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Study on Input-Output Relationship in Milk Production in the Dairy Farms of Kerala, India

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Abstract

The study was undertaken in the dairy farms of Kerala to examine the main objective of the study that is the estimation of input –output relationship in the milk production using allocative efficiency theory. The study reveals that cost of green fodder, concentrates cost and veterinary cost had a positive significant relationship and the labour cost had a negative significant relationship with the value of milk production. The dairy farmers should reduce the usage of labour input in their farms to get a better return from the value of milk production. Awareness about the new technological advancements in the farms should be delivered to the farmers.

Keywords: Allocative efficiency, dairy farms, stochastic cost function.

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I. Introduction

Dairy farming is an important sector of Indian Economy. It address the food security issues in the nation at the same time provide employment opportunities. The Dairy sector contributes to 4.6 per cent of the national Gross Domestic Product (GDP)in 2019. The Milk production in India has increased from 55.6million tones of output (1991-92) to187.749 million tones of production(2018-19). The country is now self-sufficient in milk production and exports dairy products to other countries, but in a very lowpercentage. The milk produced in India is consumed largely for home consumptio. Kerala is the 12th largest milk producing state in India. The Co-operative systems in Kerala have a long history. It was implemented in Kerala as part of the 'Operation Flood' programme. The 'Operation Flood' is called as major dairy development programme formed in India. With the establishment of the Dairy Co-Operative Societies, gives the farmers an assurance that every drop of their milk will be collected by the society. The society in return provides the milk procurement price and at the same time provides subsides and incentives in the form of cattle feed, artificial insemination and veterinary services. Among the milk and milk products, liquid milk represents the major share of more than 71 percent in Kerala.(imarc report 2018). But the milk production is having a very slow growth. In 2006-2007, the production was at 21.9 million metric tones and in 2017-2018 it rose to 25.70 million metric tones. (Dairy development board, Kerala 2018), but the growth is very slow. The Kerala state has the highest cost of milk production while comparing with other states, due to the non-availability of resources for the production process. Therefore, the present study focuses on the input – output value relationship in the milk production of the dairy farms in Kerala. The relationship is estimated on the basis of allocative efficiency (Cost efficiency) estimation of milk production. Therefore the main objective of the study is to

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understand whether the resources are over –utilized or under – utilized for the milk production process.

II. Materials and Methods

A random sample survey of 150 commercial dairy producers was selected. Out of 14 districts in Kerala, five districts were selected randomly they were Alappuzha, Kottayam, Ernakulam, Thrissur and Palakkad. From each district, 30 dairy farmers were interviewed. The farmers were classified into small (1 to 4 milch animal) medium (5 to 6 milch animal) and large (greater than six milch animals) farmers, based on a number of milch animal holdings (Kumari et al . 2016). The milch animal means number of milking animals. Table 1 shows the number of farmers from different categories selected for the study.

Farmer Group	Number of Milch Animal	Number of Sampled Farmers
Small Farmer	1 – 4	87
Medium Farmer	5-6	37
Large Farmer	Greater than 6	26
Total		**150**

Table 1: Farm groups depending on the number of milch animals

The table 1 exhibits that small farmers are more in number in Kerala. Most of the farmers in Kerala consider dairy farming as a secondary occupation; therefore the milch animal holdings will also be very less. The survey was conducted during the month of January to March 2020. Data was collected through personal interview. For the collection of socio-economic characteristics, input prices, amount of milk produced and other related aspects, a structured questionnaire was designed. The hypothesis was designed to find whether the dairy farmers are allocatively efficienct and the allocative efficiency of the farmers are same across the sample districts.

Based on Farrell's theory, there are two methods to use for the estimation of efficiency; one is Stochastic Production Frontier method (Meeuseen and van den Broeck, 1977) and the Data Envelopment Analysis (Charnes et al. 1978). The paper has used stochastic cost function and one way ANOVA tests to run the hypotheses.

III. Theroetical Framework

The efficiency is an important estimator in agricultural production economics. It is used for comparing the actual attained production value against what is attainable at the production frontier. It tries to prove the basic input –output relationship at the time of milk production process. The allocative efficiency deals with the ability to allocate the input bundle at a given level of output in a least cost method. This has been estimated using a Cobb-Douglas stochastic cost function. The study considers the value of milk produced as the endogenous and all other inputs as the exogenous variables which work for the production of milk.

The model specified in this study is expressed as

$$C = f(X_1, X_2, X_3, X_4, X_5)$$

The empirical form of the model was expressed as:

$$C = f\,(X_{\text{green feed costs}}, X_{\text{dry feed costs}}, X_{\text{concentrates costs}}, X_{\text{labour cost}}, X_{\text{veterinary cost}})$$

The Cobb-Douglas stochastic cost function was elucidated as follows:

$$C = \beta 0 X_1 \beta 1 X_2 \beta 2 X_3 \beta 3 X_4 \beta 4\ X_5 \beta 5\ e^{v-u}$$

Taking the natural logarithms of both sides, the log linear form of the cost function becomes:

$$\ln C = \beta 0 + \beta 1 \ln X_1 + \beta 2 \ln X_2 + \beta 3 \ln X_3 + \beta 4 \ln X_4 + X5\beta_5 + (vi - ui)$$

Where:

lnC = natural logarithm of the value of milk production

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$\ln X_1$ = natural logarithm of the total cost of green fodder used in each farm

$\ln X_2$ = natural logarithm of total cost of dry fodder used in each farm

$\ln X_3$ = natural logarithm of total cost of concentrates used in each farm

$\ln X_4$ = natural logarithm of total cost of labours

$\ln X_5$ = natural logarithm of total veterinary cost

(β0, β1, β2, β3, β4and β5= are unknown parameters to be estimated

(vi - ui) = e = stochastic error term

IV. Results and Discussion

The main characteristics of the sampled dairy farms average characteristics shown in table 2.

Variables	N	Minimum	Maximum	Mean	Standard Deviation
Value of milk production	150	21.54	7084	961.62	1194.1
Milch Animal (Number)	150	1	18	2.81	2.62
Experience of farmer (years)	150	1	50	18.79	11.842
Age of Farmer (Years)	150	27	80	56.26	10.760
Education of farmer(Years)	150	0	17	8.79	4.79
Green fodder Cost	150	.00	2000	127.92	233.13
Dry Fodder Cost	150	.00	1450	65.87	148.64
Concentrates cost	150	16	4968.0	529.38	665.52
Labour Cost	150	1500	51500	7491	5599.0
Veterinary Cost	150	480.0	1950.0	802.240	281.44

Table 2: Average statistics of the characteristics of sampled dairy farms

The average age of the dairy farmer is 56 years with average education is eight years and of 18.79 years of experience in the dairy farming activities. The average value of green fodder, dry fodder, concentrates and veterinary cost are 127.92, 65.68, 529.38 and 7491for per day during the production process in the farm.

Maximum likelihood estimates of the Cobb Douglas cost functions.

Variable	Parameters	Co-efficient	Standard Error	t-ratio
Constant	β_0	.258	.7115	.363
Green Fodder cost	β1	.1474	.534	.275**
Dry Fodder Cost	β2	.113	.2664	.426
Concentrates Cost	β3	.563	.657	.857**
Labour cost	β4	-.3106	.6006	-.517**
Veterinary cost	β5	.964	.836	.115**
Variance ratio	.66			

Table 3: Maximum likelihood estimates of cob Douglas cost function of the sampled dairy farmers

, **significant at 5 percent level (p value < 0.05)

The table 3 depicts the maximum likelihood estimates of allocative efficiency, the value of green fodder, the value of concentrates and veterinary cost shows a positive and statistically significant relationship with the value of milk production. These resources are underutilized in the farms. One per cent increase in the exogenous variables taken in the study (value of green fodder, concentrates and veterinary cost) will give rise increase the milk production by 14 percent, 56 percent and 96 percent

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respectively. The labour cost shows a negative sign, which implies that there is an indirect relationship between exogenous variable and the value of milk production. The labour cost is over –utilized in the farms. Any one per cent increase in the variable will reduce the value of milk production by 31 per cent. The value of dry fodder is positive with the value of milk production but found insignificant with output. The mean efficiency is only 61.3 per cent. The variation in the milk production is 66 percent, which is under the control of farmers; the rest portion is the random error occurred due to seasonal variations or measurement changes.

Hypotheses Testing

Hypothesis 1

H_0= Dairy farmers are allocatively efficient

It was proven from the stochastic cost function that they are not efficient. The mean efficiency is only 61.3 percent. Hence the null hypothesis is rejected. The dairy farmers are not allocatively efficient.

Hypothesis 2

H_0= Allocative efficiency is same across the different farm sizes

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.064	2	.032	1.43	.001**
Within Groups	3.291	147	.022	3	
Total	3.355	149			

Table 5 : ANOVA Results

**significant at 5 percent level (p value < 0.05)

The table 5, shows that there is statistical significant difference between the groups are proven by one way Anova. The p value is less than 0.05. The allocative efficiency is not same across the farm sizes. The null hypothesis is rejected, stating the allocative efficiency is different across the districts. The larger farmer is more allocatively efficient in using the inputs required for the farm. These results are agreeing with earlier studies conducted by Mburu et al. (2014) and Jha et al . (2000).

V. Conclusion

The study estimates the relationship between input–output of milk production using allocative efficiency of dairy farmers in Kerala state using stochastic cost functions. It has found that allocative efficienct of milk production is very low. The mean efficiency was estimated to be 61.3 per cent. Dairy farms have the potential to increase their efficiency by 38.7 per cent. It's also revealed that allocative efficiency differs across the farm sizes. Through proper education and training, the cost of production can be reduced; therefore, allocative efficiency can be achieved. The dairy farmers should minimize the use of labour cost. There should be a proper education and training concerning the use of inputs for the production.

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