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Cost and Profit of Dairy Farming in West Bengal : *A Micro Level Study in Paschim Medinipur District of West Bengal*

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ABSTRACT

ST farmers are not interested to cow and buffalo rearing because their income is very low, they prefer pig rearing and their per capita land is less than 5 decimals. It has become an option of earning for most of the OBC farmers of the study area. About 63 percent OBC category farmers are engaged in dairy farming. Most of OBC farmer families has female labour and sufficient land for this farming. Agriculture is the major source of livelihood in rural area in West Bengal accounting for about one-fourth of Gross Domestic Product (GDP). Livestock contributes nearly 24 percent to the gross value of agricultural output, and it has been increasingly consistently. The dairy farming or cow and buffalo rearing is influenced by a number of factors like percentage of unemployed women per village, literacy rate, percentage of child population below six years, family size and per capita land which play an important role to spread the dairy farming. Unemployment rate of women per village has a positive and significant effect on the extent of dairy farming and milk production. The small and marginal farmers are more interested in dairy farming than the semi-medium and medium farmers. Large self- employment opportunities are provided by the livestock sector in Paschim Medinipur district. Cattle and buffalo rearing is the largest provider of self-employment for rural females in the study area. The dairy farming has positive impact on per capita income, percentage of workers engaged, per capita milk production, per capita ghee production, dung supply in agriculture per acre and dung used as fuel per household.

Keywords: Dairy Farming, Marginal farmers, Unemployment, Livestock, Milk Production

1. Introduction

Dairying in India has emerged as a very important activity with around 500 million dairy animals producing more than 190 million tonnes of milk per annum. Milk and milk products are highly perishable and therefore demands adequate quality and food safety. The role of the Indian Agriculture and allied sectors is of very importance in ensuring „inclusive growth". It is very essential to make the dairy farmers aware of the importance of the quality and the risks which should be addressed while carrying out the dairying activity. Dairy in India is a unique activity in more than one respect. India ranks first in the world in having a large bovine population. So far as output is concerned, milk is the single largest agriculture commodity in the country. Dairy contributes nearly 33 per cent of the gross income of rural households in case of those who are having land and in case of those who do not have any land it accounts of 50 per cent.

According to the Livestock Census 2012 the livestock sector alone contributes nearly 25.6% of value of output at current prices of total value of output in Agriculture, Fishing & Forestry sector. The overall contribution of Livestock Sector in total GDP is nearly 4.11% at current prices during 2012-13.This present paper discusses the three most important livestock components, namely Dairy, Poultry and fisheries shows the commercial potential and domestic and foreign investment opportunities.

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The livestock species, namely Cattle, Buffalo, Sheep, Goat, pig, Horses & Ponies, Mules, Donkeys, Camels, Mithun and Yak, and there are other species - Dogs, Rabbits and Elephants. The growth of dairy industry with the milk production increasing to more than treble in the last few decades has been commendable achievement and well recognized. Global demand for animal protein will increase with the rising population and eating habit change (Birthal et. al., 1995). Therefore, animal production plays a major role in the food supply chain. The increasing demand for the livestock products offers market opportunities all types of enterprises.

Rural poverty is largely concentrated among the landless and the marginal households comprising about 70 percent of rural population (Kozel and Parker 2003; Taneja and Birthal 2004). Several empirical studies indicate that livestock rearing has significant positive impact on equity in terms of income and employment and poverty reduction in rural areas (Singh and Hazell 1993; Adams and He 1995; Birthal and Singh 1995; Thornton et al 2002; Birthal and Ali 2005) as distribution of livestock is more egalitarian compared to land (Taneja and Birthal 2004). In India, over 70 percent of the rural households own livestock and a majority of livestock owning households are small, marginal and landless households. Small animals like sheep, goats, pigs and poultry are largely kept by the land scarce poor households for commercial purposes because of their low initial investment and operational costs (Birthal 2002).

Dairy sector plays an important role in rural economy of West Bengal. .Milk production in the state was 5.04 Million MT in 2015-16 which is about 3.3 percent to total milk production in India. West Bengal improved milk production at a comound annual growth rate (CAGR) of 2.44 percent during the last 5 years. Paschim Medinipur district is the highest milk producing district in the state. It is evident that almost 60 percent of the entire milk production of West Bengal is concentrated in seven districts, namely Paschim Medinipur, Hooghly, Barwan, Murshidabad, Bankura, Nadia and Purulia.

In this paper we analyse the factors influencing milk production, and cow and buffalo farming and estimate the cost and income in cattle and buffalo farming at micro level of Paschim Medinipur district. Also examine the role of livestock sector in the rural economy and its impact on employment, cultivation and reducing rural poverty.

2. Objectives of the Study

Hence the principal objectives of the study are the following:

    i) To estimate the cost and income in cattle and buffalo farming in micro level of Paschim Medinipur district,

    ii) To analyse the factors influencing in milk production and cow and buffalo farming,

    iii) To analyses the economics of livestock sector and its impact on economic development,

    iv) To estimate the cost of milk production and profit in the study area, and

    vi) To present the Probit Estimates of Household Participation in cattle and buffalo rearing.

3. Data and Methodology

The study is based on primary data. Primary data are collected from the households which are selected on the basis of multistage stratified random sampling. Paschim Medinipur district in West Bengal is purposely chosen for the present study for the field survey. Four blocks namely Garhbeta-ll, Sabang, Pingla and Chandrakona-ll are selected from the district. Within a block all the villages are not equally important in respect of socio-economic characteristic. In view of this, three villages are selected from the village list of each block. Accordingly we have 16 selected villages. The socio-economic, soil and agricultural activities of these 16 sample villages are distinct from each other. 15 households were selected randomly from each village. From the above sample design 240 households are selected for detailed survey. Reference period for the study is the financial year 2016-17.

Cost and Profit Measurement

Several inputs have been included in the calculation of cattle rearing cost. Broadly these costs are classified into two categories such as:

Cost-A: (Variable cost/Operational cost): it includes the cost of human labour, Dry foder,, Straw, Vitamins, Medicine, Grass or Green fodder, Electric bill, Rice husk, Salt 122ou Mustard Cake

Cost-B: (Fixed cost): Rental value of owned house, Interest on fixed capital,

Cost-C: Total cost of Production (Cost A+ Cost B)
- The profitability may be calculated by using various economic formulas:
- i) Total income from per female Cattle = (Market Value of milk) + (value of dung)
- ii) Gross income from per female Cattle = Total income from per female Cattle – Cost C + Rental
- value of owned house + value of family labour
- iii) Net income from per female Cattle = Total income from per female Cattle – Cost C
- iv) Total income from per bullock = (Value of bullock labour) + (value of dung)
- v) Gross income from per bullock = Total income from per bullock – Cost C + Rental
- Value of owned house + value of family labour
- vi) Net income from per bullock = Total income from per bullock – Cost C

Probit Model:

For specific purpose probit model is used to estimate the regression parameters. The steps involved in the estimation of the probit model are as follows:

a) From the grouped data, estimate the probability that an event will occur, i.e. P_i . This P_i is estimated by n_i/N_i , where n_i is observed frequency and N_i is total frequency.

b) Given estimated P_i, obtain normal equivalent deviate (n.e.d) (=I_i) from the standard normal cumulative distribution function (CDF).

That is, $I_i = F^{-1}(P_i) = \beta 1 + \beta 2 X_i$

c) Use the estimated I_i obtained as the dependent variable in the regression, i.e.

$I_i = \beta 1 + \beta 2 X_i + U_i$

d) R^2 as a measure of goodness of fit is not particularly well-suited for the dichotomous dependent variable models, one suggested alternative as the χ^2 test. Apply the χ^2 test to regression and comment on the resulting goodness of fit.

4. Results and Discussion

4.1 Bovine Population

Dairy sector is economically and socially significant in Pachim Medinipur district due to the multi-functionality of dairy animals performing output, input, asset and socio-cultural functions. According to the field survey, there are 88 indigenous cattle, 98 crossbred cattle and 97 buffaloes in study area. In this, the proportion of adult milch females is 29.55 % (Indigenous cow), 43.88 % (Jersey Cross cow) and 38.14 % (Buffalo) respectively. Percentage of bulls & bullocks is 20.45% (Indigenous cow), 3.06 % (Jersey Cross cow) and 14.43 % (Buffalo) in this area. The percentage of total milch cow & buffalo is 37.46 % and female calf is 21.20 %. The all category of bull & bullocks is 15.90 % (bulls for breeding is 3.53 % and bulls & bullocks for work is 12.37 %) and male calf is 16.25 % in the study area (Table 1).

Table 1 Bovine Population at Micro Level

Animals		Indigenous cow		Jersey Cross cow		Buffalo		Total	
		Numbers	%	Numbers	%	Numbers	%	Numbers	%
Female	Cows in milk	26	29.55	43	43.88	37	38.14	106	37.46
	Cows not in milk	12	13.64	8	8.16	6	6.19	26	9.19
	Calf	15	17.05	24	24.49	21	21.65	60	21.20
	Total	53	60.23	75	76.53	64	65.98	192	67.84
Male	Bulls for breeding	6	6.82	1	1.02	3	3.09	10	3.53
	Bulls and Bullocks for work	18	20.45	3	3.06	14	14.43	35	12.37
	Calf	11	12.50	19	19.39	16	16.49	46	16.25
	Total	35	39.77	23	23.47	33	34.02	91	32.16
Total		88	100	98	100	97	100	283	100

Source: Field level Survey

Paschim Medinipur district which is having 10.27 lakh cattle population, 0.72 lakh buffalo population, 0.89 lakh sheep population, 0.75 lakh pig population and goat population is 12.25 lakh (19th Livestock Census,2012) While the horse population is only 87. However, a significant proportion of landless labourers, small and marginal farmers have access to livestock resources and acceleration in the growth of livestock in North Eastern region offers significant opportunities for household income augmentation and employment generation (Anjani *et al.,* 2007).

The majority of the respondents belonged to middle age (35-50 years) and falls under primary and middle level of education. Majority of the respondents in the region had medium (5-9 members) family size. The study found that 75 percent of the total respondents were marginal farmers in which 60 percent of them had more than 10 years experience in dairy farming. The farmers preferred integrated farming system in which dairying act as a major component for income generation.

Dairy farming was not much significant to the farmers in ST category (5.65%), ST farmers are not interest to cow & buffalo rearing because their income is very low, they prefer to pig rearing and their per capita land is less than 5 decimal. On the other hand it was an option of earning for most of the OBC (63.25%) farmers of the study area. About 63 percent OBC category farmers are engaged in dairy farming. Most of OBC farmer family has female labour and sufficient land for this farming. 18.72 percent general category farmers are engaged in cow & buffalo rearing in the study area. The general category farmers are not interest to dairy farming because their income level is high, education level is high, and their female members are highly educated.

Similarly 12.36 percent SC category farmers are engaged in cow & buffalo rearing. Most of SC farmers are not interest to this farming because they are only interest to poultry farming and goat rearing (Table 2).

Table 2 Distribution of Cattle and Buffalo by Caste

Caste	Cows		Buffalos		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
General	32	17.20	21	21.65	53	18.72
OBC	121	65.05	58	59.80	179	63.25
SC	24	12.90	11	11.34	35	12.36
ST	9	4.83	7	7.21	16	5.65
Total	186	100	97	100	283	100

Source: Field level Survey

4.2 Lactating Phase

The standard lactation of buffalo cows is 270 days with an average milk production of about 2,200 kg. The peak of maximum production is reached at 50–60 days from calving. Nutritional needs are related to the output of buffalo cows during lactation. The dry matter content of buffalo milk (18.5 %) is much higher than that of cow milk (Claps et al. 2007) and in order to standardize milk production according to fat and protein contents.

 Productive and reproductive performances of the indigenous and Jersey cross cows are presented in the Table 3. The average lactation length for Indigenous cow is 245 days and lactation period 6-7 in life time. Similarly lactation length in Jersey Cross cow is 272 days and buffalo is 264 days. The lactation period and length is higher in Jersey Cross cow than others. The average age at first calving is different from cow and buffalo. The first calving day (average) is highest in Indigenous cow (1742 days) followed by buffalo (1153 days) and Jersey Cross cow (1008 days). The average milk yield or lactation per year is 266 days in Indigenous cow/ local cow, 291 days in Jersey cross cow and 283 days in buffalo. Milk productivity is highest in Jersey cross cow than others. Indigenous cow/ local cow rearing take more time than others (Table 3).

Table 3 Productive and reproductive performances of cow and buffalo

	Indigenous / Deshi /Local cow	Jersey Cross cow	Buffalo
Average birth weight (kg)	12.54	18.27	16.36
Average age at puberty (days)	1382	644	956
Average age at first calving (days)	1742	1008	1153
Average lactation length (days)	245	272	264
Average lactation days per year	266	291	283
Number of Lactation	6-7	7-8	6-7

Source: Field level Survey

4.3 Feeding habit & Cost of Farming

The dry matter intake of dairy buffaloes (16 kg DM/animal/day) is generally lower than that of dairy cattle (Terramoccia et al. 2005). However, these animals show a higher digestibility of protein and fiber as compared with cattle and sheep (Bartocci et al. 2005) with lower emissions in the environment. When kept on pasture, buffalo heifers show productive and reproductive performances similar to those shown by confined animals whose diet is based on mixed rations (Sabia et al. 2014). They eat a wide variety of plants, although they only occasionally ingest non-herbaceous plants; buffaloes are, therefore, considered grazers rather than browsers (Napolitano et al. 2007). The adaptation to a highly variable diet has also led to a high resistance to unbalanced diets, particularly in terms of protein excess; as a result, these animals are rarely affected by lameness of nutritional origin (Napolitano et al. 2013).

The dry fodder intake adult female local cow is 2 kg and green fodder intake is 6 kg daily. Adult female Jersey cross cow & buffalo intake is 3.5 kg dry fodder and 8.5 kg green fodder per day. The available feed stuff was paddy straw, local green grass. Concentrate feed e.g. oil cakes, wheat bran, rice polish, identified more than six different types of local green grasses   in Paschim Medinipur like shama, beju, durba, lota, kolmi, baksha and chailla, those grass prefer to eat cow and buffalo. Farmer collects those grasses freely from field and ground, so grass or green fodder cost is minimum and mainly female family member collects it. Average grass or green fodder cost is higher in buffalo rearing (Rs: 134.24 per month) followed by Jersey Cross cow (Rs: 124.57 per month) and local cow or Indigenous cow (Rs: 27.50 per month). Similarly average dry fodder cost is higher in buffalo rearing (Rs: 442.54 per month) followed by Jersey Cross cow (Rs: 427.84 per month) and local cow or Indigenous cow (Rs: 206.52 per month). Mainly female family labour engaged in dairy farming. Per day around 1.5 hour labour or per month 45 hour labour used in per cow or buffalo farming. Value of this labour is Rs: 840 to 920. Jersey Cross cow is affected various diseases, so medicine cost (Rs: 112.62/Month) is higher in this farming. Local cow or Indigenous cow not easily affected various diseases so, it medical cost is very low (Rs: 22.50/ Month). Medical cost is also higher in buffalo rearing (Rs: 104.65/Month) than local cow rearing. Most of farmers invest won capital for this farming but few farmers take loan for this farming. Capital needs only Rs: 25000/- per cow or buffalo rearing and interest rate 7 % therefore monthly interest cost is Rs: 145/-. Vitamins cost (Rs: 70/Month) is same in Jersey Cross cow and buffalo rearing. Total monthly average cost per adult female buffalo is higher (Rs: 2081.96) followed by Jersey Cross cow (Rs: 2063.71) and Indigenous or Local cow (Rs: 1441.78) (Table 4).

Table 4 Monthly Average Cost per Adult Female Bovine Rearing

	Indigenous /Local cow	Jersey Cross cow	Buffalo
Dry fodder(Gokhaddya)	206.52	427.84	442.54
Straw	55.64	78.32	85.86
Grass/Green fodder	27.50	124.57	134.24
Medicine	22.50	112.62	104.65
Vitamins	00	70.00	70.00
Electric bill	18.62	24.36	25.27
Family Labour	841	922	918.40
Interest of Capital (Rs.25000@7%)	145	145	145
Housing Rent/cost	105	134	134
Others(Rope, net, etc)	20	25	24
Total	1441.78	2063.71	2081.96

Source: Field level Survey

The bye-products available from each of the agricultural output can be used to economically pursue the dairy activity more profitably. E.g. the cereal crop residues can be as input in the dairy activity for enriching the cattle feed. All farmers easily provide straw and local grass for this farming. The monthly average dry fodder mainly gokhhaddya cost per adult bullock cow is Rs: 136.50 and buffalo or Jersey cross is Rs: 183.64/-. Bullocks more prefer to eat rice husk and mustard cake than female cow or buffalo. Rice husk cost is higher in male buffalo or Jersey cross farming (Rs: 184.67/month) than male Indigenous or local cow (Rs: 161.72/month) farming. Medical cost is low for both types of bullocks farming. Most of farmers invest won capital for this farming but few farmers take loan for this farming. Capital needs only Rs: 20000/- per bullock rearing and interest rate 7 % therefore monthly interest cost is Rs: 116/- Total monthly average cost per adult male buffalo or cross is higher (Rs: 1803.03/-) than male local cow (Rs: 1637.01/-) (Table 5)

Table 5 Monthly Average Cost per Bullock Rearing

	Indigenous /Local cow	Buffalo/ Jersey Cross
Dry fodder(Gokhaddya)	136.50	183.64
Straw	64.32	73.85
Rice husk	161.72	184.67
Salt	12.40	14.53
Mustard Cake	107.65	129.62
Medicine	24.56	35.65
Vitamins	37.24	43.75
Electric bill	18.62	25.27
Family Labour	792.50	816.40
Interest of Capital (Rs.20000@7%)	116	116
Housing Rent/cost	145.50	155.65
Others(Rope, net, etc)	20	24
Total	1637.01	1803.03

Source: Field level Survey

4.4 Productivity of Bullocks

Monthly average buffalo bullock labour used in cultivation per household is higher (14.5 animal days) than cow (13.25 animal days). The annual average revenue earn from per bullock-buffalo is Rs: 30450/- and bullock (cow) is Rs: 27825 (Table 6). Value of Per Bullock Labour is Rs: 175/- . The livestock not only produce direct food but it also provide key inputs to crops cultivation. Livestock is an alternative for farm mechanization to a great extent. Dairy farmers are dependable source of income from the sale of milk and bullock labour.

The farmer gets the cow dung as a byproduct of the dairy activity. This cow dung is daily collected and stored in a pit nearby which in course of time gets converted into organic manure which is very much useful for the crop. Apart from the cow dung, the dried and fallen leaves on the farm is also collected and dropped in the cow dung pit as a raw material for the manure. The final product that comes out from the pit is called as Farm Yard Manure. The cow dung is used for generating energy as well as the organic fertilizer which improves the quality of the land. Dung yield per bullock is 6.5 kg/day (yearly yield 2340 kg) and its value is Rs: 6.5/- (Value of dung per kg is Rs; 1/-). Dung yield per buffalo-bullock is 10.5 kg/day (yearly yield 3780 kg) and its value is Rs: 10.50/- (Table 7).

Table 6 Average Bullock Labour Used in Cultivation per Household or Output per Bullock Labour (Monthly & Yearly)

Bullock Labour	Indigenous cow		Buffalo	
	Animal days	Value(Rs)	Animal days	Value(Rs.)
Monthly used Bullock Labour	13.25	2318.75	14.50	2537.50
Yearly used Bullock Labour	159	27825	174	30450

Source: Field level Survey   Value of Per Bullock Labour is Rs: 175/

Table 7 Average Dung Yield (Quantity and Value) per Bullock

Average Cow dung Yield	Cow		Buffalo	
	Quantity(Kg)	Value	Quantity(Kg)	Value
dung Yield/day	6.5	6.5	10.5	10.5
dung Yield/ Month	195	195	315	315
dung Yield/ Year	2340	2340	3780	3780

Source: Field level Survey

Total income from per bullock is equal to value of bullock labour and with merger value of dung.

Gross income from per bullock = Total income from per bullock – Total cost of bullock rearing + Rental value of owned house + value of family labour. Net income from per bullock is equal to total income from per bullock deducting total cost of bullock rearing. Dairy farmer earns from per bullock rearing is Rs. 30165 /- and income from per buffalo-bullock farming is Rs 34230 /-. The farmer earns highest gross income from buffalo (Rs. 13565.69 /-) than cow (Rs. 11458.88 /-) similarly dairy farmers earn more net income from buffalo- bullock (Rs.12593.64) than bullock (Rs.10520.88) (Table 8).

Table 8 Yearly Average Gross and Net Income per Bullock

	Cow	Buffalo
Bullock Labour	27825	30450
Dung	2340	3780
Total income	30165	34230
Total rearing Cost	19644.12	21636.36
Net income	10520.88	12593.64
Gross income	11458.88	13565.69

Source: Field level Survey   .

4.5 Productivity of Female Bovine

Agriculture is the major source of livelihood in rural area in West Bengal accounting for about one-fourth of Gross Domestic Product (GDP). Livestock contributes nearly 24 percent to the gross value of agricultural output, and it has been increasingly consistently. In fact, the growth in livestock sector has always remained higher than the growth in crop sector. Profitability of dairy farming depends upon the milk yield, price of milk and cost of milk production. Therefore, it is essential to know the cost of milk production in rural areas so that efforts can be made to cut down the unit cost of production and hence increasing the profitability. Gross cost per liter milk production is higher in Indigenous / Local cow (Rs.12.25/Lit) followed by Jersey Cross cow (Rs.4.91/Lit) and buffalo (Rs.4.82). The overall gross profit per liter milk earn from buffalo including the family labour cost is Rs.23.18/- and Jersey cross cow is Rs.23.09/liter, Which is lowest for local cow Rs. 15.75/liter. Net profit per liter milk is higher in buffalo & Jersey cross than local cow. The net profit in domestic category cow is negative because its milk yield is very low (Table 9). Highest market value of per liter milk is Rs.28/-. Milk yield is 1.24 liter/day in local cow while 6.68 lit/day in Jersey cross cow. Milk yield is highest in buffalo (6.92lit/day). Average milk production per lactation period is more or less same in Jersey cross and buffalo but in local cow is very low. Average monthly milk production is higher in buffalo (163.20 Liter) followed by Jersey cross (162 Liter) and Indigenous or Local cow (28 Liter)(Average monthly milk production = Average yearly milk production/ 12) (Table 10)

Table 9 Cost of Production per Liter Milk

	Gross Cost per lit. milk production	Net cost per lit. milk production	Market value of per liter milk (Rs)	Gross profit per lit. milk	Net profit per lit. milk
Indigenous /Local cow	12.25	38.75	28	15.75	-10.75
Jersey Cross cow	4.91	10.30	28	23.09	17.70
Buffalo	4.82	10.04	28	23.18	17.96

Source: Field level Survey

Table 10 Average Milk Production per Female Bovine

	Indigenous cow		Jersey Cross cow		Buffalo	
	Quantity(Lit)	Value	Quantity(Lit)	Value	Quantity(Lit)	Value
Milk Yield/day/animal (Lit)	1.24	34.72	6.68	187.04	6.92	193.76
Milk Yield/lactation (Lit)	304	8512	1817	50876	1827	51156
Milk Yield/ Year (Lit)	330	9240	1944	54432	1958	54824
Milk Yield/ Month (Lit)	27.5	770	162	4536	163.20	4569.6

Source: Field level Survey

The cow dung is used for generating energy as well as the organic fertilizer which improves the quality of the land. Dung yield per adult female local cow is 5.5 kg/day (yearly yield 1980 kg) and its value is Rs: 5.5/- (Value of dung per kg is Rs; 1/-). Dung yield per adult female Jersey cow is 9 kg/day (yearly yield 3240 kg) and its value is Rs: 9/-. Dung yield per female buffalo is higher (9.5kg/day) than others (Table 11).

Table 11 Average Dung Yield per Adult Female Bovine

Average Cow dung Yield	Indigenous/Local cow		Jersey Cross		Buffalo	
	Quantity (Kg)	Value	Quantity (Kg)	Value	Quantity (Kg)	Value
dung Yield/day/animal	5.5	5.5	9	9	9.5	9.5
dung Yield/ Month	165	165	270	270	285	285
dung Yield/ Year	1980	1980	3240	3240	3420	3420

Source: Field level Survey

Total income from per female bovine is equal to market value of milk and with merger value of dung. Gross income from per female bovine = Total income from per female bovine – total cost of female bovine rearing + Rental value of owned house + value of family labour

Net income from per female bovine is equal to total income from per female bovine deducting total cost of female bovine farming. Dairy farmer earns Rs. 935/month from per female local cow rearing, income from per female Jersey cross is Rs.4806 /month and female buffalo farming is Rs 4854.60 /month. The farmer earns highest gross income from buffalo (Rs. 2772.64 /month) than local cow (Rs. 480/month) similarly dairy farmers earn more net income from buffalo & Jersey cross than local cow (Table 12).

Table 12 Monthly Average incomes per Female Bovine

	Indigenous /Local cow	Jersey Cross cow	Buffalo
Milk	770	4536	4569.60
Dung	165	270	285
Total income	935	4806	4854.6
Total Cost	1441.78	2063.71	2081.96
Net income	-506.78	2742.29	2772.64
Gross income	479.72 (Yearly Rs:5757 /-)	3823.29(Yearly Rs:45879 /-)	3855.04(Yearly Rs:46260)

Source: Field level Survey

4.6 Factors influencing Dairy Farming

The dairy farming or cow & buffalo rearing (Y_1) is influenced by a number of factors like percentage of unemployment women per village (PUW), literacy rate, percentage of child population below six years (PCP), family size and per capita land (PCL) play an important role to spread the dairy farming The regression results show that of the three main variables, percentage of unemployment women per village has a positive and significant effect on the extent of dairy farming and milk production.

We may now examine how far the variations in cow & buffalo rearing are explained by those in PCP. PUW and PCL. Table 13 reveals that the variation in cow & buffalo rearing for farmers is explained by three variables, namely PCP. PUW and PCL to the extent of 83 per cent. The coefficient of PUW is significant at 5 per cent level, the coefficient of PCP is significant at 1 per cent level the coefficient of PCL significant at 10 per cent level and the whole model is significant at 1 per cent level, F value being 25.44.

We may now examine how far the variations in milk production per month are explained by those in PCP. PUW and PCL. Table 13 reveals that the variation in milk production per month for farmers is explained by three variables, namely PCP. PUW and PCL to the extent of 86 per cent. The coefficient of PUW is significant at 1 per cent level, the coefficient of PCP is significant at 5 per cent level the coefficient of PCL significant at 1 per cent level and the whole model is significant at 1 per cent level, F value being 32.31.The coefficient of size of per capita land per household is negative implying that dairy farming decreases with the increase of per capita land. The small and marginal farmers are more interested to dairy farming. On the

other hand, semi-medium and medium farmers are not keen to dairy farming. There exists a positive relationship between percentage of child population and cow & buffalo farming at the household level. This positive relationship is statistically significant, it implying that number of child per households creates milk demand so many parents compel to cow & bullock rearing. The coefficient of percentage of unemployment women per village is positive implying that dairy farming increase with the increase of percentage of unemployment women per village.

Table 13 Factors Influencing Milk Production and Cow & Buffalo Rearing

Blocks	Villages	Percentage of Cow & Buffalo (Y₁)	Milk Production per month(Lit) (Y₂)	Percentage of Unemployment Women (PUW)	Per capita Land (PCL)	Percentage of Child population below 6 years(PCP))
Sabang	Haripura	5.08	1485.25	33.50	54.21	5.21
	Churka	6.78	1980.5	38.95	56.32	6.75
	Palashi	5.65	1650.25	36.82	42.65	6.13
	Belki	7.91	2310.33	50.25	38.75	7.67
Garhbeta-ll	Eriamara	6.78	1980.25	42.75	45.39	7.06
	Kumari	5.08	1485.5	35.85	51.55	6.17
	Keshia	6.21	1815.66	42.57	38.64	5.52
	Kushumdanga	7.34	2145.25	48.75	39.50	6.13
Chandrakona-l	Basulia	4.52	1320.75	45.60	80.52	4.91
	Andhare	6.78	1980.65	45.85	49.75	6.44
	Ghola	7.34	2145.45	49.59	34.52	5.21
	Hajra	7.91	2310.5	51.35	31.55	6.60
Pingla	Kusumda	6.21	1815.45	49.54	40.52	6.36
	Asti	7.91	2310.67	52.10	27.65	7.98
	Chahat	3.95	1155.75	31.58	89.50	5.52
	Khirinda	4.52	1320.33	33.75	78.65	5.83
	Total	100	29212.54			100

Source: Field level Survey

$$Y_1 = 1.358 + 0.0666\ PUW** - 0.0365 PCL* + 0.591\ PCP***$$
$$\quad\quad (0.52)\quad (2.06)\quad\quad (-1.87)\quad\quad (2.77)$$
$$R^2 = 0.86 \quad R\ bar\ sq. = 0.83 \quad F\ value = 25.44 \quad Significance\ F = 0.000$$

$$Y_2 = 670.21 + 21.278\ PUW*** - 9.581 PCL*** + 115.520\ PCP**$$
$$\quad\quad (1.29)\quad (2.96)\quad\quad (-3.27)\quad\quad (2.31)$$
$$R^2 = 0.88 \quad R\ bar\ sq. = 0.86 \quad F\ value = 32.31 \quad Significance\ F = 0.000$$

Y_1= Percentage of Cow & Buffalo, Y_2 = Milk Production per month, PUW= Percentage of Unemployed Women, PCL= Per capita Land, PCP= Percentage of Child population below 6 years

i) Figures within parentheses indicates 't ' values ii) *** Indicates coefficient significant 1 percent level (iii) ** Indicates coefficient significant 5 percent level. (iv) * Indicates coefficient significant 10 percent level

4.7 The Empirical Results : Probit Estimates *(household's participation in female bovine rearing as a dummy variable)*

The empirical results relating to the household's participation in female bovine rearing (Dummy variable) are presented in Table 14. The households with per capita income (PCI) are negative and significantly associated in female bovine rearing. This negative relationship is statistically significant at 1% level. The high income group farmers are not interest in dairy farming. Only low income group farmers are interest to female bovine rearing in the study area. It is highly significant for per capita land (PCL).Landless & marginal farmers are interest to dairy farming. In Probit model there exists a positive relationship between number of unemployment female per households (NUFH) and female bovine farming. This positive relationship is statistically significant at 1% level. Participation of the households in the female bovine farming is significantly influenced by female education level (FEL) of households i.e., High educated female are not interested in dairy farming.

Table 14 Probit Estimates of Household's Participation in Female Bovine Rearing

Variable	Coefficients	t-value/ z-value	P>IZI	
Intercepts	2.524252	1.82 **	0.054	<u>Pearson Goodness of fit</u>
PCI	- 0.000218	-2.97***	0.003	
PCL	-0.004619	- 1.88 **	0.050	Chi Square = 301.12
NCB	2.679026	2.67***	0.007	Number of observation = 240
NUFH	3.667968	3.17***	0.002	P = 0.000
FEL	-0.521757	-2.71***	0.007	R^2 =0.91

*PCI= per Capita Income, PCL = per Capita land, NCB = Numbers of Child below six years, NUFH= Number of Unemployment Female per Households, FEL = Female Education Level, *** Indicates coefficient significant at 1% level and ** Indicates coefficient significant at 5% level*

5. Conclusion

Livestock contributes nearly 24 percent to the gross value of agricultural output, and it has been increasingly consistently. In fact, the growth in the livestock sector has always remained higher than that in the crop sector. Profitability of dairy farming depends upon the milk yield, price of milk and cost of milk production.

The dairy farming or cow & buffalo rearing is influenced by a number of factors like percentage of unemployment women per village, literacy rate, percentage of child population below six years, family size and per capita land play an important role to spread the dairy farming. Unemployment women per village have a positive and significant effect on the extent of dairy farming and milk production. The small and marginal farmers are more interested in dairy farming than semi-medium and medium farmers.

Large self-employment opportunities are provided by the livestock sector in Paschim Medinipur district. Cattle & Buffalo rearing is the largest provider of self-employment for rural female in study area. The dairy farming has positive impact on per capita income, percentage of workers engaged, per capita milk production, per capita ghee production, dung supply in agriculture per acre and dung used as fuel per household.

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