



Factors Affecting Productivity and Marketing Channel of Household Level Dairy Farming, Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SCA and AM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KD, SR and TI managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study was conducted to explore the factors affecting dairy production and marketing value chain, value addition at a Household level in Mollahat upazila of Bagerhat District, Bangladesh.

Methodology: For the implication of the study cluster sampling technique was used and data was collected from 80 dairy households. A Cobb-Douglas production function was used to identify the factors affecting dairy production and marketing margin was used to measure value addition as well as deriving marketing channel.

Results: Marketing Channel of dairy farming showed that 50% of milk were channeled through by farmer-milkman-sweetshop-consumer and only 10% of milk directly channeled in both directly local market and home delivery. By analyzing data, the study got human labor, utilities, medicine have a

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positive correlation with milk yield of the milk cow. But it was found that straw and green grass have a negative correlation with the milk yield of the cow due to excessive use of it. The main observation was that all of the resources were not fully utilized by those households.

Conclusion: Despite being smallholder and subsistence, if the farmers increase the amount of resource use in dairy rearing then milk production will be increased and the smallholder's socio-economic conditions will be better.

Keywords: Dairy farming; production function; Bagerhat; value addition; marketing channel.

1. INTRODUCTION

In Bangladesh, agriculture is considered as the most important productive sector and also plays a key role in developing the country. More or less 85% of people of the country directly or indirectly engaged in Agriculture and livestock sectors [1]. Besides agricultural cultivation, livestock rearing has significant positive impact on equity in terms of income and employment and thus poverty eradication reduction in rural areas as distribution of livestock was more equal as compared to land and in that case, dairy farming becomes a business, way of life and 365 days-a-year jobs [2,3]. At present in Bangladesh, the number of livestock are about 23.78 million cattles, 1.47 million buffaloes, 3.34 million goats, and 25.77 million sheep [4]. This livestock is opening so many business sectors and among them, dairy, meat processing sectors are at their utmost level in contributing 2.01% in the GDP in Bangladesh. As we know milk is considered as nature's most perfect food, as it is the sole source of nourishment for newborn beings [5]. Moreover, household level dairy farming contributes a lot in securing food security [6]. If we observe the raw milk production in Bangladesh then we will see about 90% of the produced milk in the country comes from cows, 8% from goat, and the remaining 2% from buffalo [7]. At present, the maximum dairy producers are small scale producers because their herd size is small 3.5 cattle per household [8]. They are dominating the dairy sector because 70% of the small-scale dairy farmers are producing around 70–80% of the country's total milk [9]. So, the development of small-scale livestock enterprises must be seen as a crucial element of any efforts to eradicate extreme poverty and hunger and make the livelihoods sustainable, especially in rural areas [10]. Rearing one or two cows for milk production becomes an important source of livelihood especially for landless women and little family units go about as necessary money-saving and consistent earning sources for marginal farmers [11]. Though dairy farming has been turned into a profitable business in recent years, farmers are

not aware of the key factors affecting dairy productivity and farm profitability [12]. Some research findings suggest that many farmers follow traditional feeding systems and around 59% of the farmers feed their dairy cattle in the old-style and another report suggests that they feed concentrates only to the lactating animals [13-15]. Besides feeds, some other factors also determine the productivity of dairy sectors like formal knowledge and farmer's educational background in dairy sectors [16]. Tarabla and Dodd stated that demographic and socioeconomic structures of the producers also affect the enterprise performance with a percentage of 14.4% and 34.3% respectively [17]. But most importantly the size of the farm is also a core factor to determine the performance or efficiency of a farming unit and it is crucial in the aspect of our country because most of the producer are small scale dairy producers. Let along with all the factors there is also a great variation in the productivity of different breeds of milch cattle reared in different situations due to variations in genetic characteristics and management practices. In aspects of Bangladesh, dairy sectors become a major supporting section for growing GDP and improvement of poor small-scale farmers at a household level like some rural areas of Bagerhat District, Bangladesh. Thus, it is necessary to explore the factors that affect and improve the productivity of dairy sectors and their distribution channel throughout the district for better establishment of the dairy business.

2. MATERIALS AND METHODS

2.1 Study Area

The survey was conducted in Mollahat upazila of Bagerhat district. Out of seven unions, two unions were selected randomly. Goalia and Gangni unions were determined as the study area of Mollahat Upazilla, Bagerhat District.

2.2 Sampling Technique and Data Collection

The study used cluster sampling technique for collecting information from the dairy farmers. Out of eight unions, two unions are chosen by simple random sampling. And, finally from each cluster or union 40 samples (Total 80 samples) were selected through the use of statistical method. Primary data was collected through dairy farm survey using pre-tested questionnaire. But before going to data collection procedure the questionnaire was tested several times. After modifying some questions, final questionnaire was prepared. Then it used to collect data from selected unions.

2.3 Analytical Technique

The study mainly used Cobb-Douglas production function to identify the factors that affect productivity. Simple Marketing Margin equation used for identify value addition of each intermediary level. Identifying exact actors of value chain helped the study to determine marketing channel of household level dairy farming.

For analyzing the data, both descriptive and statistical technique were employed. Gross Marketing Margin (GMM) has been estimated as follows:

$$GMM = SP - PP \quad [18]$$

Where, GMM=Gross Marketing Margin (Tk./ltr.); PP= Purchase price (Tk./ltr.); and SP= Sales price (Tk./ltr.).

Value Addition (VA) was estimated as follows:

$$VA = MM - MC$$

Where, VA = Value Addition (Tk./ltr.); MC = Marketing cost (Tk./ltr.); and MM = Marketing Margin (Tk./ltr.).

In the study area for the production of milk the following inputs such as labor, paddy straw and green grass, bran and pulses, veterinary services and medicines, utility, etc. were considered as a priori explanatory variables and these explanatory variables were considered to be mostly responsible for producing milk. Cobb-Douglas production function model was initially estimated to understand the possible relationship between the production of milk and the level of

inputs used. Cobb-Douglas production method has also been commonly used to evaluate the efficiency of production by some researchers who have used this type of function to determine the productive output of both agricultural and dairy farms [19-22].

2.4 Functional Relationship of Dairy Farming

This section makes an effort to accomplish a functional analysis of dairy milk production. It is expected to be a compromise among

- i. Adequate fit of the data;
- ii. Computational feasibility; and
- iii. Sufficient degrees of freedom unused to allow for statistical testing with the help of samples.

To explore the effects of variable inputs, both linear and Cobb-Douglas production function models were estimated initially. The result of the Cobb-Douglas model appeared to be superior on theoretical and econometric grounds.

So, the Cobb-Douglas production function was chosen for the regression under ordinary least squares (OLS). The coefficient understands this specification for production elasticity demonstrates whether the production process as a whole yield increasing, constant or decreasing returns to scale.

Cobb-Douglas production function analysis was done taking into account 80 dairy farmers. The model was specified as:

$$Y = aX_1^{b_1} \times X_2^{b_2} \times X_3^{b_3} \times X_4^{b_4} \times X_5^{b_5} \times e^{u_i}$$

In the linear form it can be written as:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + U_i$$

Where,

Y = Value of the average milk yield per cow per day (Taka);
 X_1 = Value of labor used per cow per day (Taka);
 X_2 = Value of paddy straw and green grass used per day per cow (Taka);
 X_3 = Value of bran and pulses used per cow per day (Taka);
 X_4 = Value of medicines used per cow per day (Taka);
 X_5 = Utilities used per cow per day (Taka);
 ln = Natural logarithm;

a= intercept/constant;
 b_i = Production coefficients; and
 U_i = Error term.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Condition

Pictorial view of the Table 1 represents that most of the dairy farmers are in the range of 30 to 50-year age which belonging 60% and only 15 % of farmers are above 50 years of age. In the case of education, 38.75% of respondents completed secondary education. Though the percentage of Higher education is higher than primary education. On the other hand, Table 1 showed that 67.5% of respondents have higher income

means above 100000 Tk. But the percentage belonging lower-income and middle income of the respondents are the same. This part is basically concerned with identifying the actors of the value chain to develop a value chain map and also to examine the value addition by dairy farmers.

3.2 Milk Value Chain

The analysis of the value chain is intended to provide systematic knowledge of the flow of goods and services from the origin (farmers) to the final destination (consumer). The milk market channels depicted in Fig. 1 was constructed based on the data collected in some selected areas in Bagerhat district.

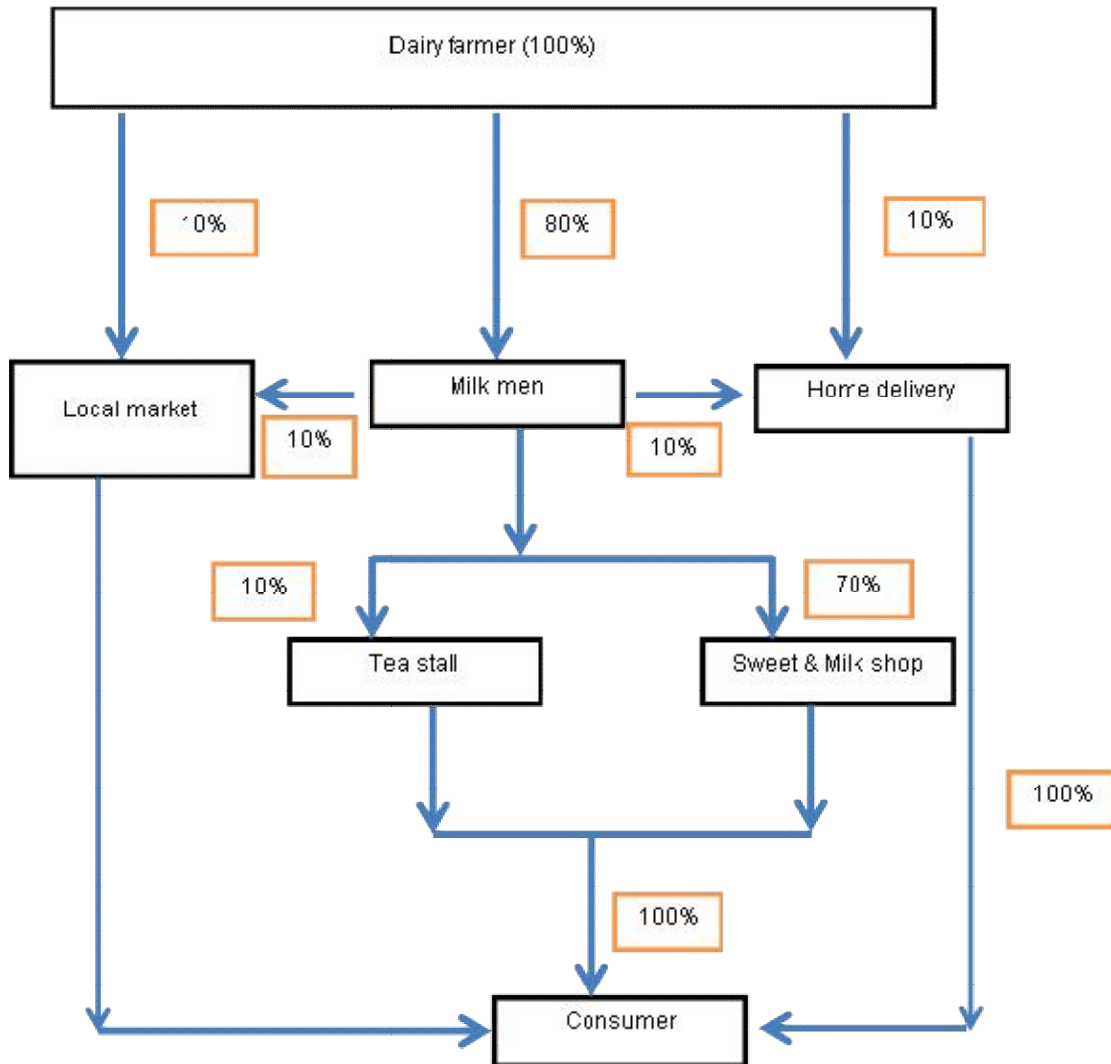


Fig. 1. Existing value chain map of dairy milk in Bagerhat district

Table 1. Descriptive statistics of farmer's socio-economic condition

Categories according to age	Frequency	Percentage
Below 30	20	25
30-50 years	48	60
Above 50 years	12	15
Categories according to education	Frequency	Percentage
Illiterate	6	7.5
Can sign only	6	7.5
Primary education	15	18.75
Secondary education	31	38.75
Above secondary education	22	27.5
Categories according to income	Frequency	Percentage
Low income (up to Tk 60000)	13	16.25
Medium income TK (60001-100000)	13	16.25
High income Tk (>100,000)	54	67.5

The channel comparison was made based on the percentage of the volume that passed through each channel.

- I. **Farmer-Home delivery:** This channel represented 10 percent of total milk supplied to the neighbor's home form during the survey period.
- II. **Farmer – Local Market-Customer:** This channel also signified 10 percent of total milk supplied as a raw milk form. Most of the farmer does not sell their product in the local markets.
- III. **Farmer – Milkman – Local Market – Customer:** It represented 10 percent of total milk supplied to the market
- IV. **Farmer – Milkman – Sweet and milk Shop – Customer:** It accounted for 50 percent of total milk supplied to the far distant market and placed the third most important channel in the district.
- V. **Farmer – Milkman – Tea stall – Customer:** This channel represented 10% of the total milk market. This is the most important channel of milk marketing.
- VI. **Farmer – Milkman – Home delivery – Customer:** A small amount of milk is supplied by this channel. Around 10% of milk goes through this channel.

3.3 Value Addition by Different Intermediaries

From Table 2 it shows that the marketing margin is highest in milkman and that is Tk. 15.65 per litre followed by the Bepari which is Tk. 9.89 per litre. The result showed that marketing margin was lowest for the local marketer.

The scenario was similar for value addition which was tk. 11.90 per litre, tk. 8.25 per litre and tk.

6.28 per litre for Milkmen, Bepari and Local marketer respectively. Marketing cost was estimated highest for Milkman followed by a local marketer. The lowest cost was held by Bepari in the study area.

3.4 Discussion of Result from the Model

The parameter estimates of the production functions for dairy milk production are presented in Table 3.

Principal characteristics of a model are noted below:

- i. F-values used to measure the goodness of fit for different types of input.
- ii. The Co-efficient of multiple determinations indicated the total variations of output explained by the independent variables included in the model.
- iii. Coefficients having sufficient degrees of freedom were tested for a significance level of 1 percent and 5 percent probability levels.
- iv. Stages of production were estimated by returns to scale which were the summation of all production elasticities of various inputs.

3.5 Interpretations of the Results

Estimated values of the coefficient and related statistics of the Cobb-Douglas production function model of dairy cows are shown in Table. It can be observed from the Table 3 that, five significant variables were taken into consideration in the production function. The regression coefficient for the labor input(X_1) was significant at 5 percent level for dairy cows. This implied that 1 percent increase in labor cost,

Table 2. Marketing margin and value addition by different intermediaries

Intermediary	Purchase price (Tk./ltr.)	Marketing cost (Tk./ltr.)	Selling price (Tk./ltr.)	Marketing margin (Tk./ltr.)	Value addition (Tk./ltr.)
Milk men	40.00	3.75	55.65	15.65	11.90
Local marketer	55.65	2.85	64.78	9.13	6.28
Bepari	64.78	1.64	74.67	9.89	8.25

Table 3. Estimated values of co-efficient and related statistics of Cobb-Douglas production function

Variables	Coefficient	t- value	P- value
Intercept (a)	5.785***	2.855	.007
Human labor (X ₁)	0.392**	2.094	0.044
Straw and green grass (X ₂)	-0.066	-1.032	0.309
Bran and Pulses(X ₃)	0.005**	2.224	.031
Medicine (X ₄)	0.243***	3.740	0.000
Utilities (X ₅)	0.033**	2.099	0.043
R ²	0.704		
F- value	14.07***		

Note: *** and ** indicate significant at 1% and 5% level, respectively

MVP = Marginal Value Product

MFC = Marginal Factor Cost

keeping other factors constant, would significantly increase the milk yield by 0.392 percent. At the same time, the regression coefficient of the paddy straw and green gases (X₂) for the dairy cow was negative and insignificant, indicating that 1 percent increases of this input, keeping other factors constant, would result in a decrease of milk yield by 0.066 percent. The major cause of being negative of this co-efficient is due to easy availability and excessive use of this input. The regression coefficient of bran and pulses cost (X₃) for the dairy cow was positively significant at a 5% level. This indicates that an increase in 1 percent of this input, keeping the other factors constant, would result in a significant increase in milk yield by 0.05 percent. In the case of veterinary (X₄) inputs for a dairy cow, the regression coefficient was positively significant at 1% level. This indicates that an increase in 1 percent of this input, keeping the other factors constant, would result in a significant increase in milk yield by 0.243percent. Finally, the regression coefficient of utilities(X₅) for the dairy cow was positively significant at 5% level. This indicates that an increase in 1 percent of this input, keeping the other factors constant, would result in a significant increase of milk yield by 0.033 percent.

The coefficient of multiple determinations, R² was 0.704 for dairy cow which indicated that about

69.4 percent of the variation in milk yields was explained by the independent variables included in the model. The F-value = 14.07 of the equation was highly significant at 1 percent level implying that all the variation in milk yield depends mainly upon the explanatory variables included in the model.

4. CONCLUSION

Household level dairy farming is not only profitable but also play a vital role in the livelihood of rural people in Bangladesh. About half of the milk produced by household level utilized by sweetshop. Due to heavily practice in rural region most of household can't efficiently utilize the inputs resulting fall down both milk production. The result of the study incurred that some factors such as labor, medicine, utilities and brain-pulses influenced milk production. It is clear that the production system of dairy at household level is not so developed. The Government should take some steps such as providing medicine facilities to dairy farm and improving the use of utilities help the dairy farmers to improve the productivity which may help to improve their livelihood.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our

area of research and country. There is no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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