' characteristics (such as gender, education level, and farmers' years of experience in farming) were estimated in percentage. The education level was categorized as literate (able to read and write) and illiterate. The mean age of respondents and layer population between districts were calculated using descriptive statistics. The Chi-square test of independence was performed on flock size, years of poultry farming experience, age of respondents, feedstock, feed outlets, feed problems, egg price, distance to market, road condition, and labor to see the association between two districts.

3. RESULT AND DISCUSSION

3.1 Respondents' characteristics

The Table 1 presents a comparative analysis between the characteristics of individuals from Tsirang and Punakha districts. In terms of gender distribution, Tsirang exhibits a higher percentage of males (76.1%) compared to Punakha (61.3%). Regarding education level, both regions show similar literacy rates, with Tsirang having 81.7% literate individuals and Punakha having 83.9%. According to Rahman (2003), the level of education influences farmers' access to information, understanding and adoption of modern farming practices to enhance farm productivity and profitability. However, there are notable differences in farming experience, with Punakha having a significantly higher proportion of individuals (80.6%) with ≤5 years of experience compared to Tsirang (17.4%). Conversely, Tsirang has a larger percentage of individuals with 11- ≤15 years of farming experience (34.9%) compared to Punakha (3.2%). These findings indicate variations in gender composition and farming experience between the two districts, which could have been the implications of agricultural practices adopted and community dynamics. The table 2 summarizes the comparison between Punakha and Tsirang in terms of mean flock size, mean years of farming experience and

Table 1: Respondents' characteristics (%)

Characteristics	Tsirang (%)	Punakha (%)
Gender		
Male	76.1	61.3
Female	23.9	38.7
Education level		
Illiterate	18.3	16.1
Literate	81.7	83.9
Years of farming experiences		
≤5years	17.4	80.6
≤10 years	39.4	12.9
11- ≤15 years	34.9	3.2
≥16 years	8.2	3.2

Table 2: Association between flock size, farming experience and age in Punakha and Tsirang

Variables	Punakha	Tsirang	df	Chi^2 value	p-value
	Mean±SD	Mean±SD			
Mean flock size	715.14±145.86	1411.28±192.39	38	34.435	0.635
Mean year of farming experience	4.218±0.83	10.440±0.77	22	37.174	0.016
Mean age respondents	38.73±2.33	50.15±2.01	35	22.304	0.953

mean age of respondents. Notably, Tsirang showed higher mean flock size (1411.28±192.39) compared to Punakha (715.14±145.86) without significant difference (p=0.635). However, there are substantial differences in mean years of farming experience, where Tsirang (10.440±0.77) exceeded Punakha (4.218±0.83) significantly (p=0.016). Thus, the difference in years of layer farming experiences could have affected the layer farm profitability because more the years in farming, respondents revealed that some problems experienced (e.g. coccidiosis) in farms could be solved by themselves and the practical knowledge and skills were updated such as record keeping, disease management, and feed management. However, respondents with fewer years of experience had encountered management issues as mentioned which affected the production. The finding is coherent with a study in Nepal that years of experience influence the efficiency of farm units (Dhakal et al. 2019) and knowledge is gained through years of experience in layer farming (Fetuga 1992). Mean age of respondents shows a considerable difference as well, with Tsirang (50.15±2.01) having a higher mean age compared to Punakha (38.73±2.33), but with no significant difference (p=0.953). Therefore, the findings of this study is not concurrent with the earlier study of Amos (2006) who reported that the older the age, the farmer can make rational decisions.

3.2 Challenges in layer farming in Punakha and Tsirang

3.2.1 Market situation

The marketing of livestock and products is the most important activity in any farming business (Ami et al. 2020). Layer farmers have several strategies to sell eggs and most of the farmers sell eggs when customers come to buy. In Tsirang, about half of the respondents sell eggs to the middle person. The farmers in Tsirang said that they sell to middle person because there is competition as a result of excess production of eggs in this district. Although the middle person takes a larger share of profits in the supply chain (Uddin 2014; Ami et al. 2020), this middle person seems to play a key role in selling eggs to groceries and retailers in other districts such as Punakha, Wangdue Phodrang, Thimphu and Dagana districts. So, layer farmers may have limited profits as the cost of production could be high (e.g. high feed price) and ultimately customers also pay high prices (Uddin 2014). In contrast, there are few-layer farms in Punakha and there was less competition. Few respondents from both the districts market to Thimphu themselves along with vegetable sales, which help themselves to solve egg marketing problems. Further, a significant association was observed for distance to market between Punakha and Tsirang district (p<0.000).

The statistical analysis reveals significant differences between the two locations across all variables (Table 3). Specifically,

Table 3: Association between the variables and market in Punakha and Tsirang

	Punakha	Tsirang			
Variable	Mean±SD	Mean±SD	df	Chi^2 value	p-value
Mean egg price (Nu.)	408.18±56.45	330±30.50	5	51.261	.000
Mean Distance to market (km)	1.82±0.40	1.83±0.38	1	29.348	.000
Poor road condition	1.68±0.48	1.98±0.15	1	40.710	.000

Punakha exhibits higher mean egg prices [for a cartoon of eggs], marginally shorter distances to the market, and poorer road conditions compared to Tsirang. These findings suggest potential socio-economic and infrastructural disparities between the two areas, which could be attributed to various factors such as market dynamics, transportation infrastructure, and economic development initiatives. Addressing these variations may require targeted interventions to enhance market accessibility, improve road infrastructure, and alleviate economic inequalities, thereby fostering more equitable development outcomes in both Punakha and Tsirang.

This finding aligns with previous research indicating that market prices for agricultural products can vary significantly between regions due to differences in production levels, market access, and consumer preferences (FAO 2022). Moreover, it underscores the importance of considering regional economic factors when analyzing agricultural markets and formulating pricing policies. Further, earlier studies highlight the influence of transportation costs and infrastructure on market access for agricultural producers (Savic et al. 2020) that it's worth noting that even subtle differences in distance to markets can have significant implications for farmers' access to buyers and overall profitability. Similarly, the road conditions can enhance transportation efficiency, reduce costs, and expand market access for rural producers (Ludwig et al. 2016).

3.2.2 Feed availability in Punakha and Tsirang

The table 4 provides a comparative analysis of association between variables and feed availability in Punakha and Tsirang districts. The variables include mean feed stock in feed shops (measured in bags of 50kg each), the number of feed outlets, mean distance to feed shops (in kilometers), and the presence of feed-related problems. The statistical analysis, employing Chi-squared tests, indicates significant differences between the two locations for mean feed stock in feed shops ($p = 0.000$), the number of feed outlets ($p = 0.001$), and mean distance to feed shops ($p = 0.000$). However, no significant difference was found regarding feed problems ($p = 0.547$).

Table 4: Association between the variables and feed availability in Punakha and Tsirang

	Punakha	Tsirang			
Variable	Mean±SD	Mean±SD	df	Chi^2value	p-value
Mean feed stock in feed shop (Bag (50kg/bag))	1.86±0.35	1.83±0.38	1	32.014	0.000
Feed outlets (no)	1.86±0.35	1.94±0.25	1	47.087	0.000
Mean distance to feed shop (km)	1.82±0.40	1.83±38		29.348	
Feed problem	1.55±0.51	1.53±.50	1	0.362	0.547

These findings suggest disparities in feed availability and accessibility between Punakha and Tsirang, which could have implications for livestock farming practices and policy support in the respective regions. Further research and interventions may be necessary to address these differences and ensure equitable access to feed resources for farmers in both areas.

The study by FAO 2018 revealed that importance of consistent feed supply to support livestock production, as inadequate access to feed can hinder animal health and productivity. Further, the study on availability and accessibility of feed outlets are mentioned as critical factors influencing farmers' ability to obtain feed inputs efficiently (Duncan et al. 2023). Similarly, the study by Beam et al. 2014 reveals ensuring reasonable distances to feed suppliers is crucial for reducing transportation costs and improving farmers' access to inputs.

3.2.3 Labour situation

Table 5 presents a comparative analysis of three variables between Punakha and Tsirang: flock size, access to modern education, and engagement in off-farm activities. For each variable, the mean value and standard deviation are provided for both locations.

The statistical analysis using Chi-square tests reveals significant differences between the two locations for access to modern education ($p = 0.000$) and engagement in off-farm activities ($p = 0.005$). However, no significant difference was found in flock size ($p = 0.635$). These findings suggest that while flock sizes are similar between Punakha and Tsirang, there are notable differences in access to modern education and participation in off-farm activities. These differences may reflect varying socio-economic and educational opportunities in the two regions, highlighting the need for targeted interventions to address disparities and promote equitable development outcomes. Livestock farming plays a crucial role in the rural economy of Bhutan, providing livelihoods and contributing to food security (World Bank, 2017). Further, the study done by UNESCO in 2022 revealed that access to education is a critical determinant of socio-economic development, influencing individuals' livelihood options and overall well-being. Similarly, off-farm employment opportunities play a crucial role in diversifying rural livelihoods and reducing dependency on agriculture (Getahun 2022).

3.2.4 Layer mortality and health care

Table 6 shows the association of mortality in layers between Punakha and Tsirang districts.

A chi-square test of independence was conducted to examine the association between mortality rates and the two locations, Punakha and Tsirang. The analysis revealed a significant association between location and mortality rates (χ^2 =

Table 5: Association between the variables and labour availability in Punakha and Tsirang

	Punakha	Tsirang			
Variable	Mean±SD	Mean±SD	df	Chi^2	p-value
Flock size (no of birds)	715±772.67	1411.28±1318.99	38	34.435	0.635
Access to modern edu.	1.73±1.03	2.13±0.97	3	29.261	0.000
Off-farm activities	2.24±1.01	2.64±0.87	3	13.029	0.005

Table 6: Association between mortality rate between Punakha and Tsirang districts

	Punakha	Tsirang			
	Mean±SD	Mean±SD	df	Chi^2 value	p- value
Mortality	37.73±8.22	50.53±6.78	13	20.617	0.001

20.617, df = 13, $p < 0.001$). Specifically, Tsirang exhibited a higher mean mortality rate (50.53 ± 6.78) compared to Punakha (37.73 ± 8.22). These results suggest that there is a notable difference in mortality rates between the two locations, which could be attributed to environmental, healthcare, or management factors. This could be due to poor management practices of heat and cold (lack of knowledge and skills), failing to maintain proper ventilation in summer and adequate lighting facilities during winter. The respondents have revealed that birds usually die from white diarrhea and paralysis. Further, the study elsewhere shows mortality was related to farmer's knowledge and training related to improved management and production in Ethiopia (Yemane et al, 2016). The death of birds from high temperatures (summer) and low temperatures (winter) for birds was revealed in Nepal also (Dhakal et al, 2019). Accordingly, respondents suggested that if they get chicks during Autumn would minimize the mortality.

To prevent layers from getting sick, respondents mentioned that they adhered to the farm bio-security protocols; timely vaccination and deworming of birds. The study by Kusi et al. (2015) showed that the proper biosecurity measures prevent diseases and parasite outbreaks. The respondents' from both the districts mentioned that they seek the extension services to treat the birds.

3.3 Prospects of in-layer farming in Tsirang and Punakha

3.3.1 Growing demand for poultry farming

The respondents from both the districts showed interest in continuing the layer farming. With an increasing human population and a rising awareness of the importance of better nutrition, the demand for eggs is expected to continue growing in Bhutan. This presents an opportunity for layer farmers in Tsirang and Punakha to capitalize on the rising demand and expand their operations to meet market needs. The growth of the poultry sector is in line with a study on global poultry status in developing countries that will spontaneously increase due to growth in human population, income and preferences for nutrition (Kleyn and Ciacciariello 2021). The establishment of the National Poultry Development Centre (NPDC) in Bhutan has facilitated access to quality day-old chicks and poultry equipment for farmers. Moreover, advancements in technology and increased availability of resources such as feed formulations can enhance the efficiency and productivity of layer farming in Tsirang and Punakha (NPDC 2022).

4. CONCLUSION AND RECOMMENDATION

The examination of layer farming in Tsirang and Punakha districts of Bhutan revealed both challenges and promising opportunities. While challenges such as market constraints, feed availability issues, and labor shortages persist, there are several positive prospects for the sector. The growing demand for eggs, supportive government policies, access to technology and resources, diversification of income streams, export potential, and contributions to community development indicate a favorable outlook for layer farming in these districts. However, it is imperative to address the identified challenges and leverage the available opportunities

effectively to ensure the sustainable growth and development of the layer farming sector in Tsirang and Punakha.

Based on the findings, the following recommendations are proposed to improve the prospects and overcome challenges in layer farming:

- ✓ Market Development: Facilitate the establishment of diverse marketing channels, including supermarkets, hotels, and export markets, to expand the reach of layer farmers and increase profitability.
- ✓ Capacity Building: Provide training and technical assistance to layer farmers on modern farming practices, disease management, and efficient resource utilization to enhance productivity and sustainability.
- ✓ Input Accessibility: Ensure timely availability and affordability of inputs such as feed, vaccines, and equipment by strengthening supply chains and establishing cooperative networks among farmers.
- ✓ Infrastructure Improvement: Upgrade infrastructure such as roads, transportation facilities, and cold storage to facilitate the efficient movement of eggs and poultry products to markets and minimize post-harvest losses.
- ✓ Policy Support: Review and revise policies related to layer farming to create an enabling environment for investment, innovation, and sustainable practices in the sector.
- ✓ Extension Services: Strengthen extension services to provide farmers with timely information, technical advice, and veterinary support, enabling them to address health and management challenges effectively.
- ✓ Implementing these recommendations in collaboration with relevant stakeholders, including government agencies, agricultural extension services, research institutions, and farmer cooperatives, will contribute to the resilience and sustainability of layer farming in Tsirang and Punakha, ultimately benefiting rural livelihoods and contribute to food security in Bhutan.

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