

Dairy Farming in a Selected *Char* Area of Northern Bangladesh: Prospect of Profitability and Contribution to Livelihood Improvement

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Abstract

The study was conducted to assess the profitability of dairy farming in a char area of Northern Bangladesh and to evaluate the role of dairy farming to improve farmers' livelihood. A total of 200 poorest households with dairying (100 treated and 100 controlled) and 200 with non-dairying were selected out of 520 households using simple random sampling technique. Majority of respondents in both the groups were males, aged between 36 and 50 years and had no primary education. Sixty five and 56 percent dairy households had 5 decimal homestead and 10 decimal cultivable land, respectively but 66 and 75 percent nondairy households had 10 decimal homestead and 20 decimal cultivable land, respectively. The status of homestead area and cultivable land of dairy farmers were better than the nondairy farmers. Significantly higher percentage of dairy household had access ($P < 0.05$) to sanitation and drinking water facilities than the nondairy households. Average self-declared daily cash income of each dairy household was Taka 129 ± 11.2 . Profitability of dairy farming was measured in terms of gross return (GR), gross margin (GM), net return (NR), and benefit cost ratio (BCR) (undiscounted). Difference in differences (DID) approach was applied for analyzing the impact of dairy farming. Annual GRs from dairy farming was estimated at Tk. 18029 and Tk. 26003 before and after the project intervention, respectively. The estimated NR per cow per year stood at Tk. 537 and Tk. 6060 before and after intervention of the project, respectively. In the study area, BCR before the intervention of the project was 1.03 and 2.04 while it was 1.30 and 2.51 after the intervention on the basis of the full cost and cash cost, respectively. After the intervention of the project, there was a significant fall in the percentage of the farmers engaging with farming and day labourer whereas there was an increase in the percentage of the farmers engaging with only farming. On an average, family male members spent about 5 h a day on dairy cattle while the female members spent about 4 h a day over the study areas. Average total income had increased by 49% after the project intervention but it increased by only 17% in case of the controlled farmers. The highest (34%) treated group's dairy income level was Tk. 10001.00–15000.00 followed by 33% and 18% of dairy income level of Tk. 15001.00–20000.00 and above Tk. 20000.00, respectively of respondent farmers. Income and expenditure of the treated group increased by 50% and 29%, respectively whereas it was increased by 18% and 8% in the case of control group. The length of time spent (working days) had increased by 100% in the study area. At last the sustainable livelihood framework including the asset pentagon was used to assess the impact of dairy farming on livelihood pattern.

Keywords: Char, farming, livelihood, agricultural, dairy

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INTRODUCTION

The social and economic structure of Bangladesh is essentially agriculture based. About 74.50% of the total population of the

country lives in rural areas and are directly or indirectly engaged in a wide range of agricultural activities [1]. As a riverine country, Bangladesh is mainly formed by

sedimentation and accretion of three rivers—the Jamuna, the Padma and the Meghna. The economy of the people of river basin areas is highly dependent on agriculture. Most of the northern region of Bangladesh is located within the floodplain area. So many *char* lands exist in the northern region of Bangladesh.

The *char* dwellers invest their available resource base (such as, human, financial, physical, natural and social) to enhance farm productivity, which in turn provide livelihoods to them. The livelihood patterns of the people of the *char* areas are much more harsh and full of uncertainties, which are totally different from that of mainland.

Basically, the poor people of the bottom stratum of the society, having no capital and little access to resources are the inhabitants of those *char* areas. Despite poor living conditions, households continue to live in the *chars* because they simply have no alternative.

Bangladesh is a low-lying densely populated country of more than 150 million people, of which 76.47% lives in rural areas [2]. About 6–7% of total population lives in *char* area [3]. Land is primarily a constraint to crop agriculture in *char* areas, although integrated approach of homestead gardening at the same time of crop farming and livestock were advocated, but many efforts were not sustained due to flash flood.

In Bangladesh, approximately 40.4% of the populations is categorized as absolute poor, and of these 19.5% (or about 29 million) are labeled hardcore poor. The absolute poor are those people who consume less than 2122 Kcal daily; and hardcore poor, who consume less than 1805 Kcal daily [4]. A further 20% are tomorrow's poor; people who, given the current trend, will soon fall into poverty (Rahman, 1998)[5].

The rural poverty rate in Bangladesh is 26% in which 36% of very poor people live in low lying erosion prone areas (*char*) of northern Bangladesh [6–8]. Over 95% of the households in the erosion prone *char* areas retained their assets, mainly cows even after devastating flood when all other household

goods are destroyed or lost. The productivity of cattle is low because of poor genetics, poor nutrition, weak herd health, veterinary services, and marketing access [9]. Family-based, very small scale dispersed dairying in the *char* areas is not capable of ensuring stable supply of milk to the major centers of demand for best economic return.

Development partners have aim to reduce poverty at the ultra-poor level (2 millions) in *char* areas of northern Bangladesh to least 50% by 2015 through improvement of socioeconomic condition. Dairy is the prospective but it is a poorly developed sector in Bangladesh. With the alarming growth of population, the demand for milk and dairy products rises faster than the demand for crops both in developing and developed countries.

As a means of sustaining and accelerating dairy and thereby promoting agricultural growth in Bangladesh there is a great need to study the reasons for poor development of dairy sector and find ways to overcome those constraints.

To the best of researcher's knowledge, no specific study on this issue of dairy sector of *char* areas is conducted in Bangladesh. To get a complete picture of poor dairy farmers, it is essential to know the demographic profile of the sampled farmers.

Also, it is expected that the present study would be helpful to evaluate the impact of dairy farming on profitability and assess the impact of dairy farming on employment creation, income generation, poverty reduction, and livelihood patterns of the dairy farmers.

Objectives of the Study

The objectives of the study are:

- i. To identify the demographic profile of the farmers in a selected *char* area;
- ii. estimate the profitability of dairy farming in the study area; and
- iii. To assess the impact of dairy farming in improving the livelihoods of farmers living in the *char* area.

Table 1: Selection of Study Areas.

District	Upazila	Union	Villages	No. of population	No. of sample			
					Dairy		Non-dairy	Total
					Treated	Control		
Bogra	Sariakandi	Bohail	Hatibaria, Komolpur, Laxmikola, Mazbari	520	100	100	200	400
					Total			
					200			

MATERIALS AND METHODS

Sariakandi Upazila of Bogra district, located in northern Bangladesh was purposively selected as the study area (Table 1). The reasons for selecting these areas are:

- i. The availability of milch cows in this area;
- ii. The area was preferred because of the resemblance to the objectives of the study; and
- iii. It was projected that cooperation from the farmers in this area would be high so that reliable data required for the study could be obtained.

From the selected study area, a total of 200 poorest households with dairying (100 were under treated group and remaining 100 were under control group) and 200 with non-dairy households were selected out of 520 households (N=520) using simple random sampling technique. Data were collected by the researcher himself in two times firstly from May to July, 2009 before intervention of the project and secondly from June to August, 2011 for after situation. The study was based on both primary and secondary sources of data and information. Primary data were collected through face-to-face interview method survey. Secondary data and information were collected from various governmental (GOs) and nongovernmental organizations (NGOs).

The sources of secondary data and information include data published in different books, handouts, publications, notifications, published and unpublished documents of Government of Bangladesh (GoB) and its different organizations and agencies. Collected data were compiled, classified, tabulated and analyzed to find out the crude association of variables. In this study tabular technique was used to illustrate the whole picture of analysis. On the other hand, the statistical technique was followed as a supplement to the tabular technique.

Profitability of Dairy Farming

In this study, profit of dairy farming was calculated by deducting total costs from total returns along with different time periods both before and after the intervention of the project to observe the impact on net return (NR). Besides, different measures such as benefit cost ratio (BCR) (undiscounted), returns to labour, return on unit investment, etc. were estimated to strengthen the profitability analysis of dairy farming, which depicted profitability situation in a different dimension.

Gross Return (GR)

GR was calculated by multiplying the total volume of output of an enterprise by the average price in the harvesting period [10]. The following equation was used to estimate GR:

$$GR_i = \sum_{i=1}^n Q_i P_i$$

Where,

GR_i = Gross return from i^{th} product; Q_i = Quantity of the i^{th} product;

P_i = Average price of the i^{th} product; and $i = 1, 2, 3, \dots, n$.

Gross Margin (GM)

GM was calculated by the difference between GR and total variable costs. That is,

$$GM = GR - TVC$$

Where,

GM= Gross margin; GR= Gross return; and TVC = Total variable cost.

Net Return (NR)

NR was calculated by deducting all costs (variable and fixed) from the GR. To estimate the relative profitability of different agricultural enterprises, profit equation of the following algebraic form was used:

$$\Pi = \sum_{i=1}^n (P_{Y_i} \cdot Y_i) - \sum_{i=1}^n (P_{X_i} \cdot X_i) - TFC$$

Where,

Π = Profit; P_{Y_i} = Price per unit of the i^{th} produce; Y_i = Quantity of the i^{th} produce; P_{X_i} = Price per unit of the i^{th} inputs; X_i = Quantity of the i^{th} inputs; TFC = Total fixed costs; and $i = 1, 2, 3 \dots, n$ (number of items).

This function determines the NR by subtracting the total cost of producing a particular commodity from its total return.

BCR

The BCR was estimated as a ratio of GRs and gross costs. The formula of calculating BCR (undiscounted) is shown as below:

$$BCR = GR/TC$$

Where,

GR = Gross return; and TC = Total cost

Impact Evaluation of Dairy Farming in the Study Area

Impact is the difference in the change in outcomes. Different types of analytical tools were used to analyze the impact of specific intervention. Based on the information, the researchers applied difference in differences (DID) approach for analyzing the impact of dairy farming. Because in the study area two groups (treated group and control group) were growing at similar rates and eliminated fixed differences not related to treatment.

Difference in Differences (DID) Method

DID is a quasi-experimental technique used to understand the effect of a sharp change in the economic environment of dairy farming in the study areas. The DID estimator was used to compare the changes in outcome measures between treated and control farmers. During the impact study by DID approach, the following formula was used [11]:

$$DID = \{(T_1 - C_1) - (T_0 - C_0)\}$$

Generally, restricting the evaluation to only ‘before/after’ comparisons makes it impossible to separate intervention impacts from the influence of other events that affect beneficiary households. Net income method was used to evaluate and compare the income of dairy farming beneficiaries and nonbeneficiaries in the study areas. The model specification for the net farm income is as follows:

$$\text{Percentage change in income} = \frac{\text{Income After} - \text{Income Before}}{\text{Income Before}} \times 100$$

RESULTS AND DISCUSSION

Demographic Profile of Dairy and Nondairy Households

From the beginning of the study, the samples were divided into two groups (viz. 200 dairy and 200 nondairy households). The overview of the samples indicated that the condition of the dairy households was comparatively better than that of the nondairy households. The general characteristics of the interviewed households are presented in Table 2.

Table 2: General Information of the Dairy and Nondairy Households.

Variables	Dairy household (n=200) %	Nondairy household (n=200) %	Total (n=400) %	χ^2 - value
Sex				
Male	51.6	49.9	50.7	0.03 ^{NS}
Female	48.4	49.1	49.3	
Age (in years)				
<35	13.2	13.3	13.2	0.02 ^{NS}
36-50	55.3	60.0	57.4	
51+	31.6	26.7	29.4	
Educational level				
No formal education	86.2	88.2	87.2	0.02 ^{NS}
Primary education	11.5	11.3	11.3	
Secondary education	1.8	0.5	1.2	
Higher secondary and above	0.5	0.0	0.3	

NS= Non Significant at (P>0.05).

Source: Field Survey, 2010.

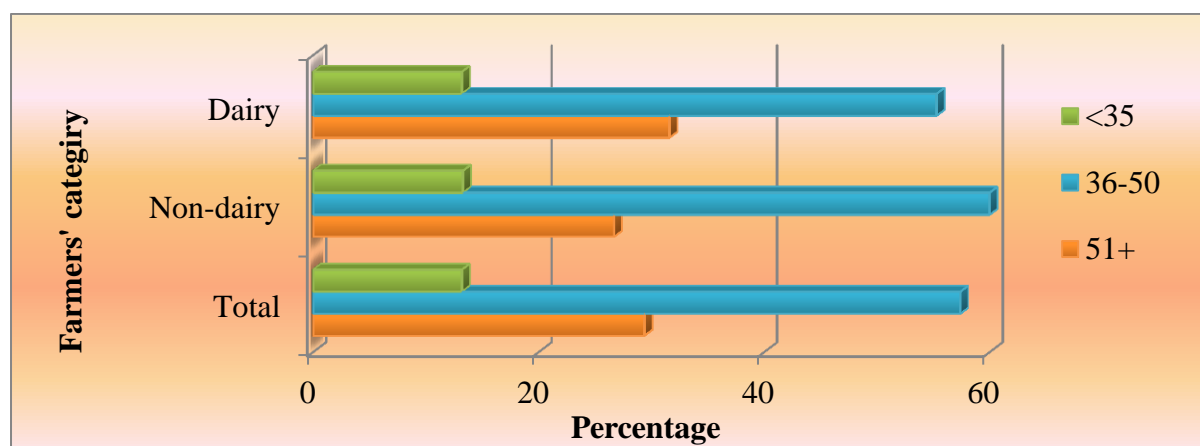


Fig. 1: Age Distribution of the Sample Farmers.

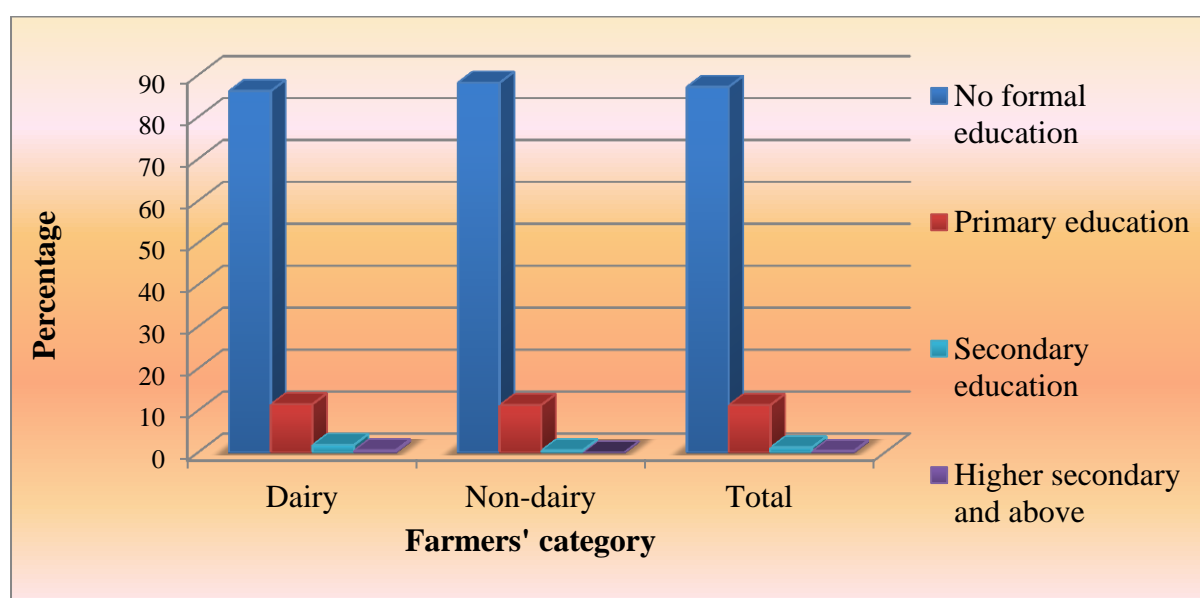


Fig. 2: Educational Level of the Sample Farmers.

Table 3: Land Ownership (% of Household) Among the Dairy and Nondairy Households.

Particulars		Dairy	Nondairy
Land ownership	Homestead (Decimal= dl)	5 dl	34
		10 dl	66
	Cultivable (Decimal= dl)	10 dl	25
		20 dl	75

Source: Field Survey, 2010.

Table 2 indicates that the distribution of household heads by sex, age and educational level in the two types of households (i.e., dairy and nondairy) were not significantly ($P>0.05$) different. Majority of respondents in both the groups were males, aged between 36 and 50 years (Figure 1) and had no primary education (Figure 2). The distribution of land ownership of the dairy and nondairy households in the

study area is described in Table 3. It is clear that dairy households had more homestead and cultivable land than that of the nondairy households. It was seen that 65% and 56% dairy households had 5 decimal homestead and 10 decimal cultivable land, respectively but 66% and 75% nondairy households had 10 decimal homestead and 20 decimal cultivable land, respectively (Figure 3).

Therefore, the status of homestead area and cultivable land of dairy farmers were better than the nondairy farmers in the study area. There were 200 dairy households who had 946 cattle, 845 sheep and goats, 1271 birds, and 3 horses; on the other hand, 200 nondairy households possess only 17 cattle, 766 sheep and goats, 1132 birds in the study area.

Majority of the farmers (about 45%) own two dairy cattle of mixed aged (Table 4). The distribution of households by number of sanitary latrine and tube well owned is as shown in Table 5. The table portrays that 70%, 74% and 49%, 44% households of dairy and nondairy groups had access to drinking water and sanitation facilities, respectively.

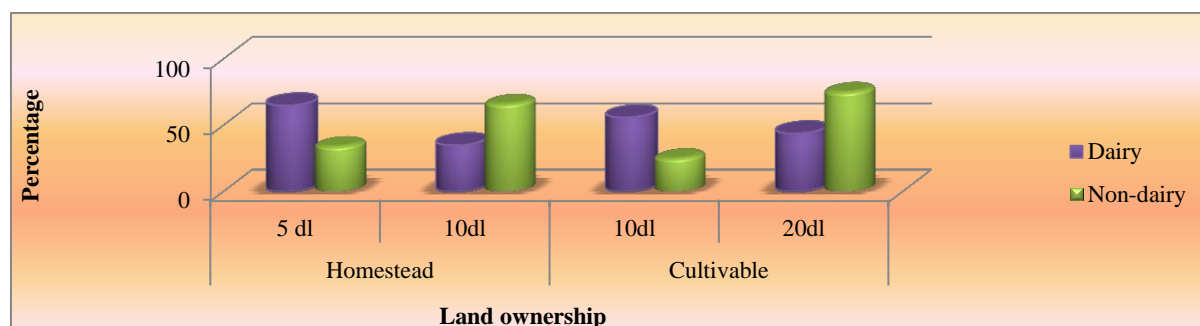


Fig. 3: Land Ownership of Two Types of Households.

Table 4: Distribution of Households by Number of Dairy Animals Owned (Mixed Age).

No. of dairy cattle	Frequency (n=200)	Percentage
1	46	23.0
2	89	44.5
3	52	26.0
> 3	13	6.5

Source: Field Survey, 2010.

Table 5: Percentage Distribution of Households by Number of Sanitary Latrine and Tube Well Owned.

Variable	Dairy household (n=200) %	Nondairy household (n=200) %	Total (n=400) %	χ^2 -value
Sanitation (Sanitary latrine)				7.01*
Available	74	44	59	
Not Available	26	56	41	
Drinking water source (Tube well)				8.05*
Available	70	49	59.5	
Not Available	30	51	40.5	

* = Significant at (P<0.05).

Source: Field Survey, 2010.

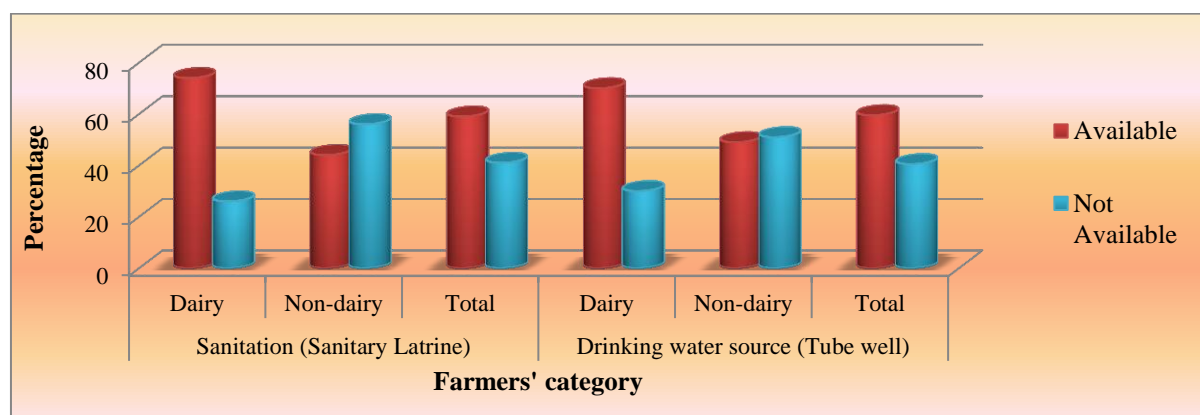


Fig. 4: Percentage Distribution of Households by Number of Sanitary Latrine and Tube Well Owned.

Table 4 reveals that significantly higher percentage of dairy household had access ($P < 0.05$) to sanitation and drinking water facilities than the nondairy households. Availability of sanitary latrine in dairy household was 74% which is better than the nondairy household (i.e., 44%) and in case of drinking water source (tube well), the availability of drinking water was 70% in dairy household whereas it was 49% in nondairy household (Figure 4).

Average self-declared daily cash income of each dairy household was Taka 129 ± 11.2 (1 US \$ = Taka: 72/-). But Taka 109 ± 15.7 was the sole income for the nondairy group (Table 6). Households living expenses were incurred by this daily income. The result indicated that dairy household group had significantly ($P < 0.05$) higher average daily income as compared to their counterpart. Further, dairy household group had a bicycle ($n=54$), radio ($n=59$), and cell phone ($n=161$); but nondairy group enjoyed only bicycle ($n=8$) and cell phone ($n=73$).

This observation indicates the role played by dairying in improving household welfare and their livelihood. To increase their potential and

to ensure better condition (i.e., dairy households) a total of 200 dairy households were selected to provide the project intervention.

Profitability of Dairy Farming

Cost of Milk Production

Cost of Feed

Feed cost was one of the major cost items of rearing dairy cows. The purchased feeds were valued according to the average prices actually paid by the dairy cow owners. Home supplied or own feeds were also charged according to the average prices prevailing in the market. The total annual feed cost per cow per farm was estimated at Tk. 7150 and Tk. 5743 on the basis of full cost and cash cost, respectively before the intervention of the project (Table 7). It is clear from Table 7 that feed cost was the largest cost in the study area on the basis of full cost and cash cost, respectively.

Table 8 reveals that the total annual feed cost per cow per farm was estimated to be Tk. 8489 and Tk. 6247 on the basis of full cost and cash cost, respectively. It is clear from Table 8 that feed cost was the largest cost on the basis of full cost and cash cost, respectively in the study area.

Table 6: Average Daily Household Income (in Taka) of Dairy and Nondairy Groups.

Variable	Dairy farmers (Mean \pm S.D)	Nondairy farmers (Mean \pm S.D)	Difference	t-value
Household income per day	129 \pm 11.2	109 \pm 15.7	20	1.8*

S.D= Standard deviation; * = Significant at ($P < 0.05$).
 Source: Field Survey, 2010.

Table 7: Cost of Milk Production in the Study Area (Before Intervention) (Per Cow/Year).

Particulars	Sariakandi	
	Full cost (Tk.)	Cash cost (Tk.)
Feed	7149.53 (40.87)	5743.28 (65.06)
Labour charge	5841.94 (33.40)	0.00 (0.00)
Veterinary services	167.08 (0.96)	167.08 (1.89)
Housing	699.14 (4.00)	699.14 (7.92)
Interest on operating capital	1540.20 (8.81)	583.71 (6.61)
Capital cost	2094.43 (11.97)	1634.20 (18.51)
Total cost	17492.32 (100.00)	8827.41 (100.00)

Source: Researcher's Estimation Based on Field Survey, 2010.

Note: Figures within the parentheses indicate percentages of total.

Table 8: Cost of Milk Production in the Study Area (After Intervention) (Per Cow/Year).

Particulars	Sariakandi	
	Full cost (Tk.)	Cash cost (Tk.)
Feed	8488.79 (42.56)	6247.16 (60.23)
Labour charge	6458.15 (32.38)	0.00 (0.00)
Veterinary services	295.64 (1.48)	295.64 (2.85)
Housing	714.69 (3.58)	714.69 (6.89)
Interest on operating capital	1498.36 (7.51)	625.80 (6.03)
*Capital cost	2488.23 (12.48)	2488.23 (23.99)
Total cost	19943.86 (100.00)	10371.52 (100.00)

Source: Researcher's Estimation Based on Field Survey, 2012.

Note: Figures within the parentheses indicate percentages of total.

*Full cost and cash cost are same in capital as farmers directly purchased the items by themselves without any other cost involvement.

Labour Cost

Labour cost was another important cost item of raising dairy cows. Tables 7 and 8 showed that on an average labour cost per cow per year was computed to be Tk. 5842 and Tk. 6458 before and after the intervention of the project on the basis of full cost.

Veterinary Services

The costs of veterinary charges were calculated by taking into account the actual cost incurred by the dairy farmers. Doctor's fees and medicine were the two major components of the total veterinary charges. Tables 7 and 8 showed that the veterinary service for dairy cow was negligible in the study area. The reason was that most of the farmers did not take proper veterinary care for various reasons especially for financial crisis. It was 0.96% and 1.89% of full and cash cost basis before the intervention while the corresponding figures were 1.48% and 2.85% of full cost and cash cost after the intervention of the project, respectively.

Housing Cost

Housing cost per cow per year was calculated by dividing total housing cost for a year by number of cows in a herd. The housing cost on full cost basis per farm per year was Tk. 699 for the farmers before the project intervention and Tk. 714 after intervention in the study area (Tables 7 and 8).

Interest on Operating Capital

The average interest on operating capital per farm per year after the project intervention was Tk. 1498 and Tk. 626 which was 7.51% and

6.03% while it was Tk.1540 and Tk. 584 which was 8.81% and 6.61% of full cost and cash cost before the intervention (Tables 7 and 8).

Capital Cost

Capital cost was measured in the present study as the interest on average amount of capital used for dairy cows. It was assumed that dairy cow owners had purchased the cows at the beginning of the year and sold them after one year. The interest on average amount of capital was calculated at the rate of 15% per annum. The cost was calculated by the following formula:

$$\text{Capital cost} = \frac{\text{Beginning value} - \text{Ending value}}{2} \times \text{Interest rate}$$

Tables 7 and 8 shows that the capital costs were Tk. 2094 (11.97%) and Tk.1634 (18.51%) before the intervention while these were Tk. 2488 (12.48%) and Tk. 2488 (23.99%) after the intervention of the project on the basis of full cost and cash cost, respectively.

Valuation of Return Items

To determine the GR from dairy cows, it is necessary to calculate return from all the items such as milk yield, coddung and net change in inventory. All these items were considered in computing the GR from dairy cows. It may be noted, however, that all these returns were calculated on the basis of per year return. The components-wise per dairy cow returns is briefly discussed below:

Milk

Milk is the main component of dairy returns. The value of milk was calculated on the basis

of average milk yield multiplied by the average price. It is evident from Table 9 that return from milk was Tk. 6432 before intervention and it was Tk. 12317 after intervention of the project (Table 10).

Cowdung

Returns from cowdung were calculated based on farmers' statement. Return from cowdung per cow was Tk. 349 before project interventions while the return was Tk. 482 at the end of the project period (Tables 9 and 10). Most of the farmers used cowdung as fuel. Due to lack of knowledge, the dairy farmers' did not use it in proper way in their crop field. If the dairy farmers used cowdung as organic manure, it would increase the productivity of crop cultivation.

Table 9: Average Return from Dairy (Before Intervention)(Per Cow/Year).

Particulars	Sariakandi
Product	
Lactation period (Days)	204.19
Milk yield/day/cow (Litre)	1.75
Milk production (Litre)	357.33
Price per litre (Tk.)	18.00
Return from milk (Tk.)	6431.99
Byproduct	
Income from cowdung (Tk.)	349.20
A. Total (Tk.)	6781.19
B. Net change in inventory	11248.00
Gross return (A + B)	18029.19

Source: Researcher's Estimation Based on Field Survey, 2010.

Net Change in Inventory

Net change in inventory was calculated by deducting the sum of opening stock and bought from the sum of closing stock, consumed/gifted, sold and died. From Tables 9 and 10 it is seen that before the project intervention, average net change in inventory was Tk. 11248 whereas after the intervention it was Tk. 13204 in the study area, indicating increase in net change in inventory of the dairy households due to the project intervention.

Gross Return from Dairy Farming

GRs are the money value of dairy production. It was calculated by multiplying the total

amount of production by their respective market prices. Here, GR is the summation of monetary value of dairy product, byproduct and net change in inventory. Annual GR from the study area was estimated to be Tk. 18029 and Tk. 26003 before and after intervention of the project, respectively (Tables 9 and 10, and Figure 5) which indicated increase in GRs of the dairy farmers due to the project intervention.

Table 10: Average Return from Dairy (After Intervention) (Per Cow/Year).

Particulars	Sariakandi
Product	
Lactation period (Days)	210.48
Milk yield/day/cow (Litre)	2.09
Milk production (Litre)	439.90
Price per litre (Tk.)	28.00
Return from milk (Tk.)	12317.29
Byproduct	
Income from cowdung (Tk.)	482.13
A. Total (Tk.)	12799.42
B. Net change in inventory	13204.00
Gross return (A + B)	26003.42

Source: Researcher's Estimation Based on Field Survey, 2012.

Net Return from Dairy Farming

NR was calculated by deducting gross cost (full cost and cash cost) from GR. The estimated NR per cow per year stood at Tk. 537 and Tk. 6060 before and after intervention of the project, respectively (Tables 11 and 12, and Figure 5).

Table 11: Profitability of Dairy Production (Before Intervention) (Per Cow/Year).

Particulars	Sariakandi
A. Gross return (Tk.)	18029.19
B. Gross/full cost (Tk.)	17492.32
C. Cash cost (Tk.)	8827.41
D. Net return (Tk.) (A-B)	536.87
E. Net margin (Tk.) (A-C)	9201.78
F. BCR (Full cost basis) (A/B)	1.03
G. BCR (Cash cost basis) (A/C)	2.04

Source: Researcher's Estimation Based on Field Survey, 2010.

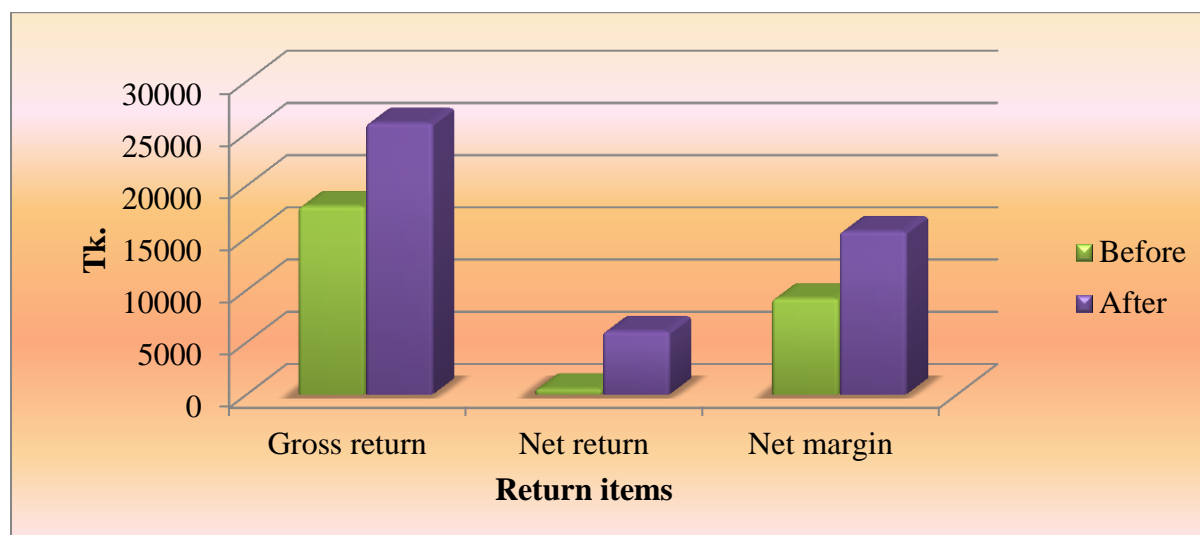


Fig. 5: Return from Milk Production in the Study Area before and After Project Intervention.

Net Margin from Dairy Farming

Net margin was calculated on cash cost basis. Tables 11 and 12 showed that net margin per cow was calculated at Tk. 9202 before the intervention of the project while it was Tk. 15632 after the intervention of the project (Figure 5).

Table 12: Profitability of Dairy Production (After Intervention) (Per Cow/Year).

Particulars	Sariakandi
A. Gross return (Tk.)	26003.42
B. Gross/full cost (Tk.)	19943.86
C. Cash cost (Tk.)	10371.52
D. Net return (Tk.) (A-B)	6059.56
E. Net margin (Tk.) (A-C)	15631.90
F. BCR (Full cost basis) (A/B)	1.30
G. BCR (Cash cost basis) (A/C)	2.51

Source: Researcher's Estimation Based on Field Survey, 2012.

BCR

BCR was obtained when the benefit stream was divided by the cost. Milk production is profitable when BCR is greater than one. Tables 11 and 12 revealed that BCR in the study area before the intervention of the project was 1.03 and 2.04 while it was 1.30 and 2.51 after the intervention on the basis of full cost and cash cost, respectively.

It can be concluded that dairy farming was profitable in the study areas both before and after intervention, but profit was

comparatively higher after the intervention of the project.

Potential Impacts of Dairy Farming

The major objective of this research was to evaluate the impact of dairy farming on employment creation, income generation, poverty reduction and livelihood pattern of the dairy farmers. Generally, there is no single statistical method to evaluate the impact of any programme or project which is rigorous and hence policy relevant [12]. To evaluate the impact of herd health management and group approach on farmers' employment creation and income generation, descriptive statistics such as, mean, sum, percentage, and DID method was used to construct a counterfactual measure of what would have happened if the project supports had not been available.

Changes in Occupational Status of the Sample Households

Occupation of the members of farm household is one of the determining factors of their status. The distribution of principal occupation is fascinating because it varies greatly depending on how much they are involved in and what level of income is earned from the present occupation. Agriculture of Bangladesh is vast and farmers have a lot of opportunities to engage themselves in various activities of farming. In the study area, farmers not only work in dairy farms but also they have another occupation. Some farmers are engaged in more than two activities but they are very few in numbers. It is observed from Table 13 that

71% farmers were engaged in farming and day labourer in Sariakandi Upazila before the intervention of the project which is the highest percentage. On the other hand, before the project intervention, 16% farmers were engaged in only farming. After the intervention of the project, there was a significant fall in the percentage of the farmers engaged in farming and day labourer whereas there was an increase in the percentage of the farmers engaged in only farming. Table 13 reveals that after the intervention, only 38% farmers engaged themselves in farming and as day labourer whereas 21% farmers engaged themselves in farming only.

Table 13: Occupational Status of Sample Farmers (In Percent).

Occupations	Sariakandi	
	Before	After
Only Farming	16	21
Farming + Business	9	34
Farming + Service	4	7
Farming + Day labourer	71	38
Total	100	100

Source: Field Survey (2010, 2012).

Employment Generation in Dairy Farming

Livestock subsector provides a great opportunity for the *char* unemployed of being employed. Both men and women are involved in livestock rearing. Especially the women in *char* area are directly involved in home-based activities to strengthen income generation through livestock rearing.

In the present study, all the respondents equally admitted that women and children were mostly involved in poultry and duck rearing. Women participants acknowledged a very little involvement of male counterparts in those respects. Table 14 revealed the length of

time spent (working hours/day) on livestock rearing by both male and female members of the family in year 2012. It revealed that, on an average, male members of the family spent about 5 h a day on dairy cattle while the female members spent about 4 h a day over the study area.

Table 14: Labour Utilization/Employment in Livestock Rearing (Working Hours/Day).

Livestock categories	Family	
	Male	Female
Milch cow	3.48	3.19
Heifer	3.30	2.67
Bull	4.57	2.82
Goat	3.37	2.49
Sheep	3.20	2.47
Poultry	0.48	3.66
Duck	0.30	1.92

Source: Field Survey, 2012.

Impact of Dairy Farming on Income Generation

Income is the important indicator of socioeconomic status of people. The overall income of a dairy household includes both farm and nonfarm income. Farm income was estimated by summing up the income, which was derived from the monetary value of crops, cow rearing, poultry birds, fruits and vegetables. In the case of nonfarm income, service, business, labour sale, rickshaw or van pulling were considered. Table 15 shows the distribution of household income by sources before and after project intervention in the study area. It appears from Table 15 that average farm and nonfarm income of the treated group before the intervention were Tk. 25627 and Tk. 16328, respectively whereas in the case of the controlled group, these were Tk. 26982 and Tk. 16450, respectively.

Table 15: Annual Average Income of the Respondents.

Sources of Income	Treated (N= 100)				Control (N = 100)			
	Before	After	Change	%	Before	After	Change	%
Farm income (Tk.)								
Nondairy	16425.28	21049.5	4624.22	28.15	17459.39	19756.92	2297.53	13.16
Dairy	9201.78	15631.9	6430.12	69.88	9522.37	12435.78	2913.41	30.60
Subtotal	25627.06	36681.4	11054.34	43.14	26981.76	32192.7	5210.94	19.31
Nonfarm income (Tk.)	16327.91	25398.66	9070.75	55.55	16450.25	18902.63	2452.38	14.91
Total income	41954.97	62080.06	20125.09	47.97	43432.01	51095.33	7663.32	17.64

Source: Researcher's Estimation Based on Field Survey (2010, 2012).

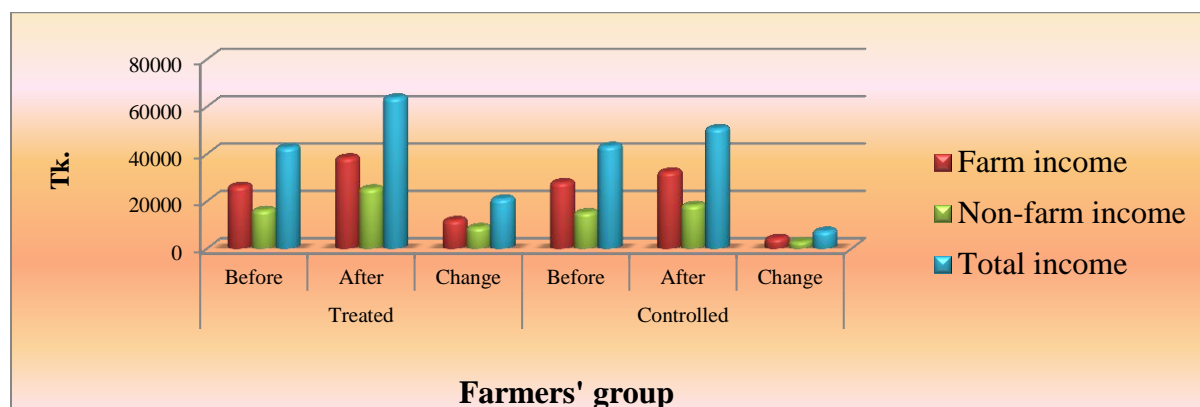


Fig. 6: Return Annual Average Income of the Respondents.

Table 16: Impact of Dairy Farming on Changes in Income of the Farmers.

Input/Items	Treated (N = 100)		Controlled (N = 100)	
	Before	After	Before	After
Farm income				
Farm income from dairy				
Cost items				
Feed	5743.28	6247.16	3946.26	4867.9
Labour charge	0.00	0.00	0	0
Veterinary services	167.08	295.64	124.36	236.73
Housing	699.14	714.69	302.92	416.38
Interest on operating capital	583.71	625.80	329.64	342.49
Capital cost	1634.20	2488.23	1073.67	2469.37
a. Total Cost	8827.41	10371.52	5776.85	8332.87
Items of Return				
Lactation period (Days)	204.19	210.48	185.30	191.43
Milk production (Litre)	1.75	2.09	259.42	363.72
Milk yield/day/cow (Litre)	357.33	439.90	1.40	1.90
Price per litre (Tk.)	18.00	28.00	18.23	23.24
i. Return from milk (Tk.)	6431.99	12317.29	4729.22	8452.78
ii. Income from cowdung	349.20	482.13	337.24	450.00
iii. Net change in inventory (Tk.)	11248.00	13204.00	10232.76	11865.87
b. Gross return from dairy (i+ii+iii)	18029.19	26003.42	15299.22	20768.65
1. Net return from dairy (b-a)	9201.78	15631.90	9522.37	12435.78
2. Farm income from nondairy	16425.28	21049.5	17459.39	19756.92
A. Total farm income (1+2)	25627.06	36681.40	26981.76	32192.70
Nonfarm income				
B. Total nonfarm income	16327.91	25398.66	16450.25	18902.63
C. Total income (A+B)	41954.97	62080.06	43432.01	51095.33
% changes in total income	47.97		17.64	
Change in total income	20501.25		7663.32	
Double difference	12461.77*(2.17)			

Source: Researcher's Estimation Based on Field Survey (2010, 2012).

Note: * Significant at 10% level.

After the intervention, average farm and nonfarm income of the treated group were Tk. 36681 and Tk. 25399, respectively whereas these were Tk. 32193 and Tk. 18902, respectively in case of the control farmers (Table 15 and Figure 6). In case of treated farmers, average total income had increased by 48% after the project intervention but it increased by only 18% in case of the control farmers (Table 15).

It is evident from Table 16 that farm income of treated farmers was Tk. 25627 and Tk. 36681 before and after project intervention, respectively and for control farmers' that was Tk. 26982 and Tk. 32193 before and after project intervention, respectively. So, it bears a clear indication that dairy farming has a positive impact on income generation. Change in total income for treated group was Tk. 20125; on the other hand for control group, it

was only Tk. 7663. Double difference was Tk. 12462 in dairy farming which was also statistically significant at 10% level. Dairy farming seems to be the driver of poverty reduction in the study area.

Table 17 reveals that about 7% treated group's dairy income level was upto Tk. 5000 whereas it was 4% for control group. The highest (37%) treated group's dairy income level was Tk. 15001–20000 followed by 22% of dairy income level of Tk. 10001–15000 of respondent farmers.

Changes in Income-Expenditure Pattern

With respect to income–expenditure pattern, the selected livestock keepers had no savings. Moreover, they were always in deficit. But there was good signal after project intervention.

Table 17: Distribution of Respondents by Income Level.

Income level (in Tk.)	Treated (in %)	Controlled (in %)
Upto 5000	7	4
5001–10000	17	27
10001–15000	22	17
15001–20000	37	35
Above 20000	17	17
Total (in %)	100	100

Source: Field Survey, 2012.

Table 18: Average Income–Expenditure Status of the Respondents' Family (in Tk.).

Particulars	Treated (N=100)				Controlled (N=100)			
	Before	After	Change	%	Before	After	Change	%
Income	41954.97	62080.06	20125.09	47.97	43432.01	51095.33	7663.32	17.64
Expenditure	51398.25	66459.18	15060.93	29.30	51244.7	55314.52	4069.82	7.94
Savings/Deficit	-9443.28	-4379.12	5064.16	53.63	-7812.69	-4219.19	3593.5	46.00

Source: Researcher's Estimation Based on Field Survey (2010, 2012).

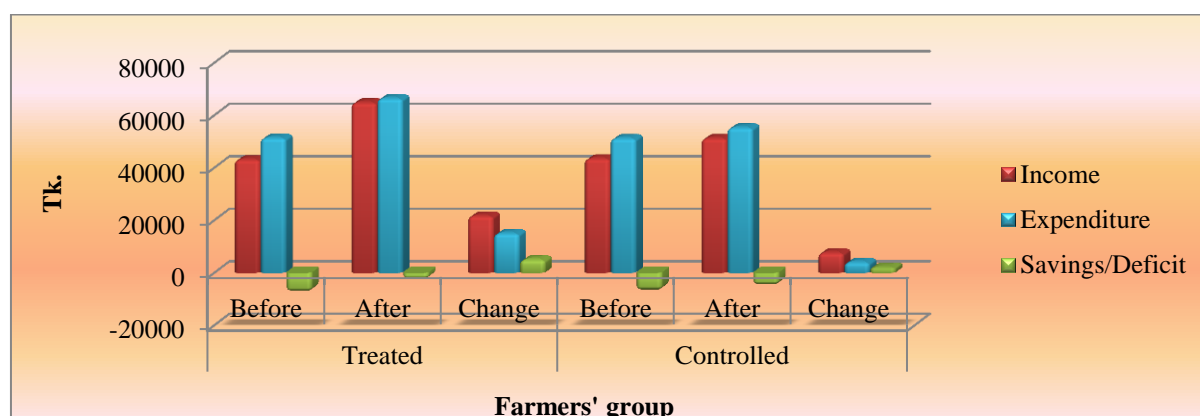


Fig. 7: Return Annual Average Income of the Respondents.

Before the project intervention, average income and expenditure of the treated group were Tk. 41955 and Tk. 51398, respectively but after the intervention, these values were Tk. 62080 and Tk. 66459, respectively (Table 18 and Figure 7). Before the project intervention, average income and expenditure of control group was Tk. 43432 and Tk. 51245, respectively but after the intervention, these values were Tk. 51095 and Tk. 55315, respectively.

Table 18 also represents that income and expenditure of the treated group increased by 48% and 29%, respectively whereas it was increased by 18% and 8% in the case of control group. After the intervention, the deficit of the treated group decreased by 54% whereas it was decreased by 46% in the case of control group.

Impact of Dairy Farming on Employment Creation

Livestock subsector provides a great opportunity for the *char* unemployed of being employed. Both men and women are involved in livestock rearing. In the study, all the respondents equally admitted that women and children were mostly involved into activities such as graze the cows, sheep and goats. Women participants acknowledged a very little involvement of male counterparts in those respects. But the male member of the family spent more time on milk marketing.

Table 19: Labour Utilization/Employment in Livestock Rearing.

Study area	Employment of labour (working days)		
	Before	After	Change in percentage
Sariakandi	50	100	100

Source: Field Survey (2010, 2012).

Table 19 shows the length of time spent (working days) on livestock rearing by both male and female members of the family. It has revealed that on an average, the employment of labour was about two times higher in Sariakandi Upazila than before which was 100. The reason of this increase in working days was that the farm size of the dairy farmers had increased after the intervention and so, they had to spend more time in work related to dairy farming.

Impact of Dairy Farming on Livelihood Pattern

The sustainable livelihood framework includes the asset pentagon which is composed of five types of capitals namely human capital, social capital, natural capital, physical capital and financial capital [13]. A sustainable livelihood is the outcome of inter and intra relationship between the components of these capitals. Changes in the asset position are discussed as transformation and improvement of the livelihoods of livestock farmers.

Human Capital

Development of human capital is one of the pre-requirements for successful attainment of other types of assets. It represents health, education, training, knowledge and access to information that together enable the farmers to pursue different livelihood strategies and achieve their livelihood objectives. Table 20 presents the changing nature of different components of human capital in farmers' livelihoods. Majority of the livestock farmers reported that quality of the components of human capital has increased over the periods through gaining education and knowledge, improving health condition, more access to information, better training and development of skill in all the selected areas. In some cases, quality of human capital was decreased but this rate was very small which was mainly due to lower productivity, outbreak of diseases and higher mortality rate of livestock animals, natural disasters, etc.

Table 20: Changes in Human Capital of Farm Households (% of Farm Household Reported).

Asset categories	Sariakandi		
	Increase	Decrease	Constant
Health	70	8	22
Education	74	6	20
Training	66	10	24
Knowledge	66	-	34
Access to information	54	6	40

Source: Researcher's Estimation, 2012.

In Sariakandi, 70%, 74%, 66%, 66% and 54% respondents stated that their health condition, educational facilities, training facilities, knowledge and access to information were increased due to project intervention,

respectively. On the other hand, 22%, 20%, 24%, 34% and 40% respondents stated that their health condition, educational facilities, training facilities, knowledge and access to information were remained constant, respectively after the project intervention (Table 20).

Social Capital

In this study, involvement in social group, political involvement, self managerial capability and social access were considered as components of social capital. From the present study, it was found that more organizations are now formally or informally working than before in the study areas to promote cooperation between people, coping distress and other awareness build-up processes. Table 21 shows the positive trends of social assets in farm families. Almost all farmers' involvements in different social groups, their managerial capacity through livestock rearing had improved in the study area in general. No farm household reported about decrease in any kind of social capital in the study area. Table 21 also shows that 75%, 90%, 20% and 15% farm households in the study area reported that their social group involvement, political involvement, self managerial capability and social access, respectively were remained constant whereas the rate of increase in these components were not in a satisfactory level.

Natural Capital

Cultivable land, using open water resources and forests were addressed to determine the natural capital aspect which is represented in Table 22. It is seen that no farm household reported about decrease in any kind of natural capital in the study area.

In the study area, 75% and 100% of farm households, respectively reported that cultivable land and using open water resources

remained constant. About 25% farm households reported that cultivable land was increased and no farmer reported that using open water resources was increased (Table 22).

Table 21: Changes in Social Capital of Farm Households (Percentage of Farm Household Reported).

Asset categories	Sariakandi		
	Increase	Decrease	Constant
Involved in social group	25	-	75
Political involvement	10	-	90
Self managerial capability	80	-	20
Social access	85	-	15

Source: Researcher's Estimation, 2012.

Financial Capital

Table 23 shows the changing trend of financial capital of the livestock farmers. Cash in hand, savings and liquid assets had increased considerably over the years. However, the rate of increase was not estimated. Farmers' income had increased and they were able to have more cash savings and liquid assets through livestock rearing along with crop farming. Remittances and donation was constant during the study year.

Physical Capital

The changing state of physical assets in the livelihoods of livestock farmers has been shown in Table 24. Number of tin roof houses increased and straw roof houses decreased. This simultaneous trend indicates improving housing condition for all types of livestock farmers. The condition of other major component of housing as well as safe livelihood such as drinking water and sanitary latrine also developed considerably.

Table 22: Changes in Natural Capital of Farm Households (Percentage of Farm Household Reported).

Study area	Position of asset categories					
	Cultivable land			Using open water resources		
	Increase	Decrease	Constant	Increase	Decrease	Constant
Sariakandi	25	-	75	-	-	100

Source: Researcher's Estimation, 2012.

Before project intervention, there were few families who used tubewell and sanitary latrine in the study area. Now most of the farmers use modern amenities. Uses of radio, television and watch have increased tremendously for all categories of dairy farms. Quantity and quality of household furniture such as chair, table and cot increased considerably. Among the livestock farmers group, middle income group used to live in tin roof houses, and lower income group in small houses, which were either tin roofed or straw roofed.

Except few cases, most farmers had tin roofed houses and their sanitation facility was not developed. Except a few, most of them used sanitary latrine. Most of the farmers in the study area were found to use solar electricity. Very few farmers also owned some modern amenities such as radio, television, watch, mobile phone and fridge (Table 24).

There had been a noteworthy improvement in communication facilities of livestock farm households in the study area. Some vehicles and equipment such as bicycle/motorcycle, electric fan, radio/TV, watch, fridge, etc. had been decreased due to damage and sometimes farmers sold them when those became old. Houses and shops had been decreased as they were destroyed by natural calamities which were a common issue in *char* areas.

Table 25 represents the overall situation of human, social, financial, natural and physical assets of the treated and control farmers whether these were increased, decreased or remained constant. In the case of both treated and control farmers, there occurs an autonomous change in the asset position of the farmers such as increasing, decreasing and constant situation, either they are beneficiaries of project intervention or not.

Table 23: Changes in Financial Capital of Farm Households (Percentage of Farm Household Reported).

Asset categories	Sariakandi		
	Increase	Decrease	Constant
Cash in hand	20	10	70
Cash at bank/Liquid assets/Saving	25	20	55
Remittances	-	-	-
Donation/Grant/Aid	-	-	-

Source: Researcher's Estimation, 2012.

Table 24: Changes in Physical Capital of Farm Households (Percentage of Farm Household Reported).

Asset categories	Sariakandi		
	Increase	Decrease	Constant
Tin roof	62	0	38
Straw roof	10	45	45
Tubewell	12	4	84
Sanitary latrine	48	5	47
Electric fan	58	2	40
Bicycle/Motorcycle	56	4	40
Radio/TV	26	2	72
Watch	28	4	68
Cot	88	2	10
Chair/Table	40	-	60
Mobile phone	70	2	28
Fridge	2	6	92
Shop	10	4	86

Source: Researcher's Estimation Based on Field Survey, 2012.

Here, the changed situation in overall asset position of both treated and controlled farmers after the project intervention is represented with the help of Table 25 and Figures 8–10. In the case of human capital of treated farmers, ‘increased’ responding farmers increased from 45% to 75%, ‘decreased’ responding farmers decreased from 22% to 13% and ‘constant’ responding farmers decreased from 33% to 12%; indicating a noteworthy improvement in the human capital of the treated farmers (Table 25) after the project intervention.

Similarly, human capital improved in the case of controlled farmers but comparatively lesser than treated farmers. In the case of social capital of treated farmers, ‘increased’ responding farmers increased from 52% to 72%, ‘decreased’ responding farmers decreased from 12% to 8%, and ‘constant’ responding farmers decreased from 36% to 21%.

20% which point towards a remarkable improvement in the social capital of the treated farmers as a result of project intervention. Similarly, human capital improved in the case of controlled farmers but not as much as treated farmers (Figure 8).

Table 25 indicates that ‘increased’ responding farmers increased from 33% to 79%, ‘decreased’ responding farmers decreased from 36% to 13% and ‘constant’ responding farmers decreased from 31% to 08% in the case of financial capital of treated farmers; and ‘increased’ responding farmers increased from 30% to 53%, ‘decreased’ responding farmers decreased from 43% to 26%, and ‘constant’ responding farmers decreased from 27% to 21% in the case of controlled farmers that indicate a better improvement in the financial capital of the treated farmers as compared to control farmers after the project intervention.

Table 25: Overall Changes in Livelihood Patterns of Sample Farmers (in Percentage).

Asset categories	Increased				Decreased				Constant			
	Treated		Controlled		Treated		Controlled		Treated		Controlled	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Human capital	45	75	35	55	22	13	40	33	33	12	25	12
Social capital	52	72	43	49	12	08	36	31	36	20	21	20
Financial capital	33	79	30	53	36	13	43	26	31	08	27	21
Natural capital	20	23	12	09	25	28	32	43	55	59	57	58
Physical capital	29	69	20	43	41	21	40	41	30	10	40	16

Source: Researcher’s Estimation Based on Field Survey (2010, 2012).

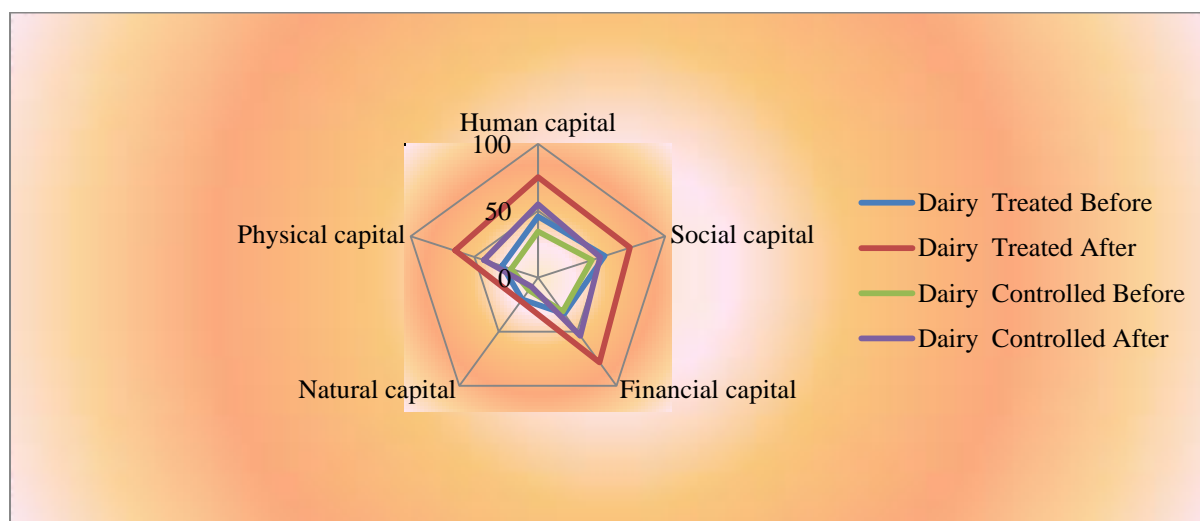


Fig. 8: Asset Pentagon (Increased).

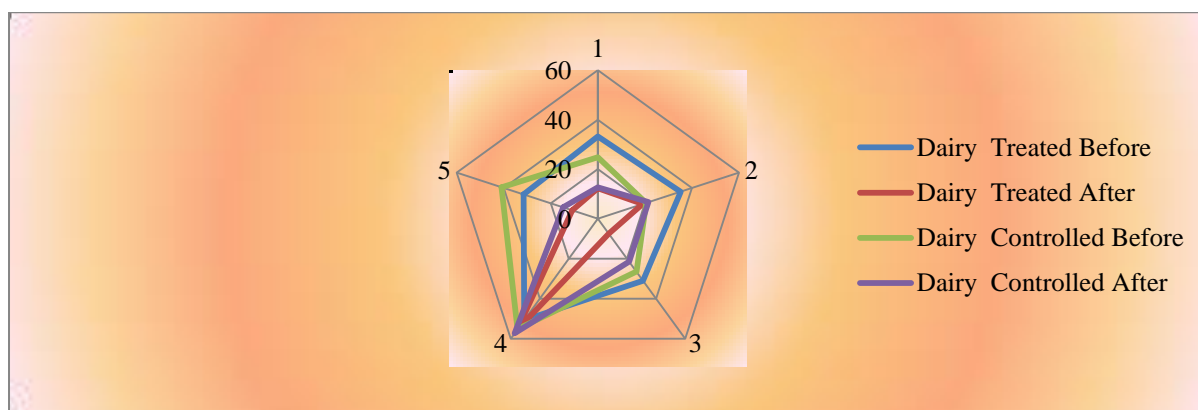


Fig. 9: Asset Pentagon (Decreased).

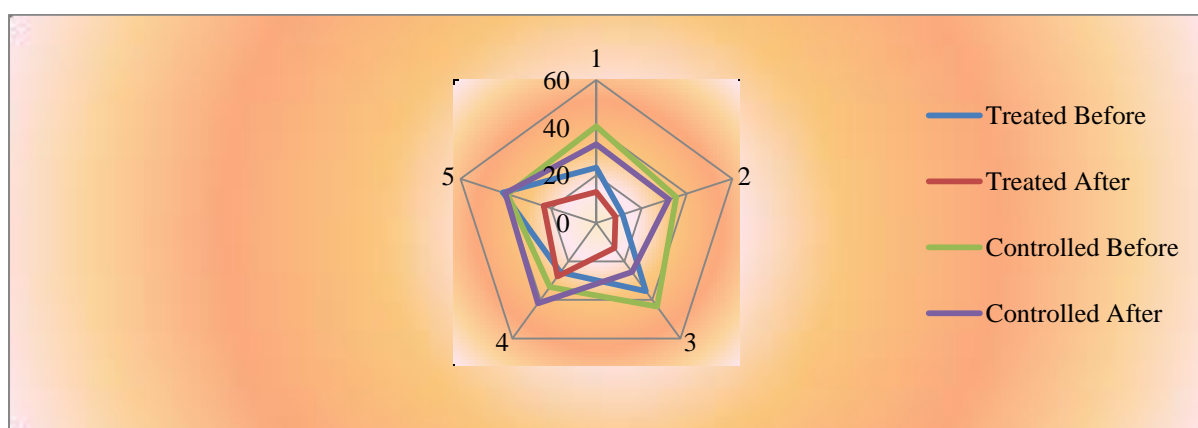


Fig. 10: Asset Pentagon (Constant).

Further, in the case of natural capital of treated farmers, 'increased' responding farmers increased from 20% to 23%, 'decreased' responding farmers increased from 25% to 28%, and 'constant' responding farmers decreased from 31% to 8% due to the project intervention; and in the case of controlled farmers, 'increased' responding farmers decreased from 12% to 9%, 'decreased' responding farmers increased from 32% to 43%, and 'constant' responding farmers increased from 57% to 58% which indicate that natural capital remained constant mostly in both cases of treated and controlled farmers.

Also, in the case of physical capital of treated farmers, 'increased' responding farmers increased from 29% to 69%, 'decreased' responding farmers decreased from 41% to 21% and 'constant' responding farmers decreased from 30% to 10% after the project intervention indicating a moderate increase in the physical capital and this situation is similar in the case of controlled farmers, also (Figures 9 and 10).

CONCLUSIONS

It can be concluded that dairy farming was profitable in the study area under both before and after intervention, but profit was comparatively higher after the intervention of the project. The BCR of dairy farming was higher after intervention. It is also concluded that dairy farming contributes significantly to household income, expenditure, and overall welfare of livelihood status of the poor dairy farmers. Overall livelihood status of the *char* dwellers ranged between low to medium.

Because of poor communication and transportation facilities, geographical and climatic hazard, low annual income, poor support from GOs and NGOs, conflict for ownership of land and other problems, the *char* landers cannot improve their livelihood status in a desirable level. The awareness/motivational campaign can reduce conflict and improve human relations among the people. In *char* area, most of the *char* landers were living in a medium condition of house (shelter). Because of poor economical

condition and being a flood-prone area, the *char* landers could not provide a better shelter. Due to low income, majority of the family possessed poor family assets. Clothing condition was also found almost moderate. They usually can purchase cloths once or twice in a year. The development agencies can work in increasing/improving the economic condition of *char* landers so that they can spend more money in building shelter and other essentials for better livelihoods. The existing health and sanitation condition of the *char* landers is not satisfactory.

In case of availability of sources of drinking water, maximum proportions of the respondents had medium facilities for drinking water which was due to supply of tubewells from GOs and NGOs. Because of awareness as well as their increased knowledge on sanitation, hygienic toilet was used by majority of the *char* landers. Due to insufficient number of hospital and other health-related facilities, majority of the *char* landers possessed very poor medicare support from both GOs and NGOs.

The *char* women were the main sufferer of these diseases. So, the development agencies have ample scope to increase health, nutrition, and sanitation education as well as facilities in the *char* area to improve their livelihoods. Majority of the households had low ability to provide education to their family members because of their economic insolvency as well as unavailability of educational facilities in the *char* area. There is a need to increase/improve the educational facilities to the *char* landers so that they can provide education to their family members. Personal education, family education and training experience of the *char* dwellers had no significant relationship with their role performance.

Educational scenario of *char* women was very poor and majority of the respondents did not receive any training. Because of less feasibility of transportation, communication facilities, socioeconomic backwardness, and also GOs and NGOs are less interested to provide training to the respondents for improvement their livelihood. As regards participation in income generating activities (IGAs) their

involvement was medium, which is not enough to improve the present status of livelihood. *Char* dwellers are trying to involve in different kinds of agricultural and nonagricultural activities. The NGOs have ample scope to facilitate IGAs for the *char* landers so as to enable them to possess sustainable livelihood status.

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