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Is Poultry Egg Production Profitable in West-Central Bhutan?

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ABSTRACT

The study objective was to determine the Cost of Production [COP] per egg, Break-Even Point [BEP], Marginal Safety Ratio [MSR] and Payback Period [PBP] of layer farms in the west-central region of Bhutan. Forty-layer farms having stock size of 100 and more birds from four districts were surveyed. Information from these farms was collected using semi-structured questionnaires and field observations were recorded to complement the questionnaire. Results showed that 93.8% of farms with the estimated mean stock size of 540 birds had obtained an estimated mean profit percentage of 32.2% from a batch of layer stock. The estimated mean COP per egg was Nu. 6.79 and mean selling price per egg was Nu.8.85 in the study area. An increase in size of the farm by 100 birds was associated with an estimated mean decrease in COP per egg by Nu. 0.12. The farms that stock in pullets had an estimated mean COP per egg of Nu. 1.22, which was higher than those that stock in Day-Old-Chicks [DOC]. An estimated mean BEP of Nu. 1,96,483.9 and 22,383 eggs or units were recorded in the region. The estimated mean margin of safety of Nu. 17,49,785 or 85.4%, indicated a high level of safety in the enterprise. Revenue-Cost ratio of 1.3 indicated that the enterprise would earn revenue of Nu. 1.3 for every ngultrum invested. The estimated mean payback period for 93.8% farms were 0.59 batches, indicating that the capital investment can be recovered from a single batch of layer stock. The general results show that the poultry egg production in the region is a profitable and sustainable venture in terms of economics. Technical assistances and improved managerial skills in poultry egg production are some areas of future support from government.

1. INTRODUCTION

Livestock is an important commodity and a source of human nutrition. In Bhutan, the average consumption of food of animal origin is far below the nutritional requirements [RGoB 2014; NSB 2013] due to low production. One of the swift means to fill this gap is poultry egg production, which can provide high quality and nutritious food. Eggs out-rank chicken, beef and pulses in terms of protein quality, and egg-white protein has a biological value of 100 [Layman and Rodriguez 2009], the highest biological value of any single protein. In addition to providing high-quality nutritious food, poultry egg production generates income and supports rural livelihood. In light of increasing human population, education level, awareness on human nutrition, and purchasing power of communities, there is a growing demand for eggs. However, in Bhutan, egg production is facing problems such as high feed cost, disease outbreaks, weak marketing and poor understanding of local economics [Nidup et al. 2005]. These issues have created dilemma among prospective farmers who are interested to invest in layer farming.

The total number of poultry birds and eggs produced in the country are 1,038,553 and 1,04,149,000, respectively [DoL 2017]. About 29% [3,00,882] of total poultry birds and about 25% [25,823,000] of total eggs, produced in the country are from the west-central region, comprising five *Dzongkhags* [Dagana, Gasa, Punakha, Tsirang and Wangdue]. Although, poultry holds promise for better income, there has been fluctuation in market price of egg and increasing cost of inputs. These issues raise concerns among poultry farmers on the profitability of poultry enterprise. Bhujel [2014] investigated the factors causing decline in poultry farming in Punakha *Dzongkhag*, and identified poor poultry economics as the major factor. This issue continues to exist since no study was undertaken on the economics of egg production in the region. To address this deficiency, the current study was conducted with the main objective to generate information on the economics of poultry egg production in the region. It is expected that the findings of this study will contribute to formulating policies and promoting poultry layer farming in the region. Further, the information is also expected to help farmers manage their poultry egg production enterprises more efficiently, resulting in better productivity and incomes.

2. MATERIALS AND METHOD

2.1 Survey sites and sample size

The study was conducted in four *Dzongkhags* in west-central region of Bhutan, covering Punakha, Wangdue, Tsirang and Dagana *Dzongkhags* [Figure 1]. All registered layer farms, with stocks of 100 birds and above, were taken as sampling frame. A purposive sampling method was employed and 20% of total layer farms were selected from each *Dzongkhag*. Good record keeping practices were the main criteria for identifying farms. Of 52 farms selected for the study, data were collected from 40 farms, as the other 12 farms were either out of stock or converted into broiler farm at the time of visit.

A survey, using a semi-structured questionnaire, was administered in the field through a face-to-face interview with the main persons responsible for managing farms during the month of June 2018. Information was collected on the total costs [fixed and variable costs] involved, total eggs produced and revenue earned for the existing batch on a farm. Fixed costs consisted of interest for capital investment, cost of leasing land [for farms established on leased land] and depreciation of building, facilities, and equipment. The variable costs in this study were cost of birds, cost of feed and costs of other variables. Other variable costs were all costs directly related to the farm size such as costs of feed, electricity, medicines, sawdust, labour, transportation, cartons, trays and binding threads.

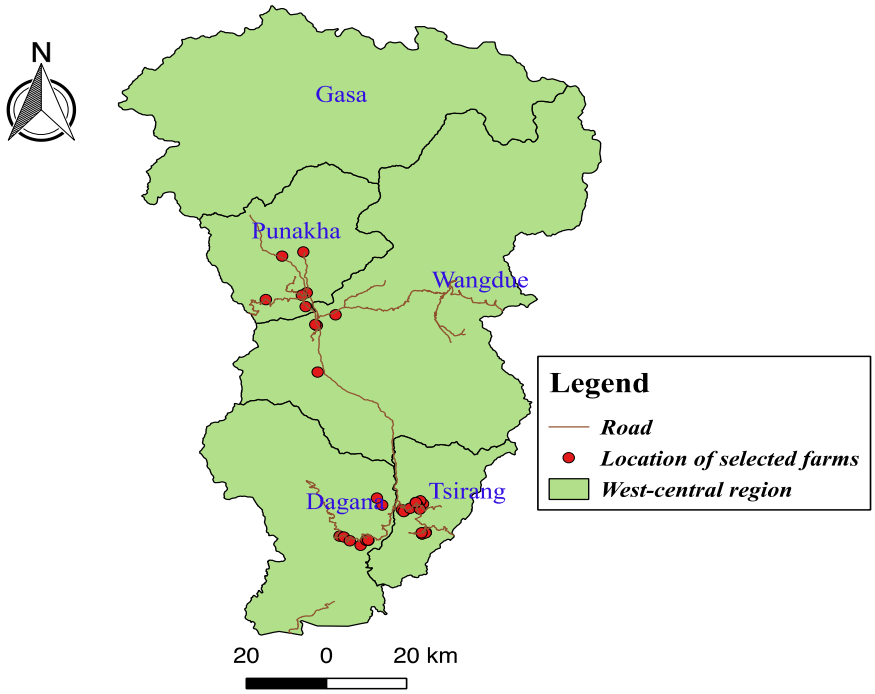

Figure 1: Location of poultry farms.

The maximum sample of 59.38% was from Tsirang, followed by 21.88% from Dagana. Punakha and Wangdue had equal samples of 9.38% each. Of the total farms surveyed, the characteristics of the farms showed that 62.50% [N=25] had the farm size of stocking capacity less than 500 birds, 25% [N=10] had stocking capacity of 1000 birds and the remaining 12.5% [N=5] had more than 1000 birds. Based on the type of stocking done in the farm, it was found that 66% of farms were stocked with Day Old Chicks [DOC] whereas 34% were stocked with pullets.

2.2 Statistical analyses

Data were analysed to calculate costs and returns; Cost of Production [COP] per egg, Break-Even Point [BEP], Marginal Safety Ratio [MSR], Revenue Cost Ratio [RCR] and Payback Period [PBP]. The profitability of egg production was calculated with costs and return analysis. The analysis used relationships > I = TR – TC and TC = TVC + TFC, Where I is net income, TR is total revenue, TC is total cost, TVC is total variable cost and TFC is total fixed cost. Depreciation cost was calculated with the straight-line method over the estimated life [number of batches it can hold] of depreciable assets. Depreciation was calculated on poultry house, electrical wiring and equipment. An interest rate of 10% per annum was fixed on capital investment and calculated for two years per batch since it takes about 23 months for each batch of layer birds to complete the cycle. The labour cost was calculated based on the daily cumulative working hours, over the entire period and converted total hours into number of days. The labour wage per day was fixed at the existing rate of that locality. Total revenue was calculated from the sales of eggs, spent birds, manure and feed sacks.

The COP per egg at the farm was estimated from the total cost of production of eggs and the total number of eggs produced [TC/Total number of eggs produced]. For this particular calculation, the depreciation of bird was taken into account instead of actual cost of bird. Depreciation of bird is the difference between the cost of DOC or pullet and the revenues earned from the spent birds. Linear regression was used to find associations of COP per egg [outcome] with exposure variables such as farm size, type of stocking [DOC or pullets], *Dzongkhags* and years of farming experience. Sensitivity analysis was conducted, adjusting for possible confounding exposure variables through a multivariate linear regression. The statistical tests were considered significant when p-values were less than 0.05. Break-even analysis was performed to estimate the break-even point, using the following formula of Saediman et al. [2014].

$$\text{Break-even point in unit [in revenue]} = \frac{\text{Total Fixed Cost}}{\left[1-\left(\frac{\text{Total Variable Cost}}{\text{Total Revenue}}\right)\right]}$$

$$\text{Break-even point in unit [no. of eggs]} = \frac{\text{Break-even Point [Revenue]}}{\text{Marker price of an egg}}$$

The margin of safety for an enterprise was defined as total sales minus the break-even sales, which would show how much sales could decline before losses would occur for the enterprise [Reddy and Ram 1996]. Marginal Safety Ratio was calculated and expressed in percentages. Revenue Cost Ratio [RCR] was calculated to see how much revenue the farm had earned for every Ngultrum invested. Investment analysis on the feasibility of layer farm business was also calculated using a simple method of payback period. It was calculated dividing the capital cost of investment by average batch net income from the investment [Hawawini and Viallet 2011]. The data were entered into the spread sheet and analyses were conducted in STATA 13.1 [STATA Corporation, College Station, TX].

3. RESULTS AND DISCUSSION

The estimated mean size/capacity of a farm in west-central region was 540 birds [SD±504]. With this capacity of laying birds, the estimated mean total cost per batch of layer stock was Nu. 13,34,926.00 [SD±11,71,770.00], which includes the estimated mean variable costs amounting to Nu. 12,82,966.00 [SD±11,15,902.00] and the fixed costs accounted for Nu. 51,959.49 [SD±65,390.33]. The variable and fixed costs account to 95.86% and 2.53% of the total cost, respectively. The cost of feed had the greatest share [79.31%] of the total variable cost of production. The cost and return analysis showed that 93.8% of the total farms obtained an estimated mean profit percentage of 32.18% [SD±18.8%] from a batch of layer stock. The scale of loss in 6.2% of total farms was comparatively low with the estimated mean loss percentage of 2.2% [SD±0.41%]. This indicates that poultry egg production is a profitable business in the region. The result of the RCR ratio analysis showed that the estimated mean RCR was 1.3 [SD±0.201], meaning that the farm would earn a revenue of Nu. 1.3 for every ngultrum invested.

The estimated mean cost of production per egg was Nu. 6.79 and mean selling price per egg was Nu. 8.85 [SD±0.65] in the study area. The results on associations between the cost of production per egg and farm size, types of stocking [DOC or pullets], Dzongkhag and farming experience are shown in Table 1. There was a significant [$p \leq 0.001$] negative association between COP per egg and the farm size. The increase in farm size by 100 birds was associated with an estimated decrease in mean COP per egg by Nu. 0.12 [95% CI 0.05, 0.19]. The estimated mean COP per egg of those farms that stocked pullets was Nu. 1.22 [95% CI 0.106, 2.034], which was significantly [$p \leq 0.05$] higher than those that stocked DOC. Sensitivity analysis, adjusting for possible confounding variables, showed no change in the results.

The COP per egg, BEP, RCR, MSR and PBP for different categories of farm size and types of stocking are shown in Table 2. The BEP, MSR and PBP were calculated only for those farms [N=30], which did not incur losses from the business. 93.8% of the total farms had production much higher than the BEP, meaning that farms profited from egg production. An estimated mean BEP of Nu. 1,96,483.90 [SD±1,64,519.30] was recorded in the region. Dividing this BEP in revenue by selling price of egg, an estimated mean BEP in units was 22,383 [SD±18,039] eggs. An estimated mean MSR was Nu. 17,49,785 [SD±17,90,558] or 85.4%. The high margin of safety ratio indicates that poultry egg production is a safe venture. In other words, the enterprise has the shock-absorbing capacity in the case of fluctuation in returns due to unpredictable conditions.

PBP is one of the simple and popular methods of investment analysis. PBP tells us the maximum number of batches the investment should take to pay back the capital investment. The estimated mean PBP for 93.8% farms was 0.59

Table 1: Univariable association between exposure variables and cost of production per egg.

Exposure variables	*Estimated β coefficient*	95% Confident Interval	p value
Farm size [100 birds]	-0.12	-0.19, -0.05	0.001
Farming experience [Years]	0.0586	-0.169, 0.520	0.288
Type of stocking			
DOC	Reference		
Pullet	1.220	0.106, 2.034	0.033
Dzongkhag			
Punakha	Reference		
Wangdue	0.427	-1.271, 2.124	0.611
Tsirang	-0.656	-1.947, 0.636	0.307
Dagana	0.590	-0.844, 2.024	0.407

[SD±0.66] batches, meaning the farms are able to make net income equal to capital investment within a laying cycle, which is within the depreciable period of capital investment. We can tell that the project is feasible when the capital will be recovered within a specified minimum number of batches. Therefore, the farms included in our study are feasible to continue except for those two farms operating with the present management practices.

Table 2: Estimated mean COP per egg, RCR, MSR and PBP as per the category of farm size and types of stocking.

Variables	COP egg^{-1} Nu. [SD]	RCR N [SD]	Safety Margin Ratio % [SD]	Payback Period Batches [SD]
Farm size [No. of birds]				
<500	7.26 [1.04]	1.21 [0.17]	80.83 [12.61]	0.82 [0.76]
>500-1000	6.16 [0.84]	1.39 [0.18]	91.31 [6.27]	0.30 [0.25]
>1000	5.64 [0.16]	1.56 [0.09]	94.09 [3.28]	0.19 [0.12]
Type of stocking				
DOC	6.35 [0.92]	1.33 [0.20]	87.38 [10.66]	0.48 [0.44]
Pullet	7.61 [0.99]	1.24 [0.19]	81.42 [13.22]	0.82 [0.95]

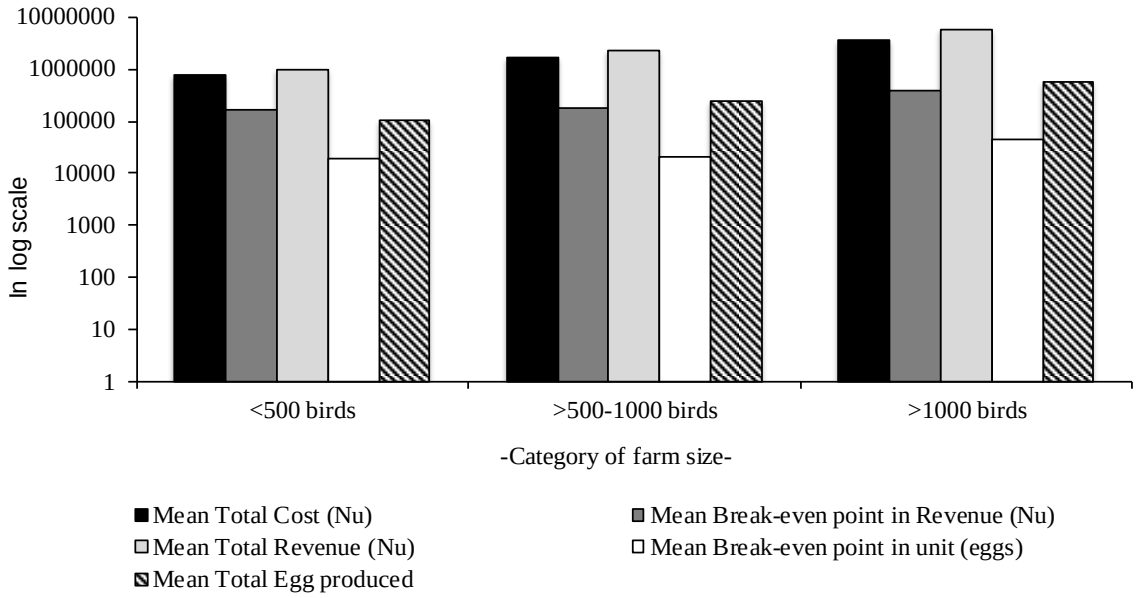

Figure 2: Figure comparing mean total revenue, Break-even point for revenue, Total revenue, Break-even point in unit and total egg produced among different category of farm size.

4. CONCLUSIONS AND RECOMMENDATIONS

Poultry egg production enterprise is profitable and economically viable in the region. Although, the main reason for taking up poultry business is for the net income, employment opportunity and manures were also other reasons. The profitable poultry egg production in the region warrants attention of policy makers and other stakeholders. The common problems associated with poultry egg production are related to the supply of inputs, inadequate support services, and occurrence of diseases. Unavailability of DOC and exuberant rise in feed price are main problems associated with input supply. On the farmers' side, the unavailability of skilled and trained workforce, inadequate management ability, lack of education and knowledge on modern technology makes them unable to maximize production. 65.6% of the farms were found feeding the birds with commercial feed above the daily-required amount. Since the cost of feed accounts for major share of production cost, there is still scope to bring down COP per egg.

Realizing the importance of poultry farming and to sustain poultry enterprise in the region, following are the recommendations based on study findings.

- The poultry farms should strictly adhere to and adopt the guidelines prescribed in the Standard Operation Procedures [SOP] for poultry farming developed by NPRDC, Sarpang. This could minimize the poultry mortality rate and increase profit from the poultry business.
- As the farm size increases the cost of production decreases. One unit increase in farm size can decrease the cost of production by Nu. 0.12. Therefore, farmers must be encouraged to adopt large farm size to bring down the cost of production and be able to sell eggs in the market at competitive rates.

- It is essential to adopt Good Management Practice [GMP], including efficient bio-security and cost-effective planning in poultry farms, which will improve the economics of poultry farming in the region.
- The availability of inputs [DOC and pullets] should be of superior quality and supplied on time to minimize fluctuation in egg production and marketing. This can be achieved by promoting inputs supply farms in the regional *Dzongkhags* through public-private partnership program or liaising with Bhutan Livestock Development Corporation Limited.
- There is a need for policy intervention to stabilize internal and external markets for eggs, which will encourage and retain poultry farmers in the business to attain continued egg self-sufficiency.
- Considering that the cost of feed accounts for maximum investment in poultry business, research is needed to develop an alternative poultry feed with reasonable cost.

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