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Research Note

RETURNS FROM INVESTMENT IN DAIRYING IN A SELECTED AREA OF BANGLADESH -A CAMPARATIVE FINANCIAL ANALYSIS OF LOCAL AND CROSS BREED DAIRY FARMS

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ABSTRACT

An attempt was made in this study to appraise the investment proposition in dairying, incorporating the cash support incentive initiated by the government in recent years. Financial analysis was performed using primary data collected from different locations of Tangail district. The results indicated that dairy farming with both local and cross-bred cows was highly profitable. The profitability with cross-bred cows was more than that with local cows. Both the categories of farms had high benefit-cost ratios at 14 percent discount rate. The internal rate of return of more than 24 percent indicated that return from investment in dairying would be far more than the opportunity cost of capital in the formal capital market.

I. INTRODUCTION

Dairying is an age old practice in Bangladesh. However, unlike in the developed world, milk production in Bangladesh remains at best a supplementary enterprise. It is only recently that the government of Bangladesh initiated dairy promotion programme through provision of direct support to the dairy farmers. The aim of this programme is to encourage people to set up dairy farms in the private sector and thereby to boost up local milk production for reducing dependency on imported milk. Since dairying is labour intensive, generation of employment and income to the rural poor is also sought to be accomplished through the programme.

A number of studies have analysed dairy enterprise in Bangladesh using farm management approach which is based on examination of performance of a farm business for a truncated period, usually one year or one lactation period (Alam *et al.*, 1995; Akteruzzaman, 1993; Ashrafuzzaman,1993; Halim, 1992; Islam, 1986; Jahan, 1995; Pandit, 1993; Rahman, 1993; Sarker, 1995). In fact, the real practice of dairying is not to keep the animals for a single year and to sell them at the end of the year or at the expiry of the lactation period. A realistic practice is to rear animals upto the end of their

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productive life. Thus determination of financial performance of dairy farming requires a different type of analysis. Moreover, costs incurred in and returns obtained from dairy farming usually occur at different points in time which calls for accounting for the time value of money in the analysis.

Thus analysis of performance of dairy farming can be better accomplished through use of project appraisal technique which can accommodate the whole productive life of the animals as a single period for analysis. With this end in view an attempt has been made in this study to analyze the financial performance of newly established dairy farms with local and cross-bred cows in selected locations of Tangail district of Bangladesh.

Section II discusses the methodolgy and section III provides estimates of costs and benefits and the results of the financial analysis. Concluding remarks are made in the final section of the paper.

II. METHODOLOGY

The study is based on farm level data and a set of plausible assumptions. Detailed data for one year of operation of the farms for the calendar year 1994 were collected in the months of March and April, 1995 through sample survey of 7 local and 12 cross-breed farms of Tangail district. Primary input-output data for the study year were collected partly from farm records and partly by farm survey of the dairy farmers.

Project appraisal technique was used for the analysis. As is well known, performance of a project can be evaluated from the view point of the economy or society as a whole or from the view point of the individual entity which is undertaking the project. The latter is known as financial analysis. In this study only the financial analysis was performed. The worth of investment was examined by the discounted measures such as Benefit-Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) for which the working formulae have been presented in Appendix Table 7. The analysis is based on a number of general and technical assumptions as described below:

General Assumptions

These assumptions were equally applicable for local and cross-breed farms. Some salient features of these assumptions can be observed from Appendix Tables 2 and 3. The general assumptions are described below:

i) A model dairy farm with 10 cows (for both local and cross-breed farms) was assumed throughout the life of the project.

ii) Artificial insemination facilities were assumed to be easily available to inseminate heifers/cows and as such the dairy farmers did not keep any bull for breeding purpose.

iii) Dairy farmers used to sell grown up (about two years old) calves (bull/heifer) born in the herd and the sale was assumed to be made at the beginning of each year.

iv) Calf mortality was assumed at 10% and milk production was assumed not to be affected by mortality of calf.

v) At the end of the productive life of cows, farmers sold all animals (both cows and calves) and the returns were added to the benefits of the terminal year as salvage value to which the scrap values of farm structures and buildings were also added.

Technical Assumptions

Technical assumptions were mde through consultation with the livestock experts and some of the features of the assumptions are observed in Appendix Tables 1, 2 and 3.

i) Age at first conception was assumed to range from 2.5 to 2.7 years such that the first calving occurred at the age of 3.5 years.

ii) Age at calvings following the first calving (Appendix Tables 2 and 3) were calculated on the basis of information (i. e. calving interval) provided in Appendix Table 1.

iii) Productive life of animals was assumed at 9.0 and 11.0 years respectively for local and cross-bred cows.

Discount Rate

The difficulties in estimating the opportunity cost of capital are reflected in the statement made by Gittinger (1982, p-3): "No one knows what the opportunity cost of capital really is". Determination of opportunity cost of capital is beset with a number of difficulties, particularly where capital markets are highly imperfect due to various types of distortions. However, the available literatures (Gittinger, 1982; Chakraborty, 1985) suggest that in most developing countries the opportunity cost of capital varies between 8% to 15%. The lending rates of nationalized commercial banks and specialized banks in agriculture for long and medium term loans in Bangladesh vary between 12% to 14%. Thus a 14% discount rate has been used for financial analysis in this study.

III. RESULTS AND DISCUSSIONS

Estimation of Costs and Benefits

Since only financial analysis has been performed in this study, the market price at which goods and services are actually exchanged has been taken for estimating costs and benefits. In a country like Bangladesh year to year fluctuation in input and output prices, with an increasing trend, is obseved. However, both input and output prices in this study were assumed to be fixed throughout the project period which would be compensatory.

Estimation of Costs

In estimating cost, both cash cost and cost of family supplied inputs were valued at the same rate assuming that all inputs were purchased from the markets. Cost items included capital costs and production costs as described below:

Capital Costs

Capital costs consisted of investment cost for animals, farm structures and buildings, and land use cost and are presented in Table 1.

Cost for Animals: Since the dairy farmers started dairying with heifers, the value of heifers was considered as the cost of animals. Estimated cost per local and cross-breed animal were Tk. 10, 000.00 and Tk. 14, 000.00 respectively. Therefore, the investment cost of 10 animals per farm were at Tk. 1, 00, 000.00 and Tk. 1, 40, 000.00 respectively for local and cross-breed farms and was incurred at the first year of dairying.

Cost of Farm Structures and Buildings: This cost included cost of construction of cattle sheds, feeding troughs, milking and milk marketing equipment etc., and reconstruction and repairing costs of these farm assets. Cost of farm structures and buildings was assumed at Tk. 1,02,000.00 for both local and cross-breed farms at the first year of dairying. A replacement investment cost of Tk. 10, 000.00 was assumed in the fifth year for both types of farms.

Land Use Cost: Land use cost was taken in the form of opportunity cost of land used for dairy farming. The opportunity cost of land use was assumed at 10% on the capitalized value of 15 decimals of land per farm valued at Tk. 3, 000.00 per decimal. Land use cost was calculated at Tk. 4,5000.00 per year for both local and cross-breed farms.

Table 1. Capital costs in local and cross-breed farms

(Taka)

Year	Cost of animal	Cost of farm structures and buildings	Land use cost	Total
1.	100000.00[a]	102000.00	4500.00	206500.00[a]
	140000.00[b]			246500.00[b]
2	-	-	4500.00	4500.00
3	-	-	4500.00	4500.00
4	-	-	4500.00	4500.00
5	-	10000.00[c]	4500.00	14500.00
6	-	-	4500.00	4500.00
7	-	-	4500.00	4500.00
8[b]	-	-	4500.00	4500.00
9[b]	-	-	4500.00	4500.00

a only for local breed farm
b only for cross breed farm
c Replacement investment

Production Costs

Costs of production associated with dairying was calculated by taking into consideration the feed cost, labour cost, veterinary charges, artificial insemination charge and miscellaneous cost. Production cost of local and cross-breed animals are presented in Tables 2 and 3 respectively. Since the production cost was expected to increase with

Table 2. Production costs per farm of local-bred cows

(Taka)

year	No. of animal (cow equivalent)	Feed cost	Labour cost	Veterinary charge	Artificial insemination charge	Miscellaneous cost	Total cost
1	8.0	35382.00	16813.00	531.00	150.00	1648.00	54524.00
2	13.6	60150.00	28581.00	903.00	150.00	2801.00	92585.00
3	17.2	76072.00	36147.00	1143.00	150.00	3542.00	117054.00
4	17.2	76072.00	36147.00	1143.00	150.00	3542.00	117054.00
5	17.2	76072.00	36147.00	1143.00	150.00	3542.00	117054.00
6	17.2	76072.00	36147.00	1143.00	150.00	3542.00	117054.00
7	17.2	76072.00	36147.00	1143.00	150.00	3542.00	117054.00

Note: Cost for each item has been derived by multiplying cost per cow equivalent (see Appendix Table 6) by the number of cow eqivalents.

Table 3. Production costs per farm of cross-bred cows

(Taka)

year	No. of animal (cow equivalent)	Feed cost	Labour cost	Veterinary charge	A.I. charge	Miscellaneous cost	Total cost
1	8.0	42129.00	13066.00	708.00	150.00	2126.00	58179.00
2	13.6	71620.00	22211.00	1203.00	150.00	3614.00	98798.00
3	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00
4	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00
5	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00
6	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00
7	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00
8	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00
9	17.2	90578.00	28091.00	1522.00	150.00	4570.00	124911.00

Note : Cost for each item has been derived by multiplying cost per cow equivalent (see Appendix Table 6) by the number of cow eqivalents.

increase in the number of animals (in cow equivalent) in the farm, total production cost per year increased during second and third years due to increase in the number of animals in the farm. Since the number of animals (in cow equivalent) remained unchanged during third and subsequent years, the total production cost remained unchanged during this period. It is noted that artificial insemination charge was derived directly by multiplying the charge per cow by the number of heifers/cows in the herd each year.

Estimation of Gross Benefits

Gross benefits earned from dairying with 10 local/cross-bred cows over their productive life have been presented in Tables 4 and 5. Gross annual benefits included total values of product (milk), by-product (cow-dung) and value of animal sold (except salvage value). During the first and fifth year of operation, benefit did not include the value of milk because in the first year only heifers were in the farm and in the fifth year no cow was in lactation. Since the lactation period and milk yield per day varied according to age at calving (Appendix Table 1) of the cows, variation in return from milk was observed. However, returns from cow-dung directly varied with the number of animals (in cow equivalent) in the herd. Value of animal (bull/heifer) was derived by

Table 4. Return per farm of local-bred cows

Year	Milk production		Cow-dung production		Animal sold		Gross return (Tk.)
	Quantity (litre)	Value (Tk.)	Quantity (kg)	Value (Tk.)	No.	Value (Tk.)	
1	-	-	17520	4380.00	-	-	4380.00
2	10085	141190.00	29784	7446.00	-	-	148636.00
3	11685	163590.00	37668	9417.00	-	-	173007.00
4	14135	197890.00	37668	9417.00	9	67500.00	274807.00
5	-	-	37668	9417.00	-	-	9417.00
6	11489	160846.00	37668	9417.00	9	117000.00	287263.00
7	9984	139776.00	37668	9417.00	9	108000.00	257193.00

Note : Milk production per lactation per cow is derived in Appendix Table 1

Price of milk : Tk. 14.00/litre.

Cow-dung production: 6 kg/animal/day.

Price of cow-dung: Tk. 0.25/kg.

Value of animal sold : see Appendix Tables 2 and 4.

multiplying the value per animal by the number of animals sold. Value per animal (bull/heifer) was higher for cross-bred animals than that for local-bred animals (bull/heifer) of equal age (Appendix Tables 2, 3, 4 and 5). At the end of the productive life, the cows were sold and the benefit thus gained was termed as salvage value (Tk 2, 08, 000 and 2,88,000 respectively for local and cross-bred farms). Salvage value also included values of calves which were in the farm at the end of the productive life of the cows. Under the cash support condition gross benefits also included the amount of incentive (25% of animal value) which was counted in the second year of dairying.

Table 5, Return per farm of cross-bred cows

Year	Milk production		Cow-dung production		Animal sold		Gross return (Tk.)
	Quantity (litre)	Value (Tk.)	Quantity (kg)	Value (Tk.)	No.	Value (Tk.)	
1	-	-	17520	4380.00	-	-	4380.00
2	17180	240520.00	29784	7446.00	-	-	247966.00
3	20550	287700.00	37668	9417.00	-	-	297117.00
4	21960	307440.00	37668	9417.00	9	108000.00	424857.00
5	-	-	37668	9417.00	-	-	9417.00
6	21960	307440.00	37668	9417.00	9	162000.00	478857.00
7	20480	286720.00	37668	9417.00	9	144000.00	440137.00
8	15910	222740.00	37668	9417.00	9	135000.00	367157.00
9	14740	206360.00	37668	9417.00	9	126000.00	341777.00

Note: Milk production per lactation per cow is derived in Appendix Table 1
Price of milk: Tk. 14.00/litre.
Cow-dung production : 6 kg/animal/day.
Price of cow-dung: Tk. 0.25/kg.
Value of animal sold: see Appendix Tables 3 and 5.

Results of Financial Analysis

The results of financial analysis of dairying with local and cross-bred cows with and without incentive bonus are presented in Table 6. Details on the derivation of the results are presented in Appendix Tables 8, 9, 10 and 11. It is evident from Table 6 that BCR, NPV and IRR of raising local cows were 1.20, Tk. 1,28,331 and 28.84% respectively with incentive bonus and 1.15, Tk 97,552 and 24.54% without incentive bonus. It also appears from the table that BCR, NPV and IRR of raising cross-bred cows were respectively 1.81, Tk. 6,33,845 and 63.33% with incentive bonus, and 1.76, Tk. 5,95,371 and 57.23% without incentive bonus.

Table 6. Results of financial analysis of local and cross-bred dairy farming with and without incentive bonus

Measures of project worth	Project worth			
	Local-bred cows		Cross-bred cows	
	With incentive bonus	Without incentive bonus	With incentive bonus	Without incentive bonus
BCR at 14 percent discount rate	1.20	1.15	1.81	1.76
NPV at 14 percent discount rate (Tk/farm)	1,28,331	97,552	6,33,845	5,95,371
Internal rate of return (IRR) %	28.84	24.54	63.33	57.23

Source: Appendix Tables 8, 9 10 and 11

The results of the financial analysis indicated that dairy farming with both local and cross-bred cows was highly profitable. The profitability with cross-breed cows was, however, more than that with local cows. Both the categories of farms had high benefit-cost ratios at 14% discount rate which could be considered as the upper bound rate of the opportunity cost of capital. The internal rate of return of more than 24% indicated that returns from investment in dairying would be far more than the opportunity cost of capital, at least in the formal capital market. Profitability analyses with and without incentive bonus did not show any remarkable difference. However, the analysis did not take into account the indirect effects of incentive bonus which could have made the difference more perceptible. The impression gained from the field visits, however, suggests that the financial incentive provided by the government has given some incentives to people to set up new dairy farms or to expand their existing herds, particularly for those having capital constraints.

IV. CONCLUSIONS

As a departure from the conventional farm management analysis, dealing with calculation of annualized costs and benefits, the present study has applied the more pertinent project appraisal technique in the analysis of dairying, as practised in small farming environment of rural Bangladesh. The financial analysis has revealed that the earning capacity of investment in dairying far exceed the opportunity cost of capital in the formal capital market. The study has noted that the financial incentive offered by the government has provided some stimulus to the small private investors to undertake dairy

farming. Further expansion and careful implementation of the incentive programme is expected to contribute more to production and consumption of milk in the country. However, sustainability of the outcomes will depend largely on the assured supply of accompanying inputs such as feed and veterinary services at reasonable price, and provision of improved milk marketing facilities closer to the doorsteps of farmers.

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APPENDICES

Appendix Table 1. Productivity characteristics of local and cross-bred dairy cows at different calvings

Calving	Length of lactation (day)		Milk production /day (litre)		Dry period (day)		Calving interval (day)	
	Local-bred cow	Cross-bred cow	Local-bred cow	Cross-bred cow	Local-bred cow	Cross-bred cow	Local-bred cow	Cross-bred cow
1	220	279	4.58	6.16	210	159	430	436
2	245	290	4.77	7.09	197	143	442	433
3	259	297	5.46	7.39	211	134	470	431
4	243	292	4.73	7.52	239	145	482	437
5	232	282	4.30	7.26	-	157	-	442
6	-	275	-	5.79	-	167	-	441
7	-	272	-	5.42	-	-	-	-
Average	240	284	4.77	6.66	214	151	456	437

Source : Field survey, 1995.

Appendix Table 2. Herd profile of the local-bred animals

Year	Type of animal	Age beginning the year	Age at calving	No. of calving	Stock/purchased						Animal sold		Total stock after sold	
					Cow/heifer			Calf						
					No.		Value (Tk)	No.		Value (Tk)	No.	Value (Tk)	No.	Value (Tk)
					Milch	Dry		Female	Male					
1	Heifer	2.50	-	-	-	10	100000	-	-	-	-	-	10	100000
2	Cow	3.50	3.50	1st	10	-	160000	-	-	-	-	-	10	160000
	Calf-1	-	-	-	-	-	-	5	4	-	-	-	9	-
3	Cow	4.50	4.69	2nd	10	-	180000	-	-	-	-	-	10	180000
	Calf-2	-	-	-	-	-	-	4	5	-	-	-	9	-
	Calf-1	1.00	-	-	-	-	-	5	4	27000	-	-	9	27000
4	Cow	5.50	5.89	3rd	10	-	180000	-	-	-	-	-	10	180000
	Calf-3	-	-	-	-	-	-	5	4	-	-	-	9	-
	Calf-2	0.81	-	-	-	-	-	4	5	22500	-	-	9	22500
	Calf-1	2.00	-	-	-	-	-	-	-	-	9	67500	-	-
5	Cow	6.50	-	-	-	10	160000	-	-	-	-	-	10	160000
	Calf-3	0.61	-	-	-	-	-	5	4	18000	-	-	9	180000
	Calf-2	1.81	-	-	-	-	-	4	5	54000	-	-	9	54000
6	Cow	7.50	7.18	4th	10	-	150000	-	-	-	-	-	10	150000
	Calf-4	0.32	-	-	-	-	-	4	5	-	-	-	9	-
	Calf-3	1.61	-	-	-	-	-	5	4	45000	-	-	9	45000
	Heifer-2	2.81	-	-	-	-	-	-	-	-	4	52000	-	-
	Bull-2	2.81	-	-	-	-	-	-	-	-	5	65000	-	-
7	Cow	8.50	8.50	5th	10	-	130000	-	-	-	-	-	10	130000
	Calf-5	-	-	-	-	-	-	5	4	-	-	-	9	-
	Calf-4	1.32	-	-	-	-	-	4	5	31500	-	-	9	31500
	Heifer-3	2.61	-	-	-	-	-	-	-	-	5	60000	-	-
	Bull-3	2.61	-	-	-	-	-	-	-	-	4	48000	-	-
Closing	Cow	9.50	-	-	-	-	-	-	-	-	10	100000	-	-
	Calf-5	0.32	-	-	-	-	-	-	-	-	9	27000	-	-
	Heifer-4	2.32	-	-	-	-	-	-	-	-	4	36000	-	-
	Bull-4	2.32	-	-	-	-	-	-	-	-	5	45000	-	-

Note : This table is prepared on the basis of assumptions and information provided in Appendix Table 1, F = Female, M = Male

Appendix Table 3. Herd profile of the cross-bred animals

Year	Type of animal	Age beginning the year	Age at calving	No. of calving	Stock/purchased						Animal sold		Total stock after sold	
					Cow/heifer			Calf						
					No.		Value (Tk)	No.		Value (Tk)	No.	Value (Tk)	No.	Value (Tk)
					Milch	Dry		F	M					
1	Heifer	2.50	-	-	-	10	140000	-	-	-	-	-	10	140000
2	Cow	3.50	3.50	1st	10	-	220000	-	-	-	-	-	10	220000
	Calf-1	-	-	-	-	-	-	5	4	-	-	-	9	-
3	Cow	4.50	4.70	2nd	10	-	245000	-	-	-	-	-	10	245000
	Calf-2	-	-	-	-	-	-	4	5	-	-	-	9	-
	Calf-1	1.00	-	-	-	-	-	5	4	45000	-	-	9	45000
4	Cow	5.50	5.90	3rd	10	-	265000	-	-	-	-	-	10	265000
	Calf-3	-	-	-	-	-	-	5	4	-	-	-	9	-
	Calf-2	0.80	-	-	-	-	-	4	5	40500	-	-	9	40500
	Calf-1	2.00	-	-	-	-	-	-	-	-	9	108000	-	-
5	Cow	6.50	-	-	-	10	245000	-	-	-	-	-	10	245000
	Calf-3	0.60	-	-	-	-	-	5	4	31500	-	-	9	31500
	Calf-2	1.80	-	-	-	-	-	4	5	94500	-	-	9	94500
6	Cow	7.50	7.05	4th	10	-	224000	-	-	-	-	-	10	225000
	Calf-4	0.45	-	-	-	-	-	4	5	22500	-	-	9	22500
	Calf-3	1.60	-	-	-	-	-	5	4	81000	-	-	9	81000
	Heifer-2	2.80	-	-	-	-	-	-	-	-	4	72000	-	-
	Bull-2	2.80	-	-	-	-	-	-	-	-	5	90000	-	-
7	Cow	8.50	8.25	5th	10	-	220000	-	-	-	-	-	10	220000
	Calf-5	0.25	-	-	-	-	-	5	4	-	-	-	9	-
	Calf-4	1.45	-	-	-	-	-	4	5	67500	-	-	9	67500
	Heifer-3	2.60	-	-	-	-	-	-	-	-	5	80000	-	-
	Bull-3	2.60	-	-	-	-	-	-	-	-	4	64000	-	-
8	Cow	9.50	9.50	6th	10	-	200000	-	-	-	-	-	10	200000
	Ca;f-6	-	-	-	-	-	-	4	5	-	-	-	9	-
	Calf-5	1.25	-	-	-	-	-	5	4	58500	-	-	9	58500
	Heifer-4	2.45	-	-	-	-	-	-	-	-	4	60000	-	-
	Bull-4	2.45	-	-	-	-	-	-	-	-	5	75000	-	-
9	Cow	10.50	1070	7th	10	-	180000	-	-	-	-	-	10	180000
	Calf-7	-	-	-	-	-	-	5	4	-	-	-	9	-
	Calf-6	1.00	-	-	-	-	-	4	5	45000	-	-	9	45000
	Heifer-5	2.25	-	-	-	-	-	-	-	-	5	70000	-	-
	Bull-5	2.25	-	-	-	-	-	-	-	-	4	56000	-	-
Closing	Cow	11.50	-	-	-	-	-	-	-	-	10	140000	-	-
	Calf-7	0.80	-	-	-	-	-	-	-	-	9	40000	-	-
	Heifer-6	2.00	-	-	-	-	-	-	-	-	4	48000	-	-
	Bull-6	2.00	-	-	-	-	-	-	-	-	5	60000	-	-

Note : This table is prepared on the basis of assumptions and information provided in Appendix Table 1, F = Female, M = Male

Appendix Table 4. Inventory of local-bred animals

Year	Stock/purchased				Animal sold		Total stock after sold	
	Cow/Heifer		Calf		No.	Value (Tk)	No. (cow equivalent)	Value (Tk)
	No.	value	No.	Value (Tk)				
1	10	100000.00	-	-	-	-	8.0	100000.00
2	10	160000.00	9	-	-	-	13.6	160000.00
3	10	180000.00	18	27000.00	-	-	17.2	207000.00
4	10	180000.00	18	22500.00	9	67500.00	17.2	202500.00
5	10	160000.00	18	72000.00	-	-	17.2	232000.00
6	10	150000.00	18	45000.00	9	117000.00	17.2	195000.00
7	10	130000.00	18	31500.00	9	108000.00	17.2	161500.00
Closing stock (salvage value)					28	208000.00		

Note : Cow equivalent number was calculated in the following way:
1 calf = 0.40 cows and 1 heifer = 0.80 cows.
Calf = animal upto 2 years of age.
Source : Appendix Table 2.

Appendix Table 5. Inventory of cross-bred animals

Year	Stock/purchased				Animal sold		Total stock after sold	
	Cow/Heifer		Calf		No.	Value (Tk)	No. (cow equivalent)	Value (Tk)
	No.	value	No.	Value (Tk)				
1	10	140000.00	-	-	-	-	8.0	140000.00
2	10	220000.00	9	-	-	-	13.6	220000.00
3	10	245000.00	18	45000.00	-	-	17.2	290000.00
4	10	265000.00	18	40500.00	9	108000.00	17.2	305500.00
5	10	245000.00	18	126000.00	-	-	17.2	371000.00
6	10	225000.00	18	103500.00	9	162000.00	17.2	328500.00
7	10	220000.00	18	67500.00	9	144000.00	17.2	287500.00
8	10	200000.00	18	58500.00	9	135000.00	17.2	258500.00
9	10	180000.00	18	45000.00	9	126000.00	17.2	225000.00
Closing stock (salvage value)					28	288000.00		

Note : Cow equivalent number was calculated in the following way:
1 calf = 0.40 cows and 1 heifer = 0.80 cows.
Source : Appendix Table 3.

Appendix Table 6. Production cost in local and cross breed farms

(Taka)

Farm category	Cost by item (Tk per cow equivalent)					
	Feed cost	Labour cost	Veterinary charge	A. I. charge	Miscella-neous cost	Total cost
Local-breed farm	4422.83	2101.58	63.43	15.00	205.98	6811.82
Coss-breed farm	5266.16	1633.19	88.49	15.00	265.78	7268.62

Source : Field surey, 1995.

Appendix Table 7. Mathematical formulae used for financial analysis

The following mathematical formulae were used for estimating project worth:

$$\text{BCR} = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}}$$

$$\text{NPV} = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} \quad \text{and}$$

IRR is the discount rate i which makes NPV of the project zero, that is;

$$\text{NPV} = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} = O$$

Where B_t = benefit in each year from dairying:

C_t = cost in each year for dairying;

t = 1, 2, ... , n;

n = number of years or project life and

i = interest (discount) rate

Appendix Table 8. Financial analysis of local bread dairy enterprise with incentive bonus

(Taka)

Year	Capital costs	Production costs	Gross costs	Gross benefits	Present value of gross costs at 14% D. F.	Present value of gross benefits at 14% D. F.	Incremental benefit (=cash flow)	Present value of cash flow at 25% D. F.	Present value of cash flow at 30% D. F.
	1	2	3	4	5	6	7 (=4-3)	8	9
1	206500	54524	261024	4380	228968.42	3842.11	-256644	-205315.20	-197418.46
2	4500	92585	97085	148636	74703.76	114370.58	51551	32992.64	30503.55
				+40000[a]		+30778.70	+40000	+25600.00	+23668.64
3	4500	117054	121554	173007	82045.49	116774.80	51453	26343.94	23419.66
4	4500	117054	121554	274807	71969.73	162707.80	153253	62772.43	53658.14
5	14500	117054	131554	9417	68325.03	4890.89	-122137	-40021.85	-32895.04
6	4500	117054	121554	287263	55378.37	130873.16	165709	43439.62	34330.96
7	4500	117054	121554	257193	48577.52	102783.92	135639	28445.56	21616.29
				+208000[b]		+83124.56	+208000	+43620.76	+33148.19
				+204000[c]		+8152.60	+20400	+4278.19	+3251.07
Total					629968.30	758299.12		22156.09	-6717.01

a incentive bonus.
b salvage value of animal.
c salvage value of farm structures and buildings.

Benefit-cost ratio (BCR) at 14% = 758299.12 ÷ 629968.30 = 1.20
Net present value (NPV) at 14% = 758299.12 - 629968.30 = 128330.82
Internal rate of return (IRR) = 25 + 5 × [22156.09 ÷ (22156.09+6717.01)] = 28.84
Source : Tables 1, 2, 4 and Appendix Tables 2 and 4.

Appendix Table 9. Financial analysis of local breed dairy enterprise without incentive bonus

(Taka)

Year	Capital costs	Production costs	Gross costs	Gross benefits	Present value of gross costs at 14% D. F.	Present value of gross benefits at 14% D. F.	Incremental benefit (=cash flow)	Present value of cash flow at 20% D. F.	Present value of cash flow at 25% D. F.
	1	2	3 (=1+2)	4	5	6	7 (=4-3)	8	9
1	206500	54524	261024	4380	228968.42	3842.11	-256644	-21387.00	-205315.20
2	4500	92585	97085	148636	74703.76	114370.58	51551	357999.31	32992.64
3	4500	117054	121554	173007	82045.49	116774.80	51453	29776.04	26343.94
4	4500	117054	121554	274807	71969.73	162707.80	153253	73906.73	62772.43
5	14500	117054	131554	9417	68325.03	4890.89	-122137	-49084.12	-40021.85
6	4500	117054	121554	287263	55378.37	130873.16	165709	55495.61	43439.62
7	4500	117054	121554	257193	48577.52	102783.92	135639	37854.35	28445.56
				+208000[a]		+83124.56	+208000	+58048.98	+43620.76
				+204000[b]		+8152.60	+20400	+5693.27	+4278.19
Total					629968.30	727520.92		33620.17	-3443.91

a salvage value of animal.

b salvage value of farm structures and buildings.

Benefit-cost ratio (BCR) at 14% = 727520.42 ÷ 629968.30 = 1.15

Net present value (NPV) at 14% = 727520.42 - 629968.30 = 97552.12

Internal rate of return (IRR) = 20 + 5 × [33620.17 ÷ (33620.17 + 3443.19)] = 24.54

Source : Tables 1, 2, 4 and Appendix Tables 2 and 4.

Appendix Table 10. Financial analysis of local breed dairy enterprise with incentive bonus

(Taka)

Year	Capital costs	Production costs	Gross costs	Gross benefits	Present value of gross costs at 14% D. F.	Present value of gross benefits at 14% D. F.	Incremental benefit (= cash flow)	Present value of cash flow at 60% D. F.	Present value of cash flow at 65% D. F.
	1	2	3 (=1+2)	4	5	6	7 (=4-3)	8	9
1	246500	58179	304679	4380	267262.28	3842.11	-300299	-187686.88	-181919.39
2	4500	98798	103298	247966	79484.46	190801.79	144668	56510.94	53137.92
				+50000[a]		+38473.38	+50000	+19531.25	+18365.47
3	4500	124911	129411	297117	87348.74	200545.51	172206	42042.42	38335.09
4	4500	124911	129411	424857	76621.70	251549.45	299946	45768.13	40467.59
5	14500	124911	139411	9417	72405.70	4890.89	-129994	-12397.19	-10629.27
6	4500	124911	129411	478857	58957.91	219160.81	353946	21096.83	17540.15
7	4500	124911	129411	440137	51717.47	175895.17	315226	11743.08	9467.48
8	4500	124911	129411	367157	45366.20	128710.21	242246	5640.23	4409.46
9	4500	124911	129411	341777	39794.91	105099.14	216866	3155.82	2392.41
				+288000[b]		+88562.29	+288000	+4190.95	+3177.14
				+204000[c]		+6273.16	+20400	+296.86	+225.05
Total					778959.37	1412803.90		9892.49	-4945.43

a incentive bonus.
b salvage value of animal.
c salvage value of farm structures and buildings.
Benefit-cost ratio (BCR) at 14% = 1412803.90 ÷ 778959.37 = 1.81
Net present value (NPV) at 14% = 1412803.90 - 778959.37 = 633844.53
Internal rate of return (IRR) = 60 + 5 × [9892.49 ÷ (9892.49 + 4945.43)] = 63.33

Source : Tables 1, 3, 5 and Appendix Tables 3 and 5.

Appendix Table 11. Financial analysis of cross breed dairy enterprise without incentive bonus

(Taka)

Year	Capital costs	Production costs	Gross costs	Gross benefits	Present value of gross costs at 14% D. F.	Present value of gross benefits at 14% D. F.	Incremental benefit (= cash flow)	Present value of cash flow at 55% D. F.	Present value of cash flow at 60% D. F.
	1	2	3 (=1+2)	4	5	6	7 (=4-3)	8	9
1	246500	58179	304679	4380	267262.28	3842.11	-300299	-193741.29	-187686.88
2	4500	98798	103298	247966	79484.46	190801.79	144668	60215.61	56510.94
3	4500	124911	129411	297117	87348.74	200545.51	172206	46243.76	42042.42
4	4500	124911	129411	424857	76621.70	251549.45	299946	51965.64	45768.13
5	14500	124911	139411	9417	72405.70	4890.89	-129994	-14529.97	-12397.19
6	4500	124911	129411	478857	58957.91	219160.81	353946	25523.89	21096.83
7	4500	124911	129411	440137	51717.47	175895.17	315226	14665.61	11743.08
8	4500	124911	129411	367157	45366.20	128710.21	242246	7271.15	5640.23
9	4500	124911	129411	341777	39794.91	105099.14	216866	4199.58	3155.82
				+288000[a]		+88562.29	+288000	+5577.08	+4190.95
				+204000[b]		+6273.16	+20400	+395.04	+296.95
Total					778959.37	1374330.52		7786.11	-9638.76

a salvage value of animal.

b salvage value of farm structures and buildings.

Benefit-cost ratio (BCR) at 14% = 1374330.52 ÷ 778959.37 = 1.76

Net present value (NPV) at 14% = 1374330.52 - 778959.37 = 595371.15

Internal rate of return (IRR) = 55+ 5 × [7786.11 ÷ (7786.11+ 9638.76)] = 57.23

Source : Tables 1, 3, 5 and Appendix Tables 3 and 5.