

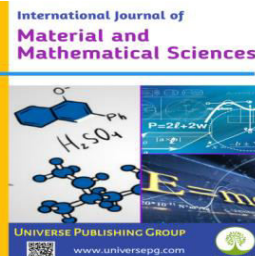


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## An Economic Analysis of the Smallholder Dairy Farming: A Case Study in Muktagacha Upazila, Mymensingh

**Lutfunneher\***

Department of Economics, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh, Bangladesh.

\*Correspondence: [lutfu7870@gmail.com](mailto:lutfu7870@gmail.com) (Lutfunneher, Assistant Professor and Principal Investigator, Department of Economics, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh, Bangladesh).

### ABSTRACT

The present study was conducted to analyze the smallholder dairy farming sector in the rural areas of Bangladesh from an economic viewpoint. In this study we tried to find out the factors affecting dairy income and milk productivity, comparing the results from crossbred and indigenous cows and also found out the various constraints faced by smallholder farmers in dairy farming in rural areas of Muktagacha Upazila. Primary data was collected from four different villages at Muktagacha Upazila in Mymensingh division. The sample size was 40 cattle farmers. They were interviewed through a survey questionnaire. To analyze farmer's income and milk production in relation to economic factors two econometric and economic models were used as Multiple regression models and the cobb-douglas production function. From the survey, it was found that dairy farms owned on average 3.07 milking cows comparing. 37 indigenous and 2.70 crossbred cows. In selected areas, most of the dairy farmers own about 3.07 milking cows where maximum cows are crossbred cows and a small number of cows are indigenous. At present time due to price rise in every sector. Dairy farmers in rural areas also need to find the ways to produce more at the lowest cost. Milk productivity was 6.90 liter per cow per day, in crossbred whereas indigenous cows provided only 1.9/2.00 liter per day and total productivity was 12/13kg. From average viewpoint it was found that, in large farms, the productivity was large compared to the small firms or households. We also tried to estimate the average monthly income from the farm. From this study finding it is clear that cross-bred cows are providing higher economic benefits to the dairy farmers compared to the indigenous breeds. With the improvement in every step such as training programs, food cost, proper farm management, proper treatment of the cows and farming experience are highly related to the monthly income and milk productivity. Now a day, smallholder dairy farming is a progressive economic sector despite various constraints.

**Keywords:** Dairy farm, Smallholder, Cows, Economic analysis, Productivity, Livestock, and Crossbred.

### INTRODUCTION:

The economy of Bangladesh is the predominantly agrarian. Being an agrarian society, people of Bangladesh are greatly dependent on the various form of agriculture. Although agricultural contribution to total

GDP has been decreasing in recent years. But agriculture remains the largest sector of the economy comprising about 19% (including livestock) while the crop sector is 14.3% of the country's GDP. Livestock sector also helps the economy by creating employment

generation, alleviating poverty, by developing human resources and by providing the food security. The agricultural production systems in Bangladesh at present time may depend on livestock sector to develop the future of production. For the subsistence farm economy, livestock is an essential element. Livestock provide the basic draft power of the agricultural practices, organic manures for crop land, transport in both rural and urban areas and are the main sources of protein for human consumption. Farmers directly related with cash income only in livestock sector and in the national economy livestock bring a significant portion of foreign exchange earnings through the export of hides. Statistics show that about 2.9% of national GDP is covered by livestock sector and its annual rate of growth 5.5%. In Bangladesh about 20% percent of people depend on cattle farming in rural areas. The present scenario of Livestock population in Bangladesh is estimated to comprise 25.7% million cattle. In spite of a high density of livestock population, the country suffers from an acute shortage of livestock products like milk and meat. So it is urgent to invest in livestock sector in a large scale.

It is expected that if farmers invest in livestock by one taka will get a return of taka double per year depending on the type of the livestock species and product. Development of cattle farming depends on factors such as veterinary health services, veterinary support services, delivery systems of the veterinary biological products, the quality production inputs, veterinary extension services and co-operation between private and public sectors dealing with various problems of cattle/livestock, viz diagnosis of the diseases, their treatment, prevention and control. The responsibility for development of livestock resources in Bangladesh is vested in the government, non-government organizations (NGOs) and the private sector. Other development aspects include improvement of livestock through genetic up-gradation, artificial insemination, transfer of technology etc. The financial assistance of international agencies may contribute to livestock development programmes (Bamikole and Adebowale, 2023).

The government of Bangladesh has given top priority to livestock development in recent years to meet the growing demand for milk and meat and to create

employment and generate income for the rural poor. To encourage the development of livestock resources, the Govt. provides subsidies to the farmers who rear crossbred milch cows. The government also provides subsidies for vaccination and artificial insemination programmes. Under Muktagacha Upazila in many villages - poor farmers are able to solve the economic problem by cattle farming. Keeping this in view, the present study will, therefore, under taken to analyze, the income from dairy farming by smallholder farmers in selected areas of the Muktagacha Upazila.

### Review of Literature

Uddin *et al.* (2012): Focused on how dairy farming improves the living standard of farmers. Anik *et al.* (2015): Founded that the sources of maximum amount milk in the rural areas of Bangladesh are traditional dairy farmers for the consumers. With the advancement of technology to improve living standard and earnings the dairy production in the rural areas has outstanding scopes. Hossain *et al.* (2005); Datta *et al.* (2019): Founded that compared to the indigenous breeds rearing crossbred cows are more economically profitable for the dairy farmers.

Datta *et al.* (2013): Observed that without a considerable amount of financial support, making profitability is difficult for the dairy farmers. Khan *et al.* (2013): performance of the dairy farms calculated by using the Gross margin and net revenue. Dolewikou *et al.* (2016): Observed that the dairy cattle business on the farmers group members in West Ungaran District, Semarang was profitable in which the respondents able to earn more than minimum wage of the other work. Kumarasekara, K. M. A. L. B. (2009): Founded that educated and experienced farmers increased their firm productivity within less hours compared to the old farmers.

The above review of literature indicates that, research studies on this line are not sufficient. Very little economic investigations are the undertaken by the researchers. Keeping this in view, the study will, therefore, undertaken to analyze the economic characteristics of farm households and the income from dairy farming in selected areas of Muktagacha Upazila, Mymensingh district.

### Justification of the study

The findings of the study will help the policy makers in making decisions regarding the income, output profitability and cost of dairy farming. Moreover, farmers, extension workers and planners will utilize the findings of the study in making decisions regarding dairy farming and identify the major constraints face by the farmers in dairy farming in the study area. The result of the study will also has academic importance to the students and the teachers of economics. The study will be helpful to the researchers for further studies of similar nature.

### Objectives of the study

The main objective of the study was to investigate the income from dairy farming in selected areas of Muktagacha Upazila, Mymensingh district. However, the following specific objectives of the study are as follows.

- 1) To examine the monthly income and milk productivity relative to cost and others factors of farming.
- 2) To determine the economic characteristics of Sample Farm Households.

### METHODOLOGY:

The present study was based on mainly primary data. The primary data collected from different farmers. Four sample villages of Muktagacha Upazila were selected purposively. The four villages were Garaiquty, Tarati and Kandulia and sotrashia. Four villages are bordered each other. The villages are situated within 8 kilometers from Mymensingh town and 2 kilometers from Muktagacha Upazila. Four villages have homogeneous Physiographic conditions. The reasons for choosing the areas are: i) the areas easily accessible, ii) the university in which the researchers work is located near the areas. iii) the researchers have good knowledge about the areas. After selecting the study areas a list of households will prepared. Total 40 farm households from the four villages were selected by purposive and random sampling technique. An interview schedule was used for data collection. Data collected by direct interview method. Due to time and resource constraint only cattle was studied. The duration of data collection was October 2021 to September 2022. Collected data were processed and econometric techniques (regression analysis and cobb- Universe PG | [www.universepg.com](http://www.universepg.com)

douglas production function) were used. Secondary data were collected from different official & non-official documents.

Income of smallholder dairy farm has been measured by using multiple regression models. Mumba *et al.* (2011). More precisely we want to find out the impacts of various economic explanatory variables on dependent variables. Monthly Income is the dependent variable.

$$Y = \beta_0 + \beta_1 X_{1age} + \beta_2 X_{2ysc} + \beta_3 X_{3fex} + \beta_4 X_{4fs} + \beta_5 X_{5scrb} + \beta_6 X_{6ind} + \beta_7 X_{7tp} + \beta_8 X_{8tsd} + \beta_9 X_{9lc} + \beta_{10} X_{10fc} + \beta_{11} X_{11mc} + \beta_{12} D_1 + \beta_{13} D_2 + \beta_{14} D_3 + \mu_i$$

Where,

Y = Monthly income from dairy farming

$X_{1age}$  = Age of farmers (years)

$X_{2ysc}$  = Education of farmers (years of schooling)

$X_{3fex}$  = Farming experience of farmers

$X_{4fs}$  = Farm size (number of cows)

$X_{5scrb}$  = Cross band cow

$X_{6ind}$  = Indigenous cow

$X_{7tp}$  = Total profit

$X_{8tsd}$  = Time spend (hour)

$X_{9lc}$  = Labor cost

$X_{10fc}$  = Food cost

$X_{11mc}$  = Medicine cost

$D_1$  = Feeding green grass (yes= 1, 0= otherwise)

$D_2$  = Bio security (yes= 1, 0= otherwise)

$D_3$  = Membership in dairy (yes= 1, 0= otherwise)

### Cobb- douglas production function

To show the production efficiency (milk-productivity) we have used the Cobb-Douglas production function. In the study Cobb-Douglas production function model have used because of the best fit of the sample data and to show the production efficiency (milk-productivity). The following specification was made for the cob-Douglas model.

$$Y_1 = A X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} D_1^{\beta_8} D_2^{\beta_9} \mu$$

By taking log in both sides of the Cobb-Douglas production function, the function was transformed into the following logarithmic form, because it can be solved by ordinary least square (OLS) method.

$$Y_1 = A X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} D_1^{\beta_8} D_2^{\beta_9} \mu$$

$$\ln Y_1 = \ln A + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln D_1 + \beta_9 \ln D_2 + \mu_i$$

Where,

$Y_1$  = Milk yield (in liter)

A = Constant

$x_1$  = Dairy farm size (no. of milk cow)

$x_2$  = Countable feed cost

$x_3$  = Labor use (man days)

$x_4$  = Capital cost (BDT)

$x_5$  = Others cost

$x_6$  = Experience in dairy farm of household head (years)

$x_7$  = Age of cow (years)

$D_1$  = Training received (yes= 1, 0= otherwise)

$D_2$  = Feeding green grass (yes= 1, 0= otherwise)

**RESULTS AND DISCUSSION:**

Socio-economic characteristics of the farm households are the most important thing in making production planning. In this study, a number of socio-economic aspects of sample households were examined such as family size, educational status, age distribution and farm size. The findings of the study depicted here that all the surveyed household are smallholder of a farm. Most of them were illiterate and their age groups were 25-60 with farming experience. From this study it was clear that the farmers were related to milk productivity. Monthly income of the farmers were related various factors. In study areas the farmers owned maximum crossbreed cows than indigenous cows. During survey

period it was clear that average herd size 4 to 10 and about 85% of the farm are small and 15% are large. And also found that maximum milking cows were crossbreed where small parts are indigenous. Jabbar *et al.* (2005) declared that around 63% of the cows in the herd were the crossbreed and the rest 37% were indigenous cows. The cost of indigenous cows was zero but return was not so small. From this survey we also found that the larger the farm the larger the cost and return also high. In rural areas family labour is employed in the farm for this reason labour cost was low in some cases and most of the labour in household was women. In case of the large farm economic saving is easy because with the increase in farm size the amount of feed used per cow decreased. In milk producing farm, most of the farmers save money by supplying the straw by own. And they also supply the green grass from nature which also saved money. The owner of the large farms cultivated grass in 40 decimals of land. Medical cost for cattle was also small. Most of the cattle were vaccinated from Upazila veterinary hospital. From natural water source most of the farmers wash their cows they clean the farms regularly. Educated owners of the farms were the member of the farm management organization and had received training about rearing and carering cattle.

**Table 1:** Economic characteristics of smallholder dairy farmers by regression model estimation.

Respondents characteristics	Coefficient	Standard error	t value	p< t  value
Y				
Age of farmers (years) $x_{1age}$	533.9393	4034.002	0.13	0.896
Education of farmers (ysec) $x_{2ysec}$	2929.143	9725.707	0.030	0.766
Farming experience of farmers( $x_{3fex}$ )	1887.121	278.4866	5.46	0.00*
Farm size (no. of cows) $x_{4fs}$	8.287302	3.055173	2.26	0.045**
Crossbreed cow (no.) $x_{5scr}$	26.53766	8.552712	-2.75	0.017*
Indigenous cow (no.) $x_{6ind}$	-20650.92	187113.7	-0.11	0.913
Total profit( $x_{7tp}$ )	1.856373	1.354371	1.37	0.183
Time spend (hour) $x_{8tsd}$	-11221.79	26431.98	-0.42	0.675
Labor cost( $x_{9lc}$ )	.8809449	5.18118	0.17	0.866
Food cost( $x_{10fc}$ )	23.42924	10.75821	2.18	0.039*
Medicine cost( $x_{11mc}$ )	-9.168201	45.98353	-0.20	0.844
Feeding green grass to cow (1= yes, 0= otherwise) $D_1$	2663.401	150437.7	0.02	.986
Bio security taken $D_2$ (1= yes, 0= otherwise)	-23437.45	142975.4	-0.16	0.871
Dairy group member (1= yes, 0= otherwise) $D_3$	38883.94	75494.68	0.52	0.611
Constant	84271.05	9851.333	2.19	0.015*

Source: Field survey 2021

$R^2 = 0.8962$

Where, \*indicates the p values significant at 1% significance level, \*\*indicates the p values significant less than at 5 % significance level.

### **Non Dummy**

The sign of the various non dummy repressors' make economic sense. The coefficient of,  $X_{1age}$ ,  $X_{2ysc}$ ,  $X_{3fex}$ ,  $X_{4fs}$ ,  $X_{5crb}$ ,  $X_{7tp}$ ,  $X_{9lc}$ ,  $X_{10fc}$  are Positive and,  $X_{6ind}$ ,  $X_{8tsd}$ ,  $X_{11mc}$  are negative.

### **Dummy**

The differential intercepts coefficients of  $D_1$  and  $D_3$ , are expected to be positive and  $D_2$  negative. Now we discussed the regression analysis of the data about monthly income related to others factors.  $R^2=0.8962$  is the coefficients of multiple regression analysis. Which indicates that about 89% variations in the monthly income are explained by the considered explanatory variables in the model.

### **The Regression co-efficient of age of the farmers (years)**

The regression co-efficient of age of farmers was 533.9393 with a positive sign. It implies that if age of farmers increase one year, keeping other factors remaining constant would lead to an increase of total monthly income by 533.9393tk. The estimated co-efficient for the age of farmers is not statistically significant as its p-value is high (Table 1).

### **The Regression co-efficient of education of farmers (years of schooling)**

The regression co-efficient of education of farmers was 2929.114 with a positive sign. It implies that if years of schooling of farmers increase one year (education of the farmers), keeping other factors remaining constant would lead to an increase of total monthly income by 2929.114tk. The estimated co-efficient for the education of the farmers is not statistically significant as its p-value is high (Table 1)

### **The Regression co-efficient of Farming experience of farmers**

The regression co-efficient of Farming experience of farmers was 1887.121 with a positive sign. It implies that if farming experience of farmer's increase one year, keeping other factors remaining constant would lead to an increase of the total monthly income by

1887.121tk. The estimated co-efficient for the farming experience of the farmers is statistically significant as its p-value is quite low and t-value is high. Which means that this variable greatly influences the dependent variable and the monthly income of the farmers with farming experience are different from the monthly income of the farmers who have not any farming experience.

### **The Regression co-efficient of Farm size (No. of cows)**

The regression co-efficient of Farm size (No. of cows) was 8.287302 with a positive sign. It implies that if farm size (No. of cows) of farmers increase by one number, keeping other factors remaining constant would lead to an increase of total monthly income by 8.287302tk. The estimated co-efficient for the farm size of the farmers is statistically significant as its p-value is quite low and t-value is high. Which means that this variable greatly influences the dependent variable and the monthly income of the farmers with large farm are different from the monthly income of the farmers who have small farm.

### **The Regression co-efficient of Crossbreed cow**

The regression co-efficient of the Crossbreed cow (26.53766) was with positive sign. It implies that if number of crossbreed cows goes up by one number, keeping other factors remaining constant would lead to an increase of total monthly income by 26.53766tk. The estimated co-efficient for the crossbreed cows of the farmers is statistically significant as its p-value is quite low and t-value is high. Which means that this variable greatly influences the dependent variable and the monthly income of the farmers with crossbreed cows are higher as the production of milk is high by crossbreed cows the monthly income of the farmers who have others types of cows.

### **The Regression co-efficient of indigenous cow**

The regression co-efficient of the indigenous cow (-20650.92) was with negative sign. Which indicate that if number of indigenous cows goes up by one number, keeping other factors remaining constant would lead to decrease of total monthly income by 20650.92tk. The estimated co-efficient for the indigenous cows of the farmers is not statistically

significant as its p-value is quite high and t-value is low. Which means that this variable influenced the dependent variable and the monthly income of the farmers with indigenous cows are lower and have no difference with others cows without crossbreed cows.

#### **The Regression co-efficient of total profit from farm**

The regression co-efficient of total profit from farm was 1.856373 with positive sign. It implies that if total profit goes up by one tk. keeping other factors remaining constant would lead to an increase of total monthly income) by 1.856373 tk. The estimated co-efficient for the total profit from the farm is not statistically significant as its p-value is high (Table 1).

#### **The Regression co-efficient of time spend (hour)**

The regression co-efficient of time spend (hour) in farm was -11221.79 with negative sign. Which indicate that if time spend increase by one hour, keeping other factors remaining constant would lead to decrease of total monthly income by 11221.79 tk. The estimated co-efficient for the time spend (hour) is not statistically significant as its p-value is quite high and t-value is low. Which means that this variable influenced the dependent variable and the monthly income of the farmers (by spending more time with more labor) are lower because of labor cost rising.

#### **The Regression co-efficient of time spend (hour)**

The regression co-efficient of the labour cost was .8809449 with positive sign. It implies that if labour cost goes up by one tk. keeping other factors remaining constant would lead to an increase of total monthly income by .8809449tk. When the labour cost high it means that farms are developing as a result production rise and monthly income also rise. The estimated co-efficient for the labour cost is not the statistically significant as its p-value is high (Table 1).

#### **The Regression co-efficient of food cost**

The regression co-efficient of food cost was 23.42924 with positive sign. It implies that if food cost goes up by one tk. keeping other factors remaining constant would lead to an increase of total monthly income by 23.42924 tk. Food cost high means more food are needed to feed the cows to rise the milk productivity which causes to rise monthly income. The estimated co-efficient for the food cost is statistically significant

as its p-value is low. This variable has great influence on dependent variable (Table 1).

#### **The Regression co-efficient of medicine cost**

The regression co-efficient of medicine cost was -9.168201 with negative sign. Which indicate that others thing remaining the same if medicine cost increase by one tk. the monthly income goes down by 9.168201 tk. This variable is not the statistically significant.

#### **Interpretation of dummy variables**

In the above table the coefficient attached to the variable dummy is a differential intercept, showing how much the monthly income that receives a dummy value of 1 differs from that of the benchmark. The average monthly income of the farmers from farm whose farms do not use the green grass to feed cows, whose farm do not have Bio-security facility and the farmers whose are not the members of the dairy management group is a benchmark category (84 271.05). The estimated coefficient for the variable when farmer use the green grass to feed the cows is (2663.401). That means average monthly income is higher by (2663.401) tk. for actual average monthly income  $(84271.05+2663.401) = 86934.451$ tk. The estimated intercept coefficient for green grass is not statistically significant as its p value is quite high and t- value is quite low. That means the average monthly income of the farmers whose farms use the green grass to feed cows is not statistically different from the average monthly income whose farms do not use the green grass to feed cows. The estimated coefficient for the variable when farmers take the bio-security in the farms is (-23437.45). That means average monthly income is lower by (23437.45) tk. for actual average monthly income  $(84271.05-23437.45) = 60833.6$ tk. The estimated intercept coefficient for the bio-security in the farms is not statistically significant as its p value is quite high and t- value is quite low. That means the average monthly income of the farmers whose farms have taken the bio-security facilities for farm is not statistically different from the average monthly income whose farms do not use this facilities for farms. The estimated coefficient for the variable when farmers are the members of dairy group is (38883.94). That means average monthly income is higher by (38883.94) tk. for the actual average monthly income  $(84271.05+$

38883.94) = 123154.99tk. The estimated intercept coefficient for members of dairy group in the farms is not statistically significant as its p value is quite high and t- value is quite low

Sample: 15 and included observations: 15.

$\ln Y_1$	Coefficients	t-value	p-value
Dairy farm size ( $\ln x_1$ )	.4972521	1.06	.483
Countable feed cost ( $\ln x_2$ )	-.4718246	-1.33	.411
Labor use ( $\ln x_3$ )	-.0119369	-0.03	.979
Capital cost ( $\ln x_4$ )	.175596	1.17	.451
Others cost ( $\ln x_5$ )	.2401079	.80	.570
Experience ( $\ln x_6$ )	2.00851	2.61	0.025*
Age of the cow (years) ( $\ln x_7$ )	4.164481	2.58	0.017*
Training received (1=yes,0=otherwise) ( $\ln D_1$ )	4.259128	2.68	0.01*
Feeding green grass (1=yes,0=otherwise) ( $\ln D_2$ )	3.075434	2.03	0.04**
Constant	4.985987	0.96	.512

Source: Field survey 2021.

$$R^2 = 0.7869$$

### Sign of the coefficient of variables

Non Dummy: The sign of the various non-dummy repressors make economic sense. The coefficient of,  $\ln x_1$ ,  $\ln x_4$ ,  $\ln x_5$ ,  $\ln x_7$  are Positive and  $\ln x_2$ ,  $\ln x_3$ ,  $\ln x_6$  are negative. Dummy: The differential intercepts coefficients of  $D_1$  and  $D_2$  are positive. From the above table it is clear that milk production per month related many factors. From regression analysis we see that the coefficients of multiple determinations  $R^2$  for milk productivity indicated that included variables in the model not only explained higher variability in the model but also explained the significant effect on the milk productivity. Variables - age of cow, capital cost, other cost, training received, feeding green grass have positive impact on the dependent variable. Coefficients of the variables- Farming experience, the training received, feeding green grass are statistically significant which means a 1% increase in the farming experience a 2.00% change in the milk production per cow per month which is statistically significant at less than 5% level. Similarly a 1% increase in age of the cow results in 4.16% change in milk production per month. If training received by farmers increase by 1% than milk productivity change by 4.25%. which also means that the farms production receiving training is different from the production which farm are not

### Production function estimation results for the milk productivity.

Regression Analysis

Here, Dependent variable:  $\ln Y_1$  (Milk yield in liter per month).

Method: Least squares.

receiving the training. Feeding green grass also positive and statistically significant impact on the milk productivity. A 1% increase in the feeding green grass will lead 3.07% increase in the milk productivity. Labour use and feeding cost variable have the negative impact on the milk productivity. This may be for households own supporting. Family labour support and own straw support causes this negative impact. From the above two analysis it is clear that the surveyed dairy firms were enjoying increasing returns to scale. From all-over analysis we see that the average daily milk productivity of crossbred cow was higher than that of the indigenous cow. So investment in this sector will profitable in future.

### Various constraints faced by the farmers and to recovers these constraint some suggestions

Most of the farmers/ owners of the dairy farms are illiterate and financially insolvent. Their major problem were lack of financial support, lack of capital, lack of training facility, lack of governmental and non-governmental helping hand, high price of feed, lack of proper medical facilities, non-availability of breeding and veterinary services, lack of educational knowledge and technological advancement. To overcome these shortcomings some suggestions were:

- 1) Supporting farmers by providing technical training.
- 2) Provide financial support from various govt. and non govt. institutions.
- 3) Feed supply with low price.
- 4) Provide medical facilities.
- 5) Develop the milk supply and milk marketing system.

### CONCLUSION:

From this study we see that all the farms analyzed produce a positive farm income. Most of the farmers are smallholder and this smallholder farming known as subsidiary profession. The findings of the study indicate that now a day, dairy farming is the most profitable farming system and in study areas it was observed. We also found that the farms with crossbred cows are more profitable than that of the indigenous cows. Therefore proper management and technological improvement might contribute positively towards dairy sector development by reducing unemployment, poverty and by ensuring food security in rural areas of Bangladesh.

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### CONFLICTS OF INTEREST:

There is no conflict of interest from the authors end.

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