Technical efficiency of chicken layer farms in Tamil Nadu

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ABSTRACT

The study intended to examine the technical efficiency of poultry layer farms in Namakkal district of Tamil Nadu. Purposive sampling was followed for the selection of study area and sample respondents. Ninety layer farmers were contacted for the study. Stochastic Frontier Production function model was used to assess the technical efficiency of layer farms. The variables such as flock size, feed intake, labourers employed were found to be significantly influencing the egg production across the group I and II. Poultry farmers could be able to increase the efficiency of the farm by 79 per cent given the current level of technology. Both the size of the farms were technically efficient, however, larger farms (group II) were more efficient than small farms. Farmers' age, experience and credit access were the most important determinants which would reduce the poultry farmer's technical inefficiency. The study suggested that periodical training may be given to the layer farmers by veterinary colleges or KVKs for effective utilization of feed and other inputs to enhance the technical efficiency of farmers.

Moreover, Poultry insurance scheme may be insisted among the farmers to reduce losses and strengthening of research and development on feed for provision of a least-cost combination of inputs to the layer farmers by the veterinary universities may be done reduce the technical inefficiency.

Key Words: Poultry layers, technical efficiency, Stochastic Production function

INTRODUCTION

The global egg production was 800.9 billion in 2017. China is the largest egg producing country in the world; it accounts 39.13 per cent of total egg production, followed by USA (7.82 per cent), India (6.06 per cent), Mexico (3.46 per cent) and Brazil (3.17 per cent). The global egg production is expected to increase by 24 per cent in 2025. World per capita consumption of eggs increased from 4.55 kg in 1961 to 10.12 kg in 2017 (FAO STAT, 2017).Indian poultry industry is one of the fastest growing segments of the agricultural sector in India. The annual per capita availability of eggs in the country has increased from 5 eggs per annum in 1950-51 to 69 eggs per annum in 2016-17 (INDIA STAT, 2017). Annual growth rate of egg production was increased from 4.63 per cent in 1950 to 5.75 per cent in 2016(India stat, 2017). Tamil Nadu ranks the first and accounts for 16.15 billion (18.9

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per cent), followed by Andhra Pradesh (18 per cent) and Telangana (13.4 per cent) of the total production in the country. Namakkal is the largest egg producing place in Tamil Nadu, accounts for 77.83 per cent during 2016-17 (Department of Animal Husbandry and Veterinary Services). The annual growth rate of egg production was 3.5 per cent in Tamil Nadu during 2016-17. Per capita availability of egg was 237 eggs per annum in Tamil Nadu during 2016-17 (Tamil Nadu State, 2017)). Namakkal is the biggest exporter of eggs, especially to the Gulf region.

Poultry is an income intense enterprise and provides more or less a regular flow of income throughout the year. But despite of all, poultry farming is considered as a risky enterprise. The main reasons are increasing the cost of production due to higher inputs cost , low price of eggs due to inefficient marketing system, high mortality of birds and lack of adequate knowledge and incapability of the farmers to make egg production an economically viable business proposition. Currently, poultry sector is facing a number of problems such as high cost of feed (Adepoju, 2008), persistent outbreak of disease Anja and Temkatu (2016) and Praveena and Bojiraj (2017) and inability of the marketing system to meet the demand of the poultry producers. The monopoly control of the market by middlemen coupled with un-remunerative prices for eggs has further worsened the situation. These problems seem to occur frequently among the poultry farmers in Tamil Nadu when compared to other parts of the country. Despite these problems, the majority of poultry farmers in Namakkal district of Tamil Nadu continue to operate in the poultry industry. They are exploring all the avenues for expanding the poultry enterprise to minimize the risks. They are hesitant to leave the industry in view of the lack of an alternative source of income. Poultry enterprise offers both incentives for investors and at the same time pose a risk of economics losses to the farmers. This paper aims to analyze the technically efficiency of poultry farms in Namakkal district of Tamil Nadu.

MATERIALS AND METHODS

Sampling

Namakkal district was purposively selected for the study because of its largest egg production capacity in the state (77.83 per cent), Namakkal block (38 per cent) and Mohanur block (15 per cent) were purposively selected, 10 revenue villages in Namakkal block and 5 revenue villages in Mohanur block were selected. Finally, from each village, six farmers those who registered in Tamil Nadu Poultry Farmers Association, Namakkal were randomly selected to tune of 90 as total sample size. The post stratification of selected sample farms were categorized into two groups viz., Group I (below 50000 birds) and Group II (above 50000 birds) for further analysis.

Data Collection

The primary data was collected through personal interview method using well-structured interview schedule considering socio-economic features of poultry layer farmers in the study area. The required information was collected from sample poultry farmers which includes age, family size, education status, cropping

pattern, flock size, capital invested, quantity of inputs used and their value, experience in layer farming, details on cost and returns, marketing practices, constraints in production and marketing of eggs, etc. The primary data was related to the agriculture year 2017-18.

Tools of Analysis

Estimation of Technical Efficiency

Technical efficiency is the ratio of output to input which represents the ability of a farm to produce maximal output from the given resources available in the farm. The linearized Cobb - Douglas form of the Stochastic Production Frontier was used to analyze the technical efficiency of layer farms which is represented in Equation (1).;

$$\ln Y = a_0 + a_1 \ln FS + a_2 \ln FQ + a_3 \ln LAB + a_4 \ln VMC + Vi - Ui \text{ -------- (1)}$$

Where,

Y = Production of eggs (kg)

FS = Flock Size (Nos.)

FQ = Feed Quantity (kg)

LAB = Labour (Man-days)

VMC = Vaccine and Medicine Cost (Rs.)

ln = Natural logarithm

a_0 = intercept

a_1 to a_4 = parameters to be estimated

Vi-Ui = e = error term

Technical inefficiency model

Some of the socio-economic characters of the sample farmers were added into the frontier function, assumes those factors are directly affecting the inefficiency of production. The efficiency function is specified as

$$R = \sigma_0 + \sigma_1 AGE + \sigma_2 EDU + \sigma_3 HHS + \sigma_4 EXP + \sigma_5 TRA + \sigma_6 CRE + e$$

Where,

R = Technical Inefficiency (Score value)

AGE = Age of household head (Years)

EDU = Educational dummy variable indicating 1 if educated, 0 otherwise

HHS = Household size (Nos.)

EXP = Experience in poultry farming (Years)

TRA = Training dummy variable 1 if attended training, 0 otherwise

CRE = Credit availed from banks 1 if Yes, 0 otherwise

σ_0 = intercept

σ_1 to σ_6 = parameters to be estimated

e = error term

The technical efficiency of layer farms and the factors determining technical inefficiencies were assessed for group I and group II farms, separately. The frontier analysis was estimated using STATA 11 econometric tool.

RESULTS AND DISCUSSION

The sample layer farms contacted for the study in Namakkal district was 90 which were classified into two groups viz., the group I (below 50,000 birds) and the group II (above 50,000 birds). Of the sample layer farms (Table 1), nearly 64 per cent of them were having less than 50000 birds (Group I) and around 36 per cent of them were having more than 50000 birds (Group II) with an average number of 25260 and 125656 layer birds per farm, respectively which is five times higher than group I. The average number of birds per batch in layer

stage in group I and group II were 10129 and 25491. Overall, the average layer birds' capacity of the farm was 1.51 lakh whereas the average number of birds in the laying stage was 35260.

Table 1. Classification of Sample Layer Farms

Layer Farm Size	No. of Farms	Farm Size	Mean Layers (Nos.)
Group I (Below 50,000 birds)	58 (64.44)	25620.69	10129
Group II (Above 50,000 birds)	32(35.56)	125656.25	25491
Total	90(100.00)	151276.94	35620

(Figures in the parenthesis indicate per cent to the total farms)

Table 2 revealed that the average age was 51 years. Majority of the sample poultry growers were educated up to the secondary school education (57 per cent in group-I farms and 53 per cent in group II farms). Overall, 27 per cent of them were graduated. The average family size of the sample farm households was 4.0.The average experience of the sample farmers in poultry layer farmers was 15 years.

Table 2. Profile of Sample Layer Farmers

Particulars	Group I	Group I	Overall
Average Age (Yrs)	50	52	51
Education			
Illiterate	7 (12.07)	8 (25.00)	15 (16.67)
Primary	24 (41.38)	9 (28.13)	33 (36.66)
Secondary	10 (17.24)	8 (25.00)	18 (20.00)
Graduate	17 (29.31)	7 (21.87)	24 (26.67)
Average Family Size (Nos.)	3.95	3.97	4.00
Experience in Poultry farming (Yrs)	13	14	15

(Figures in the parenthesis indicate per cent to the total)

Table 3 revealed that the majority of sample farmers belonged to the medium farmers (49 per cent), followed by large farmers (34 per cent) and small farmers (13.33 per cent). The average size of land holding of the sample farmers was 3.52 ha.

Table 3. Operational Landholding of Sample Farm Households

Particulars	Group I	Group I	Overall
Marginal farmer (< 1 ha)	6(10.34)	3(09.38)	9 (3.33)
Small farmer (1 to 2 ha)	8(13.79)	4(12.50)	12(13.33)
Medium farmer (2 to 4 ha)	34(58.62)	18(56.25)	52(48.89)
Large farmer (> 4 ha)	10(17.24)	7(21.88)	17(34.44)
Average Farm Size	3.40	2.85	3.52

(Figures in the parenthesis indicate per cent to the total)

It was observed that (Table 4), the most of the farmers were employed both in poultry and farming around 94.83 per cent in the group-I and 81.25 per cent in the group-II farms. As a whole, 90 per cent of the sample farmers engaged in farming along with poultry.

Table 4. Employment status of the farmer

Particulars	Group I	Group I	Overall
Poultry alone	3(5.17)	6(18.75)	9(10.00)
Poultry and Farming	55(94.83)	26(81.25)	81(90.00)
Total	**58**	**32**	**90**

(Figures in the parenthesis indicate per cent to the total)

The Cobb Douglas Stochastic frontier production function (SFPF) was used to analyze the technical efficiency of layer farms and to identify the determinants of technical efficiency of layer farms. The results are presented in Table 5. In the stochastic frontier production function, the variables such as (1) stock size (Numbers), (2) feed quantity (kg), (3) labour used (Man-days) and (4) vaccine and medicine cost (Rs.) were used to assess the technical efficiency of farms in terms of production of eggs. The results revealed that the coefficient of flock size in group- I farms was positive and significant at one per cent level, which indicates that for every one percent increase in flock size will increase the output by 0.32 per cent. Whereas in group II farms, flock size and feed intake were positively significant at one per cent level of probability. The result clearly shows that the coefficient of feed was positively significant, representing that an increase in feed intake by one per cent will increase their output by 0.12 per cent. Similarly, flock size was positively significant, indicating that an increase in flock size by one per cent will lead to an increase in the output of layers by 1.01 per cent. The results are accepted with other studies such as Sarker *et al.,* (1999) and Ajibefun (2000). The results and positive sign fulfilled the priori expectations. Increase in flock size means using more outputs efficiently and get higher output under good management. Medication cost was negative indicating that expenses on medication reduce the output of layers.

Table 5. Maximum Likelihood Estimates of Stochastic Frontier Production Function of Layer Farms

Variables	Group I		Group II		Overall	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Production Model						
Constant	9.87**	10.24	1.09***	5.29	3.56***	5.68
Flock size (Nos.)	0.32***	4.95	1.01***	2.58	0.36***	6.21
Feed Quantity(Kgs)	0.054	1.29	0.12***	2.34	0.19***	2.89
Labour (Man-Days)	0.077	1.22	0.03	0.25	0.06***	2.24
Cost of Vaccine & Medicine (Rs.)	0.049	1.01	-0.02	-1.18	-0.01	-0.53

*** = Significant at 1 % level; ** = Significant at 5 % level

In overall farms, the estimated coefficients of flock size, feed intake and labour was positive and found to be significant at one per cent level of probability. It indicates that an increase in flock size by one per cent would increase the output by 0.36 per cent. In the same way, increase in feed intake by one per cent productivity would increase by 0.19 per cent. As in the case of labour use, an increase in one labour man-days by one per cent will increase the output by 0.06 per cent. The coefficient of cost of vaccine and medicine was negative and insignificant.

Distribution of technical efficiency among the two groups of farms (Table 6) shows that majority (37.93 per cent) of the group I sample farmers were working at a technical efficiency ranges between 0.61 to 0.70 whereas, in Group II, the most of the farmers (31.25 per cent) were operating at 0.41 to 0.50 level of technical efficiency. The mean technical efficiency of group I and group II farms were 0.66 and 0.83 per cent.

Table 6. Distribution of technical Efficiency of Poultry Farmers

Efficiency Score	Group I		Group II		Overall	
	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
0.21-0.30	5	8.62	0	0	7	7.78
0.31-0.40	6	10.34	3	9.38	11	12.22
0.41-0.50	12	20.69	10	**31.25**	19	21.11
0.51-0.60	13	22.41	2	6.25	26	**28.89**
0.61-0.70	22	**37.93**	7	21.88	20	22.22
0.71-0.80	…	…	6	18.75	4	4.44
0.81-0.90	…	…	4	12.50	3	3.33
Total	58	100.00	32	100.00	90	100.00
Maximum	0.74		0.85		0.97	
Minimum	0.25		0.34		0.29	
Mean TE	0.66		0.83		0.79	
Mean TI	0.34		0.17		0.21	

In overall farms, 29 per cent of the farmers fall in the range of 0.51 to 0.60. The mean technical efficiency of 0.79 per cent implies that the poultry farmers could be able to increase the efficiency by 79 per cent given the current level of technology if the available resources are efficiently utilized and they could increase their output when efficient use of inputs by 21 per cent. Therefore, vast opportunities still exist for increasing productivity. This result matches with Ohajianya *et al.,* (2013), shows that the individual technical efficiency indices range between 16.23 per cent and 94.17 per cent with a mean technical efficiency of 62 per cent.

The MLE estimates of stochastic frontier production function were used to assess the determinants of technical inefficiency among the farmers in the study area and the results show that the

variance factors such as sigma square (σ^2) and gamma (□) were estimated to be statistically significant at 1 per cent level in group I, group II and overall farms.

Table 7. Factors contributing to Technical Inefficiency

Variables	Group I		Group II		Overall	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Inefficiency model						
Constant	3.54***	0.15	0.92***	2.89	1.04***	8.67
Age (Yrs)	-0.56	-0.11	0.01	0.07	-0.01***	-5.62
Education (1 for aboveprimary; 0 otherwise	0.16	0.02	-0.03	-1.05	-0.001	-0.44
Experience (Yrs)	0.17***	9.57	-0.04	-1.02	-0.01***	-2.18
Family Size (Nos.)	-0.37	-1.23	-0.16	-0.66	0.002	1.28
Formal Training (Yes=1;No=0)	0.29	0.32	-3.42	0.08	0.54	0.98
Access to credit (Yes=1;No=0)	-0.49***	2.21	0.02**	1.98	-0.062***	3.98
Variance						
Sigma square (σ^2)	1.112***	2.28	0.001***	3.18	0.005***	4.52
Gamma (γ)	0.78***	2.02	0.75***	4.48	0.6***	3.12

*** = Significant at 1 % level; ** = Significant at 5 % level

Table 7 indicated that the sigma square and gamma were estimated to be 0.005 and 0.6, respectively, and are significant at one per cent level. The sigma square is the systematic component which captures variations in output due to exogenous random shock and measurement error. The sigma square (0.60) is the one sided error which specifies the effect of variation in output due to inefficiency in the production function i.e. 60% of shortfall below the frontier output was due to the technical inefficiency of the farmers.

In group I farms, experience and credit access were significant which affect farmer's efficiency. Also shows that poultry farming experience is positively related to technical efficiency, thereby increasing efficiency. A farmer having higher experience in poultry farming will be more efficient in taking his decisions also he is willing to adopt a better practice of technologies. Whereas, access to credit was negative but significant in influencing the technical efficiency, which implies that if a farmer has access to credit for poultry business it will influence the egg production. The farmers who availed the credit was very less because the farmers in group I farms are small scale poultry farmers and they may not have enough collateral to avail loan from banks and also it involves less investment rather than group II farms. The result is matching with that of Okike (2000) who found a negative relationship

between credit and technical efficiency of poultry farms in northern Nigeria. Though, it differs with Ohajianya *et al.,* (2013) they found that access to credit is significant and positively related to technical efficiency. Whereas in group II farms, access to credit (i.e) who availed loan was positively significant at one per cent level which means that availing credit from financial institutions had significant influence on egg production. In overall farms, coefficient of farmers' age, experience in layer farming and access to credit were negative and significant, implies that these factors led to a decrease in technical inefficiency.

CONCLUSION

Based on the results of the study, it is inferred that the variables such as flock size, feed intake, labourers employed were significantly influencing the egg production across group I and II. Poultry farmers could be able to increase the efficiency of farm by 79 per cent given the current level of technology. Both the size of the farms were technically efficient, however, larger farms (group II) were efficient than small farms. The study proves that the 'null hypothesis of different layer farm sizes are technically efficient' can be accepted. Farmers' age, experience and credit access were the most important determinants which would reduce the poultry farmer's technical inefficiency. The study suggested that the periodical trainings may be given to the layer farmers by veterinary colleges or KVKs for effective utilization of feed and other inputs to enhance the technical efficiency of farmers. Moreover, Poultry insurance scheme may be insisted among the farmers to reduce losses and strengthening of research and development on feed for provision of least-cost combination of inputs to the layer farmers by the veterinary universities may be done to reduce the technical inefficiency.

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