Pro-Poor
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Policy
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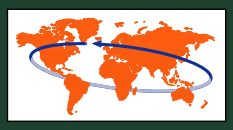

International
Farm Comparison
Network IFCN

A Review of Milk Production in Bangladesh with Particular Emphasis on Small-Scale Producers

T. Hemme, O. Garcia and A. R. Khan

PPLPI Working Paper No. 7

A Living from Livestock

TABLE OF CONTENTS

PREFACE

This is the seventh of a series of "Working Papers" prepared by the Pro-Poor Livestock Policy Initiative. The purpose of this series is to review issues affecting livestock development in relation to poverty alleviation.

The livestock sector plays a vital role in the economies of many developing countries. It provides food, or more specifically animal protein in human diets, income, employment and possibly foreign exchange. For low income producers, livestock also serve as a store of wealth, provide draught power and organic fertiliser for crop production and a means of transport. Consumption of livestock and livestock products in the developing countries, though starting from a low base, is growing rapidly.

The purpose of this study is to assess the economics of dairy farming in Bangladesh and to gauge the prospects for improving the dairy income for small-scale producers, which currently form the backbone of the dairy industry. The document begins with a general overview of milk production in the country, followed by a detailed study of dairy farming in the northern district of Sirajganj. The study only addresses milk production from bovines although the majority of the milk in Bangladesh is produced by goats. Preliminary estimates of the margins in the dairy chain are provided. It is concluded that milk production from bovines in Bangladesh is not competitive internationally and that under a liberal trade regime for dairy products dairy farmers in Bangladesh are unlikely to fully benefit from the vast increase in milk demand predicted to occur over the next ten years unless productivity is significantly improved.

It is hoped that the paper stimulates discussion and any feedback would be gratefully received by the authors and the Livestock Information and Policy Branch of the Animal and Production and Health Division of FAO.

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Disclaimer

Keywords

Costs of production, Bangladesh, milk, policy, poverty reduction, small scale dairy, typical farms.

Date of publication: 5 January 2004.

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1 EXECUTIVE SUMMARY

Introduction

Milk production is a livestock enterprise in which small-scale farmers can successfully engage in order to improve their livelihoods. Regular milk sales also allow them to move from subsistence to a market based income. The main purpose of this study was to gain insight into the household and farm economics of small-scale dairy farmers in Bangladesh and to obtain estimates of their costs of milk production so as to gauge their vulnerability to international competition. A case study approach is used, the aim being qualitative insight rather than quantitative extrapolation.

Methodology

The district of Sirajganj, one of the major milk producing districts in Bangladesh, was chosen for this study. The methodology applied for the economic analysis was developed by the International Farm Comparison Network (IFCN) and utilises the concept of 'typical' farms. Farm types are determined on the basis of the knowledge of regional dairy experts. The first (small) farm type in this study has been defined in a way to represent the size that is close to the statistical average in the study area. The other 'typical' farms represent larger farm types and illustrate economies of scale or exemplify a different dairy production system. Management levels on the typical farms are average to slightly above average compared to other farms of their type.

In the case of Sirajganj, typical farms were defined by the criteria (a) location, (b) size and (c) production system so as to cover the farm types that make important contributions to milk production in the region. Data was collected using a standard questionnaire, and a computer simulation model, TIPI-CAL (Technology Impact and Policy Impact Calculations), was used for biological and economic simulations. The farm input data and the related output figures were discussed and validated with local experts and farmers.

Results

Milk Production in Bangladesh and Sirajganj District

At 2.11 million tons, milk production in Bangladesh in 2002 was relatively low, and Bangladesh has to import around 250,000 tons of milk equivalent annually to satisfy national milk demand. While 36 and 1 percent of the milk in Bangladesh are produced by local cattle and buffaloes, it is goat milk that contributes the largest share of 62 percent to total milk production. Milk yields per 'dairy' bovine (mainly cattle) are less than half of those achieved in Pakistan and India. The vast majority (over 70 percent) of 'dairy' cattle are kept in herds with an average of 3.5 animals.

Analysis of 'Typical Farms' in Sirajganj

Based on the IFCN methodology described, three farm types have been identified as 'typical' and were subjected to detailed analysis:

BD-2: This farm represents a rural household with 2 local cows and 0.4 ha of land. The farm sells about 62 percent of its milk to the local milkman. This farm represents the vast majority of farms and is close to the average farm size in the area.

BD-10: This farm is also located in a rural area but has 1.6 ha of land used for growing small grain crops. Ten dairy animals (2 local and 8 crossbred cows) are kept. 90

percent of the milk is sold to a nearby milk collection point. The household depends on the farm as the only source of income.

BD-25: This rural farm has 1.8 ha of land and keeps 25 crossbred cows. Milk (98 percent) is sold to a milk processing company with a collection centre nearby.

Although BD-10 and BD-25 might be considered as untypical dairy farms in Bangladesh due to their larger herd sizes, a closer look at the dairy sector in Sirajganj shows that these farms represent the fastest growing farm types in the district. Their selection thus provides an outlook into the future of the dairy sector in Bangladesh and allows the analysis of economies of scale.

Dairy Production Systems

On the two larger farms, the dairy animals are kept in tied stalls at all times while the animals on the smallest farm graze several hours per day on communal land. Milking is done by hand on all three farms. Feed rations are based mainly on home-grown fodder and straw and have a small component of energy-rich agricultural by-products such as cereal bran, broken rice, molasses, and oilseed cakes. Urea is also commonly utilised by the two larger farms. On the latter, crossbred cows are the main type of dairy animal whereas the smaller farm uses only indigenous breeds. The family is in charge of the management of the farms and provides 100, 88, and 57 percent of farm labour on BD-2, BD-10 and BD-25 respectively. Production per dairy animal ranges from 1,024 to 1,936 kg energy corrected milk per year.

Household Comparison

All farms have a diverse income structure, income sources being the sale of milk, cash crops, vegetable, eggs, poultry and / or fish, and off-farm employment. Annual household incomes lie between 1,160 US$ (BD-2) and 3,680 US$ (BD-25).

For all the farms, the main cash income source is on-farm (self-)employment (77 to 90 percent). Off-farm employment contributes only 6 percent to the household income of the smallest farm and none on the two other farms. The non-cash benefits obtained from the dairy (in the form of milk and manure for the household) contribute between 10 and 16 percent to the household income on the three farms.

Whole Farm Comparison

The returns from farming range from 1,362 to 16,576 US$ per year. Net cash farm income closely follows the level of total farm returns. The highest net cash farm income (3,270 US$/year) is achieved by farm BD-25. The net cash income of farm BD-2 is at a low of 898 US$ year. This is due mainly to the low share of milk sold.

Comparison of the Dairy Enterprises - Costs of Milk Production

The cost of producing 100 kg of energy corrected milk (ECM) lies around 22 US$ on all three farms. Interestingly no cost difference was found between the small and the large farms. This can be explained by the differing production systems, particularly the related feed costs. The smallest farm (BD-2) grazes cattle ‘for free’ on public land. Therefore feed costs are very low while the larger farms have to purchase feed or grow feed on their land. It appears that this feeding strategy of farm BD-2 compensates for the economies of scale of the two larger farms.

In the year 2002 all farms were able to cover their full economic costs. As long as milk prices remain at the current level and the production systems (grazing on public land) will remain unchanged, all farms can be classified as competitive in the short as well as in the long run.

International Competitiveness of Milk Production

The costs of production of 22 US$ per 100 kg milk (ECM) in Bangladesh can be classified as intermediate within the costs levels estimated by the International Farm Comparison Network (IFCN) for the year 2002. Costs in Bangladesh are about 20 percent below the cost of production in the EU (28 US$ per 100 kg) but 40 to 50 percent above the levels in other countries in the Southern Hemisphere. The large farms in India and Pakistan can achieve production costs below 15 US$ per 100 kg. All three farm types will have difficulties to compete with imports of dairy products as long as the world market prices for milk range between 15 and 18 US$ per 100 kg milk. Moreover, milk producers in Bangladesh will have difficulties in competing with producers from other countries in the region such as India and Pakistan.

Margins of the Dairy Chain in Sirajganj (preliminary estimates)

The prices paid to the farmer for milk with 4.5 percent fat vary between 53 and 83 percent of the consumer prices for milk at different fat contents. The extracted cream value ranges from 0.03 to 0.10 US$ per kg. The returns obtained from processing and retailing one kg of 4.5 percent fat milk in the formal sector are about 13 percent higher than in the informal sector.

The margin for milk processing and retailing in Sirajganj amounts to around half of what the dairy chain in Europe covers to deliver the milk to the consumer. The highest margins (0.23 US$/kg) in the chain are achieved by the co-operatives, while the lowest margins (0.07 US$/kg) are made by farms that sell milk directly to consumers with a fat content of 4.5 percent (no cream extraction).

Conclusions

Based on the consideration that 130 million people in Bangladesh should consume at least 120 g of milk per day (as fluid or processed in any form), the annual milk demand would be about 5.70 million tons. This estimate of milk demand in Bangladesh demand is over two and half times FAO's recorded national milk production for the country (for 2002). Therefore, meeting Bangladesh's potential milk demand is a huge national task and the question arises how well-positioned Bangladesh is to meet this milk demand.

This study shows that the 2 cow farm (BD-2) does not only cover its full economic costs, but can produce milk at a cost almost as low as the larger farms included in the study. This should be very encouraging for more than 7.2 million Bangladeshi families involved in small scale cattle rearing, of which few make a profit and most consider it a highly risky activity.

The small farm (BD-2) is competitive at the national level but not at the international level. The cost of milk production of all farms in comparison to larger farms in India, Pakistan and Oceania is around 50% higher. Assuming a liberal trade of dairy products in the future all farms analysed will have to improve the production systems significantly to gain from the growing demand of dairy products in the country.

Further studies of small dairy farms in Bangladesh need to include a land-less milk production system, a typical goat milk production system and a more exhaustive evaluation of the non-cash benefits obtained from dairy cattle (like draught power). Moreover the cost reduction potential of the farms by improvements in farm management, should be analysed.

2 OVERVIEW – MILK PRODUCTION IN BANGLADESH

2.1 Bangladesh Dairy in the Global Context

World Milk Production

In 2002, with a production volume of 2.11 million tons Bangladesh produced 0.35 percent of total world milk production. This represents around 6.7 and 2.5 percent of the milk production of Pakistan and India respectively or less than 2 percent of the milk production of South Asia.

'Dairy Bovines'

Bangladesh has 24 and 0.8 million cattle and buffalo respectively, over two and a half as many bovines as New Zealand, one of the major dairy exporters worldwide. Unlike in India and Pakistan, milk production from bovines in Bangladesh relies heavily on cattle rather than on buffaloes while goats contribute more than half of national milk production.

Dairy Farm Sizes

The graph on the following page shows how small the dairy farms in India and Bangladesh are in comparison with those of other major milk producing nations. The most common herd size ranges between 1 and 2 cows per farm. These figures are based on expert estimates as official farm structure statistics for the whole of Bangladesh are not available. Saadullah (2000) estimates that over 70 percent of the dairy farms would have an average of 3.5 bovines.

Milk Yields

The average milk yield per bovine reported for Bangladesh is extremely low. On average a Bangladeshi cow is reported to produce around 200 kg/year, which is below 30 percent the production of an Indian cow. This low milk yield is mainly due to poor feed resources and low milk productivity of the most common types of animal, which are of one of the local breeds.

Milk Prices

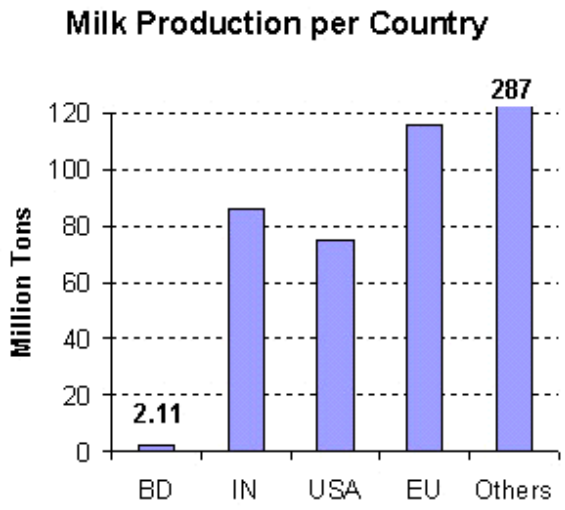
Farm gate milk prices in Bangladesh are about 40 to 50 percent higher than in India and New Zealand, but about 30 and 17 percent lower than in the USA and Germany respectively.

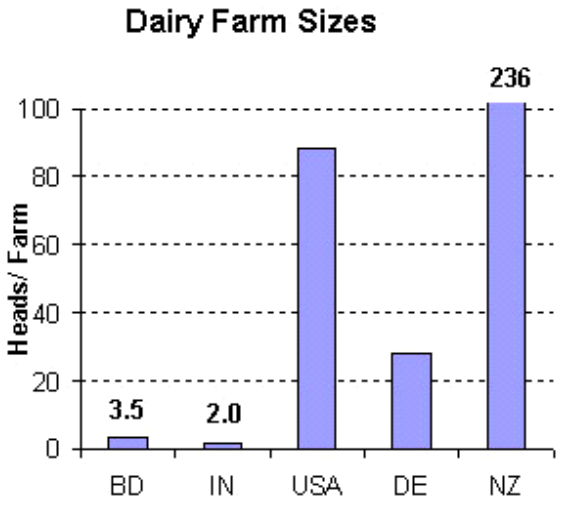
Milk Production per Capita

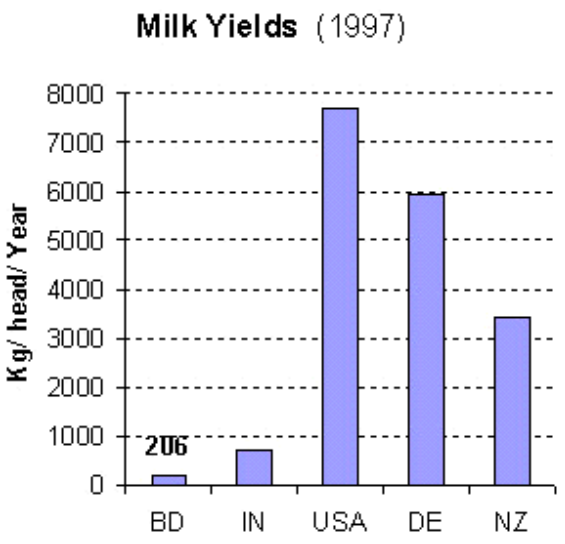
A comparatively low national milk production and a high population result in a per capita milk production in Bangladesh of 13 kg/capita/year, which is 16 percent of the per capita milk production achieved in India.

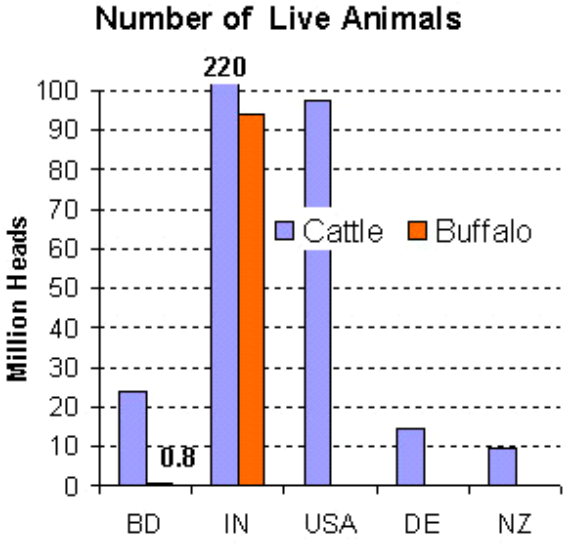
Explanations of variables; year and sources of data:

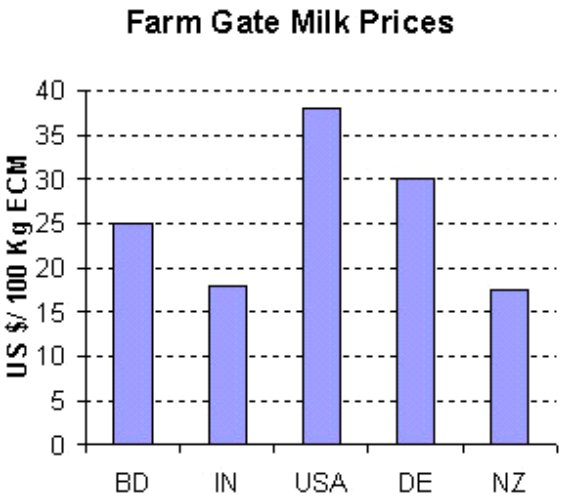
- Milk Production per Country: FAO Statistics at http://www.fao.org (as in May 29, 2003)
- Dairy Farm Sizes (Average): IFCN Dairy Report 2003, Saadullah (2000).
- Milk Yields per Milch Animal: Directorate of Livestock Services, Government of Bangladesh (2002)
- Number of Live Animals: FAO Statistics including all bovine animals; at http://www.fao.org (as in May 29, 2003)
- Farm Gate Milk Prices: Monthly Statistical Bulletin of Bangladesh (2002)
- Production per Capita: total milk production in Bangladesh (given by FAO Statistics (at http://www.fao.org as in May 29, 2003) divided into the country population.

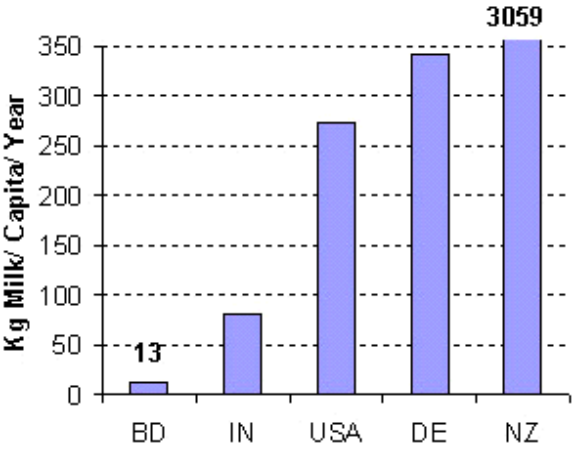

Milk Production per Country
Million Tons
120
100
80
60
40
20
0
2.11
287
BD
IN
USA
EU
Others


Dairy Farm Sizes
Heads/ Farm
100
80
60
40
20
0
3.5
2.0
236
BD
IN
USA
DE
NZ


Milk Yields (1997)
Kg/ head/ Year
8000
7000
6000
5000
4000
3000
2000
1000
0
206
BD
IN
USA
DE
NZ


Number of Live Animals
Million Heads
100
90
80
70
60
50
40
30
20
10
0
0.8
220
Cattle
Buffalo
BD
IN
USA
DE
NZ


Farm Gate Milk Prices
US $/ 100 Kg ECM
40
35
30
25
20
15
10
5
0
BD
IN
USA
DE
NZ


Milk Production per Capita
Kg Milk/ Capita/ Year
350
300
250
200
150
100
50
0
13
3059
BD
IN
USA
DE
NZ

2.2 Recent Dairy Developments in Bangladesh

Developments of Milk Production in Bangladesh

From 1996 to 2002 milk production in Bangladesh increased by merely 3 percent. Over 62 percent of the country's milk is goat milk whereas cattle contribute 36 percent. Buffalo contribute about 1 percent to national milk production, comparable to the contribution made by sheep (under 'others' in the graph).

Regional Shares of Bangladesh Milk Production

Nearly half of the milk in Bangladesh is produced on the northern region, where Sirajganj district is located. Good availability of fodder and multiple dairy development programs are main reasons for the higher share of milk production from this area.

Development of Milk Yields

Bangladesh has seen a slight improvement in milk yields in the period 1996 to 2002. The majority of animals, which are local cattle breeds, increased milk yield by around 5 percent, while milk yield of crossbred cows and buffaloes increased by 4 to 8 percent.

Development of the Numbers of 'Live Animals'

Between 1996 and 2002, the number of bovines in Bangladesh has increased by no more than 1 percent. The buffalo population increased by about 4 percent in this period, while the number of cattle increased by less than 1 percent. The main reasons for the stronger increase in buffaloes are the establishment of the Rampal Artificial Insemination Centre in Bagarhat District and a loan program for buffalo rearing.

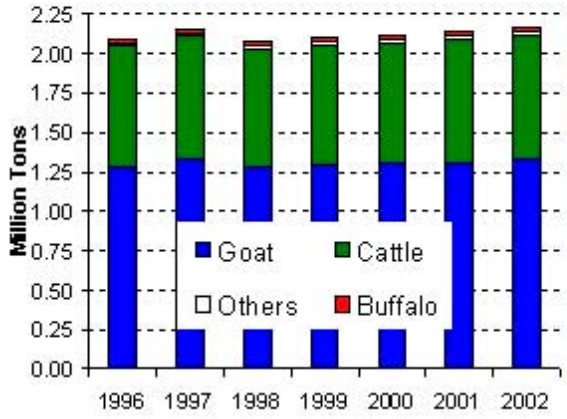
Development of Milk Prices

While nominal milk prices in Bangladesh grew by 50 percent from 1996 to 2002 (in Taka), the exchange rate to the US Dollar rose only by 40 percent and the national inflation was 35 percent (1996 to 2002). In real terms, milk prices received by farmers have increase by about 16 percent over the past six years.

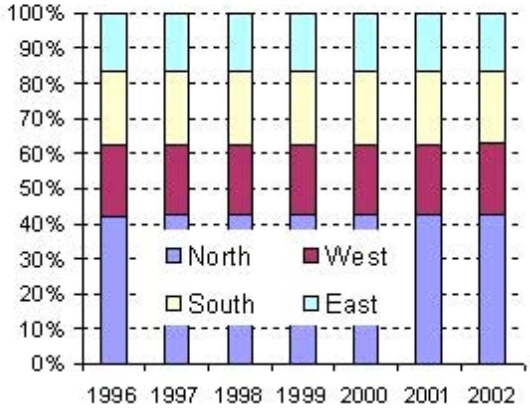
Explanations of variables; sources of data:

- Local Cattle: Dairy animal of local origin (Bos indicus)
- Crossbred: local cattle crossed with a highly productive breed (Bos taurus; usually Holstein)
- Milk production: FAO Agricultural Statistics (2003), http://www.fao.org, May 2003.
- Regional Milk Production: Calculations from 'Directorate of Livestock Services, (2002)'; and 'Bangladesh Bureau of Statistics' (2003).
- Daily Milk Yield: Directorate of Livestock Services (1996-2002).
- Number of Live Animals: FAO Agricultural Statistics (2003), http://www.fao.org, May 2003.
- Milk Price Development: Monthly Statistical Bulletin of Bangladesh (2002); data converted into ECM (Energy Corrected Milk).

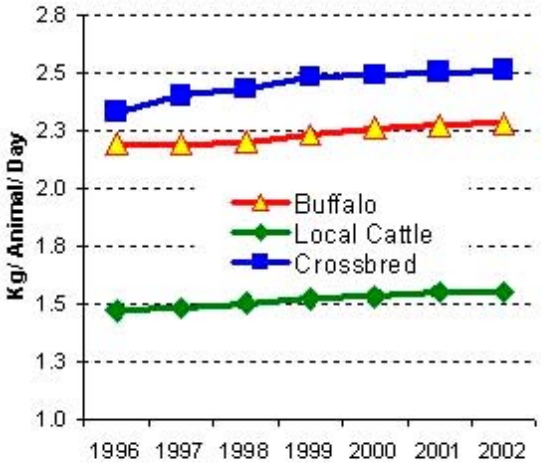
Milk Production



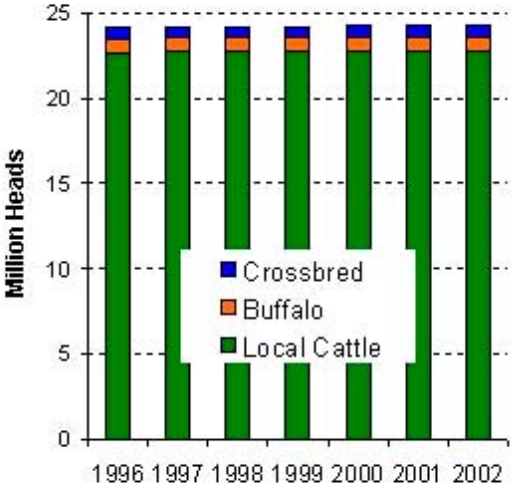
Milk Production by Regions



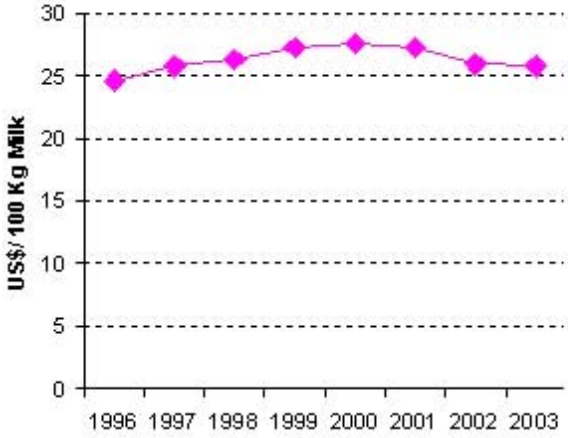
Daily Milk Yields



Number of Live Animals

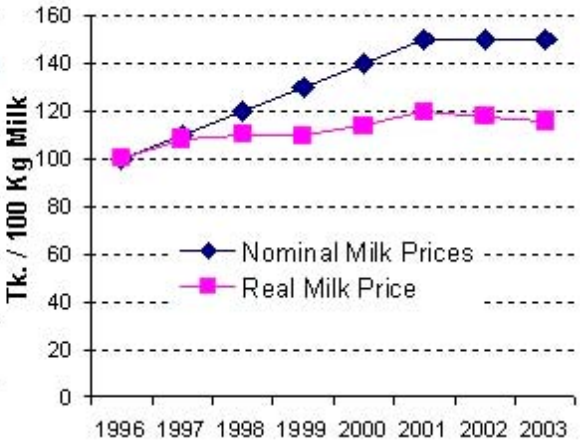


Milk Price Developments



Milk Price Developments

(Indexed to 1996 Prices)



2.3 Processing and Marketing Channels for Dairy Products

It is estimated that about 3 percent of the milk produced in Bangladesh flows through the formal channels of processing. The remaining 97 percent are informally handled as liquid milk through small travelling traders (locally called Farias) and distributing traders (locally called Paikers) as shown in the diagram overleaf.

Liquid Milk

Subsistence farmers usually consume most of their farm milk in the form of fresh liquid milk and various home-made dairy products such as curd and butter oil (ghee). The surplus milk products are sold in the village or bartered in exchange for other products.

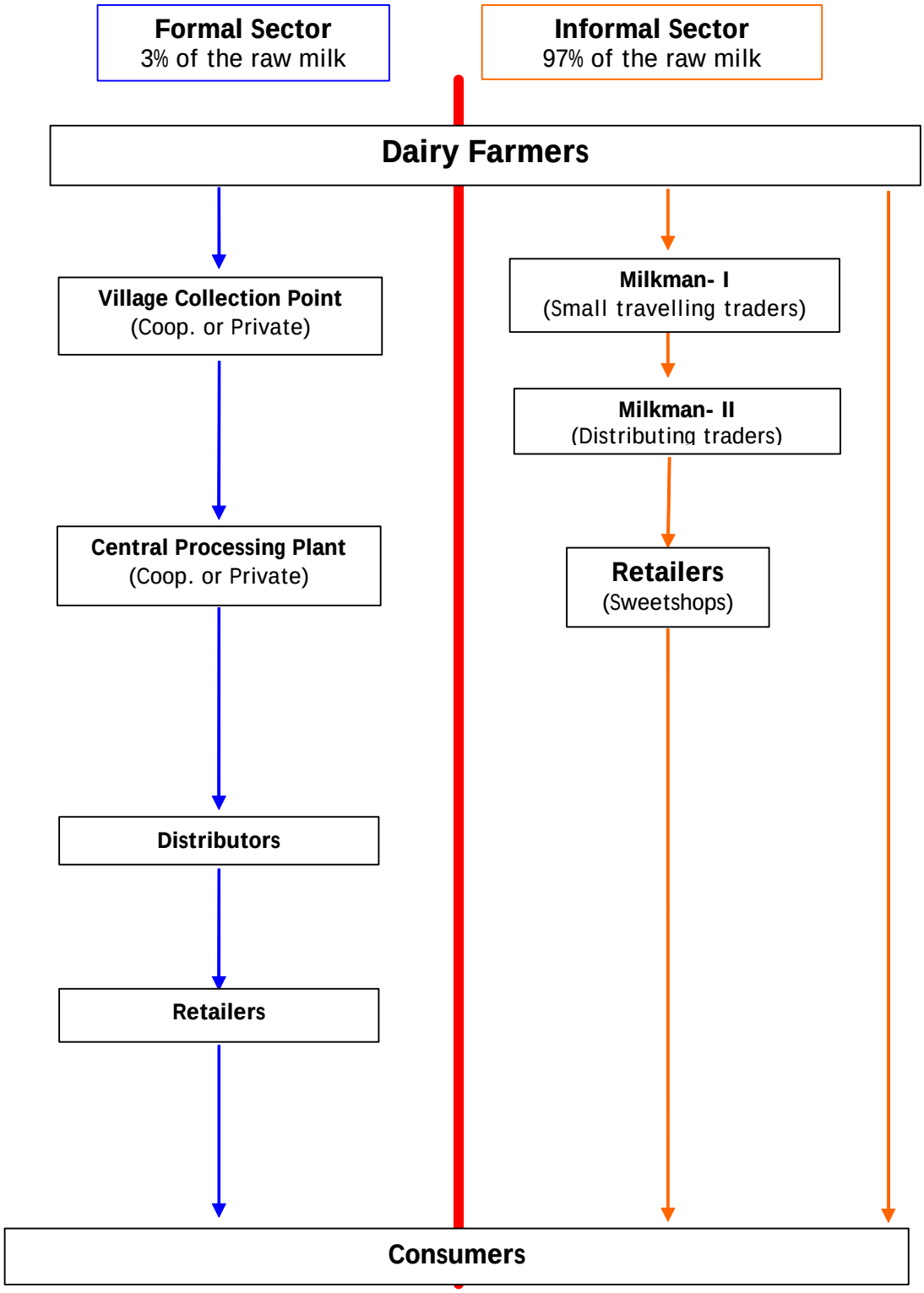
More commercially oriented rural farmers (over 3 animals) sell their surplus milk either to the local milkman or deliver it to the village milk collection point of the local dairy co-operative society or, less frequently, to collection points of corporate processing companies. Commercial farms near major population centres usually sell their milk directly to the customer as the milk prices in towns are very attractive.

Dairy Products

A list of dairy products available in urban centres of Bangladesh will include pasteurised liquid milk, butter, ghee, ice-cream and ice lollies, full cream milk powder, skim milk powder, flavoured milk, sweet curd, cream and rasa malai (sweetmeats).

Although both the formal and informal sectors process milk, their processing and marketing systems are quite different. The formal sector, led by co-operative societies, extracts cream from the raw milk to produce ghee and butter. The resulting creamless milk is utilised as the main raw material for their pasteurised (3.5 percent fat content) milk. This milk is sold in plastic bags of 0.5 and 1 litre.

Although most milk processing is done at the household level, sweetshops producing sweetened dairy products are the main player. Sweetmeat is the local term for a coagulated and sweetened milk product, which is consumed as a sweet snack and or dessert. Sweetmeat is by far the most popular dairy product sold by the informal sector followed by Ghee and some other typical sweets.



Source: Own illustration (based on Saadullah, 2000).

3 ANALYSIS OF THE DAIRY SECTOR IN SIRAJGANJ DISTRICT

3.1 Recent Dairy Developments in Sirajganj

Milk Production

The total milk volume obtained from local cattle increased by about 20 percent from 1996 to 2002, whereas milk obtained from crossbred cows increased by 14 percent over the same period. These increases were driven by higher milk yields for both types of cows and by the replacement of local cattle with crossbreds. Buffalos are not very prevalent in Bangladesh.

Milk Yields

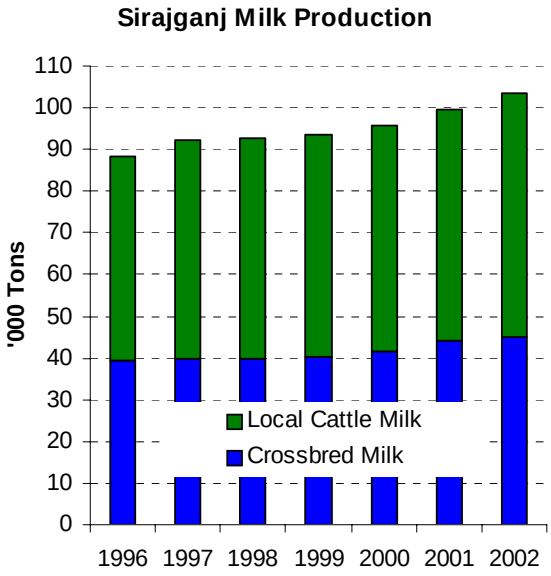
Starting from a much lower milk yield level (around 3 kg per day), daily milk output of local cows increased by 22 percent from 1996 to 2002 while for crossbred cattle the increase was 11 percent (staring from around 6.2 kg per day).

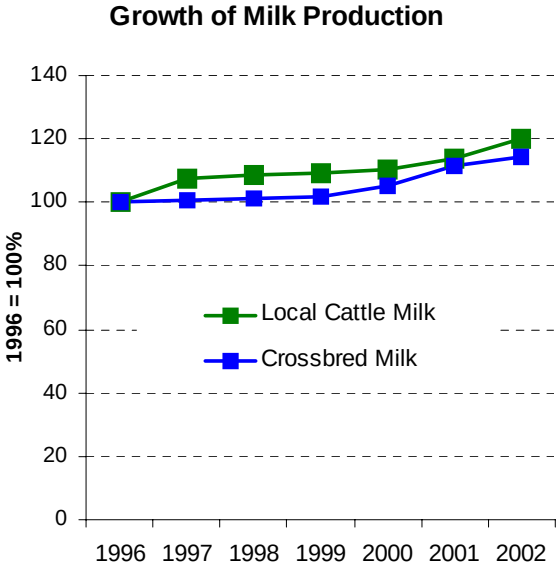
Composition of the Dairy Herd

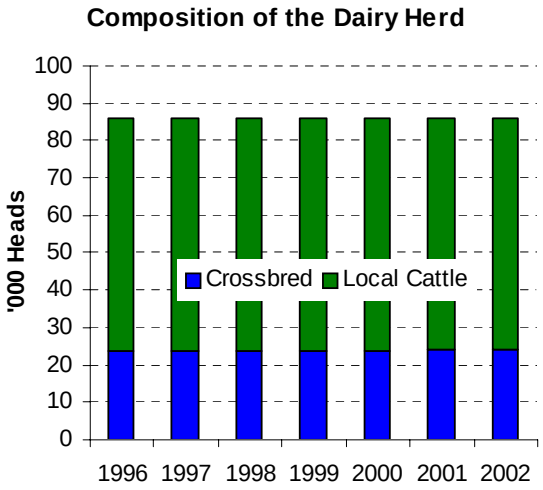
The total number of cattle in Sirajganj increased by less than one percent from 1996 to 2002. However, the number of cows of local breeds shows a small decrease of about one percent over the period while the number of crossbred cows rose by around 2 percent. This substitution of local cattle with crossbred cattle is a result of the experience that milk production with crossbred animals is more profitable and that most farmers in the region can, with minor changes, achieve higher incomes. Nevertheless, local cattle still constitute around three quarters of the cattle population of the district.

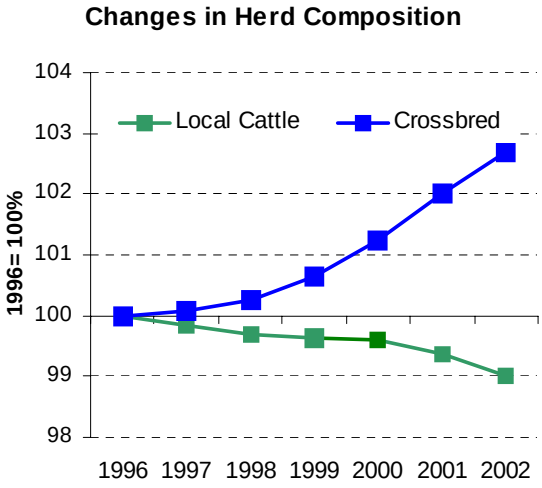
Explanations of variables; year and sources of data:

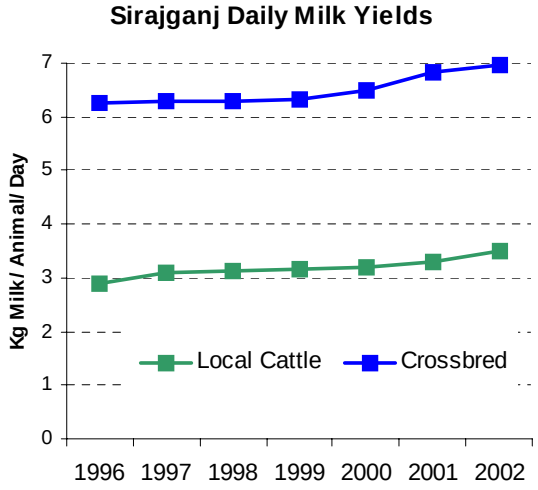
- Local Cattle: Original 'dairy' animals (mostly Bos indicus), which have a relatively low milk yield but are well adapted to local conditions.
- Crossbreds: Dairy animals with varying degrees of a highly productive dairy genetics (Bos taurus; usually Holstein Friesian) and one of the many local breeds.
- Milk Production: Bangladesh Milk Producer's Co-operative Union Ltd, 2002.
- Sirajganj Daily Milk Yields: Bangladesh Milk Producer's Co-operative Union Ltd, Sirajganj, 2002.
- Composition of the Dairy Herd: Bangladesh Milk Producer's Co-operative Union Ltd, Sirajganj, 2002.

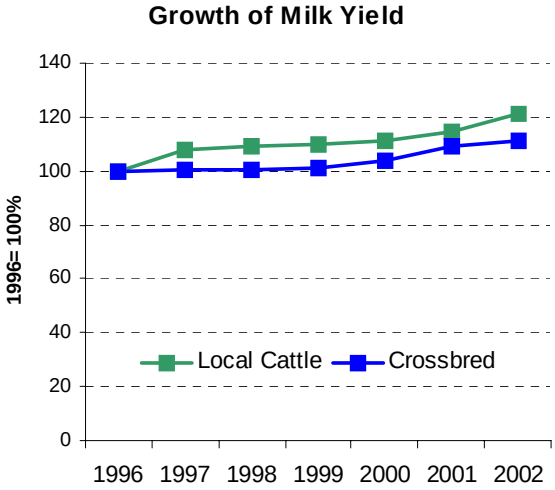

Sirajganj Milk Production
'000 Tons
110
100
90
80
70
60
50
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002
Local Cattle Milk
Crossbred Milk


Growth of Milk Production
1996 = 100%
140
120
100
80
60
40
20
0
1996 1997 1998 1999 2000 2001 2002
Local Cattle Milk
Crossbred Milk


Composition of the Dairy Herd
'000 Heads
100
90
80
70
60
50
40
30
20
10
0
1996 1997 1998 1999 2000 2001 2002
Crossbred
Local Cattle


Changes in Herd Composition
1996= 100%
104
103
102
101
100
99
98
1996 1997 1998 1999 2000 2001 2002
Local Cattle
Crossbred


Sirajganj Daily Milk Yields
Kg Milk/ Animal/ Day
7
6
5
4
3
2
1
0
1996 1997 1998 1999 2000 2001 2002
Local Cattle
Crossbred


Growth of Milk Yield
1996= 100%
140
120
100
80
60
40
20
0
1996 1997 1998 1999 2000 2001 2002
Local Cattle
Crossbred

3.2 Natural Conditions and Farm Structure in Sirajganj

Sirajganj district is situated between 24^0 01′ and 24^0 47′ North latitudes and between 89^0 15′ and 89^0 49′ East longitude. Sirajganj has an area of 2,498 km^2 (964 sq. miles) which including riverine areas, which is around 1.7 percent of the total area of Bangladesh. Sirajgonj ranks 4^{th} in size among the 16 districts of Rajshahi division and 25^{th} among the 64 districts of Bangladesh.

Natural Conditions

Temperature

Sirajganj experiences moderate and high temperatures throughout the year with only slight variation between seasons. Summer begins in mid-April and lasts up to mid-June. Winter normally lasts from December to late February.

Rainfall

The monsoon (rainy) season commences towards the end of June and continues to September. The level of rainfall is highest during the monsoon and the lowest in March. Demand for irrigation from tube-wells in the area peaks in March.

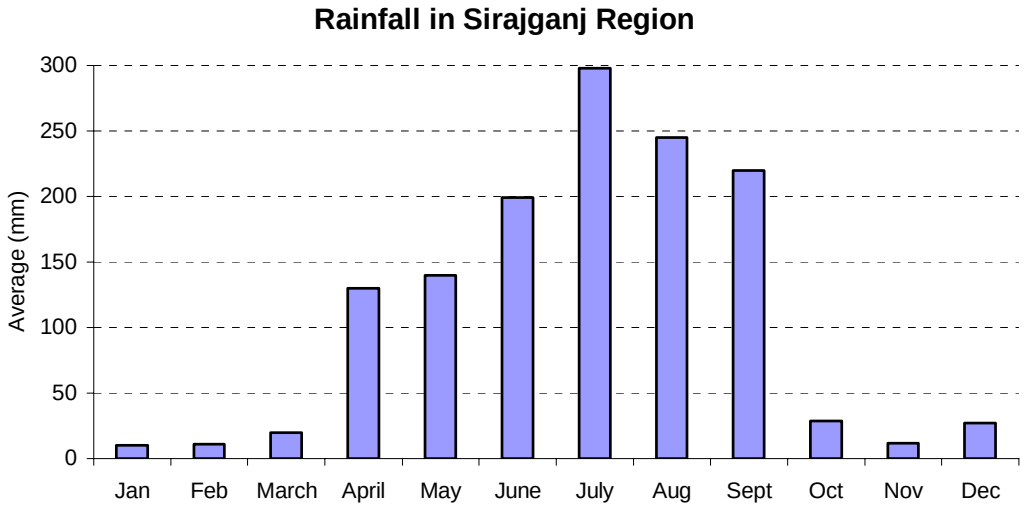
Farmland Structure in Bangladesh

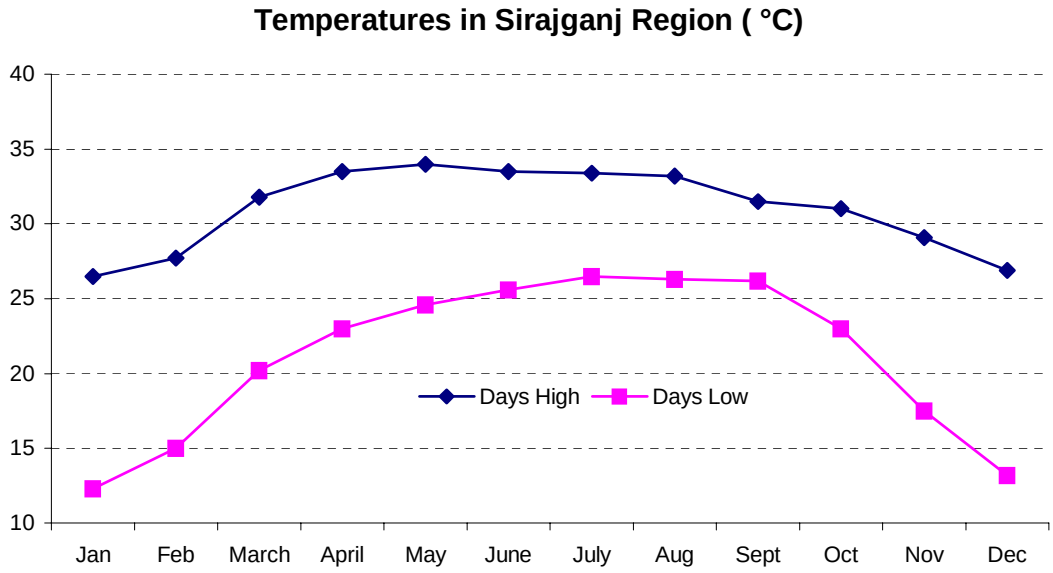
In Bangladesh, about 70 percent farms hold under 6 hectares of land. Most, if not all, of these small farmers engage in some livestock farming as a parallel activity to the crop and/or fish farming. Less than 8 percent of the farms have land holdings of more than 18.5 hectares.

The economy of Sirajganj district is mainly dependent on agriculture. Over 60 percent of the holdings perform multiple farming activities all year long. The most common mixtures of enterprises are crop production (mainly paddy, wheat, pulses, vegetables and other minor crops) and animal production (mainly dairy, goat, poultry, sheep and fish farming).

Explanations of variables; year and sources of data:

- Temperature: Bangladesh Meteorological Department. 2002.
- Rainfall: Bangladesh Meteorological Department. 2002.
- Farm Structure: Saadullah and Hossain. 2000.





Farm Structure in Bangladesh

Farm Type	Land less	Small	Medium	Large
Farm Land Size (ha)	0 - 0.019	0.02 - 1.00	1.01 - 3.03	> 3.04
Average Cow Number (hd)	2	2,9	3,7	4,4
Shares of Farm Types (%)	28,5	39,6	23,5	8,4

3.3 Description of the 'Typical' Farms in Sirajganj

Three typical milk production systems have been identified by IFCN in the district of Sirajganj. One farm from each category has been analysed for this study. In the following part each farm is briefly described. More details, particularly about the dairy production systems can be found on the next page.

2-cow farm (BD-2)

Location: A family farm with 0.4 ha of irrigated land located in the rural upland.

Activities: The farm keeps 2 indigenous cows of the Pabna type. Its feeding system consists of 3 to 4 hours/day of grazing on communal land and stall feeding with some concentrates. About 63 percent of the milk produced is sold to the local milkman. The farm raises its own heifers as replacement. Off-farm income is minimal (6 percent of total household income).

10-cow farm (BD-10)

Location: A rural farm with 1.55 ha of irrigated land (no land rented).

Activities: The farm keeps 2 indigenous and 8 crossbred cows. It delivers 90 percent of the milk produced to the nearest collection point. The feed basis is provided by crop residues and fodder, both grown on-farm. Lactating cows are supplemented with cottonseed cake, molasses and urea. The farm raises its own replacement heifers. No off-farm income is earned by any of the family members.

25-cow farm (BD-25)

Location: A farm in the rural area with 1.8 ha of irrigated land.

Activities: The farm keeps 25 crossbred cows. Over 97 percent of its milk is sold at the nearest milk collection point. The feed rations consist of cereal straw, green fodder, concentrate by-products such as oilseeds, wheat bran, molasses and urea. The farm raises about 15 percent of its own heifers and purchases cows early in their lactation or near calving.

Farm	Units	BD-2	BD-10	BD-25
Land Owned	ha	0.40	1.55	1.80
Land Rented		0	0	0
Dairy Enterprise				
Milk Animals	no.	2	10	25
Breed	description	Indigenous (Pabna type)	2 Indigenous 8 Crossbreds	25 Crossbreds
Liveweight	kg	275	300	300
Milk yield	kg ECM/cow/yr	1.024	1.385	1.937
Fat and protein content	%	4.5% / 3.7%	4% / 3.5%	4% / 3.5%
% milk sold	%	62%	90%	97%
Land use Dairy enterprise				
Land use for dairy	ha	0.180	0.540	1,100
Milk produced per ha	Kg ECM / ha	10.900	25.454	44.015
Stocking rate	LU / ha	5	7	14
Labour				
Full time employees	persons	0	0	2
Share of family labour	% of total	100%	88%	57%
Hours per milking cow	h / cow/ yr	1.463	937	607
Buildings				
Housing type	description	Mud & bricked house + thached roof	Bricked house + tiled roof	Bricked shed + roof (steel frames).
Building Built	year	1999	1996	1998
Milking				
Milking system	description	hand	hand	hand
Calves/ Animal/ Year	head	0.91	0.98	0.98
Length of lactation	days	270	295	295
Collection Centre	km (far)	7	5	4
Herd management				
Seasonality	yes / no	no	no	no
Dry period	months	4	3	3
Feeding times	per day	1	3	3
Death rate	% cows	1.0	1.0	1.0
Cow Culling rate	%/ year	15	15	25
Feeding				
Feeding systems	description	Grazing + stall fed	stall fed	stall fed
Roughage feed source	description	grasses * + rice straw	grasses * + rice straw	grasses * + rice straw
Concentrates fed	description	Broken rice + rice bran +oilseed** cake +salts	Broken rice/ bran +molasses +oilseed** cake + urea +salts	Broken rice/ bran +molasses +oilseed** cake + urea +salts
Concentrate use in total	t per cow	0.33	0.53	0.89
Concentrate input	g / kg ECM	322.00	381.50	459.90
Calf rearing				
Death rate of calves	% calves	20%	20%	25%
Weaning period	months	6 ***	6 ***	3 ***

Notes: * Grasses include millet types of green chops (and for BD2 native local grasses on road sides and public land).

** means cakes from Cottonseed and or Mustard seed.

*** calves are kept apart from the cows and at the milking time used to help the milk letdown.

3.4 Farm Comparison: Household Approach

Size of the Household - Labour Utilisation

The three farm families each consist of five or six members, which corresponds well with the average family size in the region (six persons/family). Only family members from the smallest farm work off-farm. The estimation of the allocation of family labour to the dairy enterprise and its valuation have proven difficult, and the estimates should be considered as tentative. It was estimated that household BD-2 sums a total of 4,080 working hours per year of which 56 percent are for its dairy, 14 percent for off-farm employment, and the remainder for other farm activities. BD-10 accumulates a total of 6,720 working hours (80 percent for the dairy and 20 percent for the crop enterprise). BD-25 utilises 7,350 hours of labour per year (75 percent for the dairy and 25 percent for the crop enterprise).

Household Income Levels

The household income includes the net cash farm income, the salary brought home from off-farm employment and the value of manure (heating) and milk used in the household. The annual household incomes range from 1,160 US$ (BD-2) to 3,680 US$ (BD-25). BD-10 has a relative high household income of 3,240 US$, which can be explained by its low production costs.

Household Income Structures

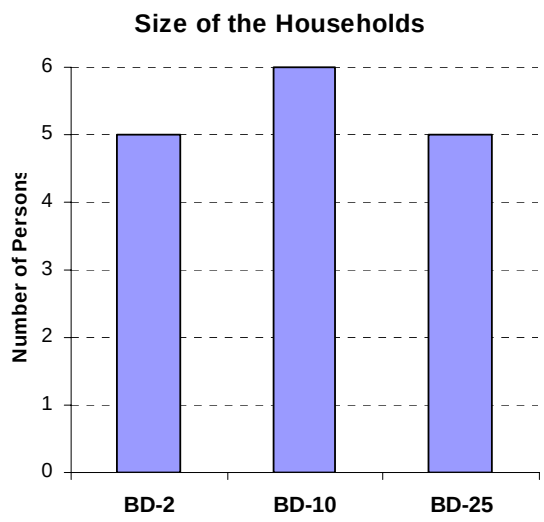
The non-cash benefits obtained by BD-2 constitute 17 percent of its household income, whereas 77 and 6 percent of its income come from its own farm employment and off-farm sources respectively. These non-cash benefits do not include the draft power provided by the dairy cows on farms BD-2 and BD-10 (used for soil preparation and transportation mainly) the value of which lies in the order of 10 and 7.5 US$/cow/year for BD-2 and BD-10 respectively. BD-25 has a power tiller or simply contracts out any heavy farm work when required.

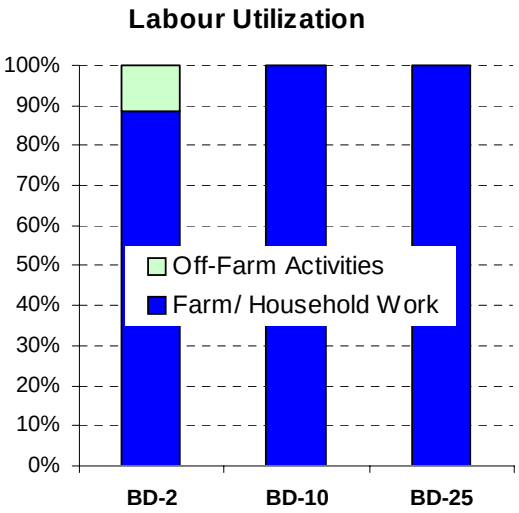
Household Living Expenses

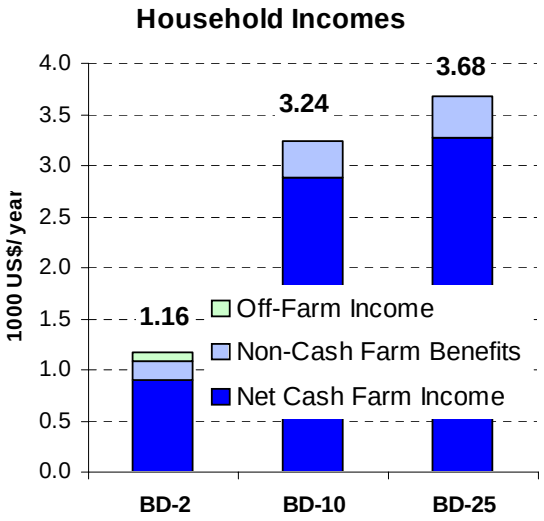
The family living expenses increase with increasing farm/herd size. All households are able to cover their living expenses from their farm incomes. It should be noted that the family living on the farm BD-2 on 1,160 US$/year (232 US$/person/year) survives under 'poor' living conditions. The households on BD-10 and BD-25 dispose of more than 540 and 736 US$/person/year.

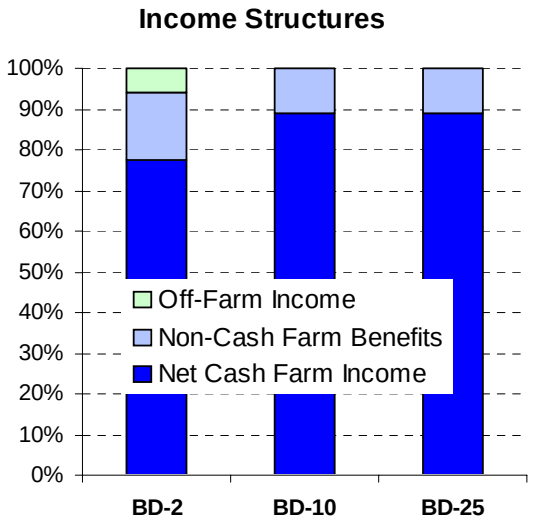
Explanations of variables; year and sources of data:

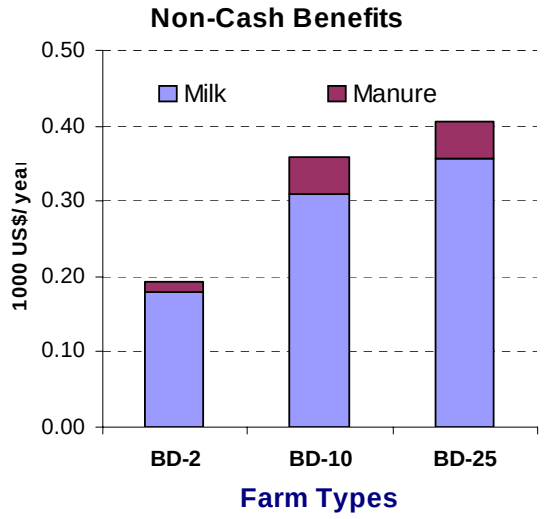
- Size of the household: People living together in one house
- Labour utilisation: Family labour used to generate income
- Household income: Includes cash and non-cash incomes from farm and off-farm activities
- Off-farm incomes: Includes all salaries for all family members
- Non-Cash Benefits: Value of manure (7.5 US$/animal/year) & milk used by the family.
- Net cash farm income: Total farm receipts minus total farm expenses
- Household living expenses: Annual cash expenses for the family to maintain current living conditions.
- Exchange rate used: 1 US$ = 59.63 Bangladeshi Taka.
- Sources of Data: IFCN data collection based on expert estimations and statistics, year 2002.

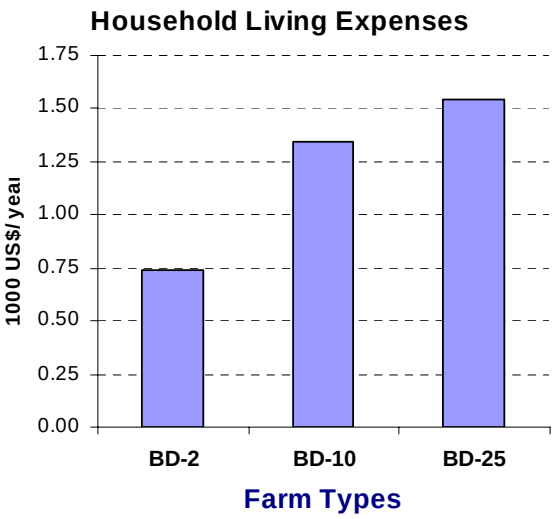

Size of the Households
Number of Persons
0
1
2
3
4
5
6
BD-2
BD-10
BD-25


Labour Utilization
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Off-Farm Activities
Farm/ Household Work
BD-2
BD-10
BD-25


Household Incomes
1000 US$/ year
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3.68
3.24
1.16
Off-Farm Income
Non-Cash Farm Benefits
Net Cash Farm Income
BD-2
BD-10
BD-25


Income Structures
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Off-Farm Income
Non-Cash Farm Benefits
Net Cash Farm Income
BD-2
BD-10
BD-25


Non-Cash Benefits
1000 US$/ year
0.50
0.40
0.30
0.20
0.10
0.00
Milk
Manure
BD-2
BD-10
BD-25
Farm Types


Household Living Expenses
1000 US$/ year
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
BD-2
BD-10
BD-25
Farm Types

3.5 Farm Comparison: Whole Farm Approach

Farm Returns

Farm returns range from 1,362 (BD-2) to 16,576 (BD-25) US$ per year. The farm returns are highly dependent on the herd size of the farms. The return structure show that the larger the herd size the lower the contribution of the crop and other farm activities to the total farm returns.

Net Cash Farm Income (NCFI)

The net cash farm income mainly follows the level of farm returns. However, although BD-10 only had two fifths of the farm returns of BD-25, its net cash farm income amounts to more than four fifths of the NCFI of BD-25. This can be explained by BD-10 having higher milk returns and considerably lower cash costs than BD-25.

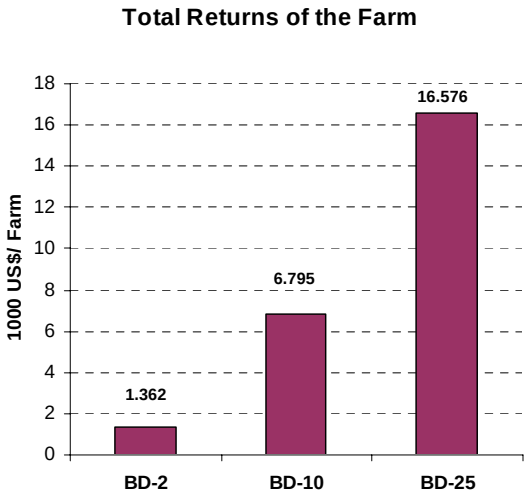
The low share of milk sold (about 62 percent) explains BD-2's low net cash farm income (about 900 US$/year).

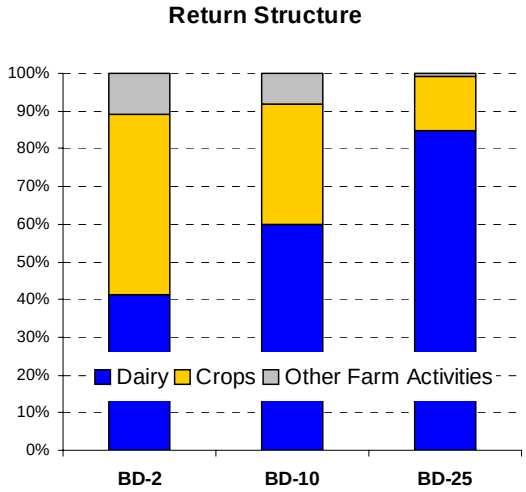
Farm Assets

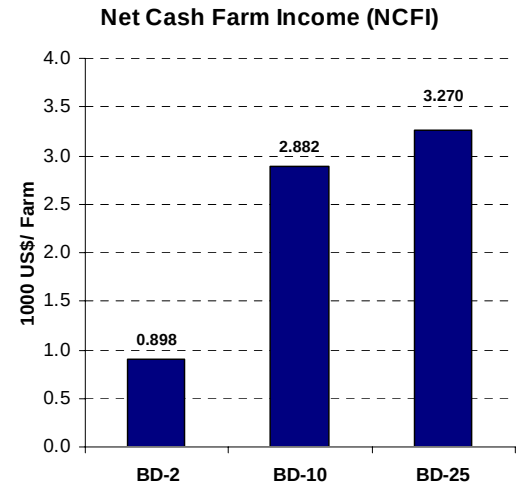
On a whole farm basis, land is the most important asset given that land prices are very high (about 7,800 US$/ha). Therefore, land values represent from 60 to 70 percent of farms assets. Cattle constitute the second most important asset category varying from 19 up to 31 percent of farm asset value. 'Other Animals' in the graph overleaf refers to goats, sheep, or poultry kept on the farm (relevant only for BD-2). Machinery, buildings and cash on hand, are combined in the category of 'other' assets and make up between 15 and 8 percent of the value of farm assets.

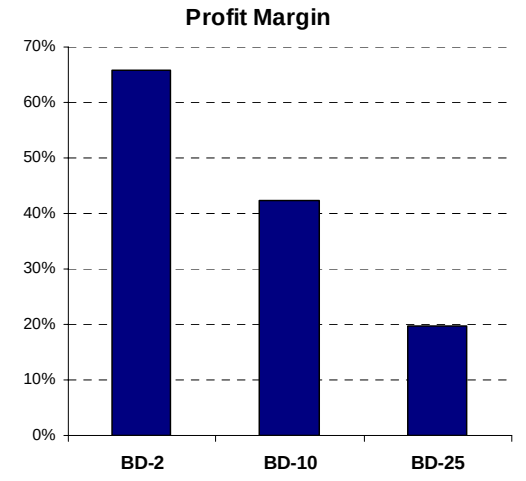
Explanations of variables; year and sources of data:

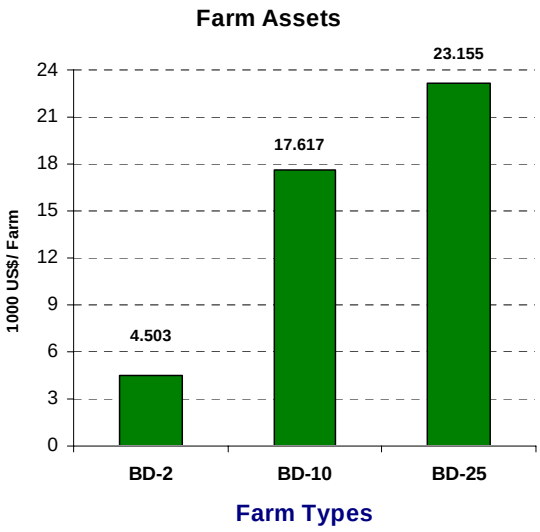
- Total returns: All cash receipts minus the balance of inventory (for example livestock).
- Returns from the dairy: Milk, cull cows, heifers, calves, sale of manure, etc.
- Returns from the crops: Sale of surplus crops like rice, wheat, vegetables, etc.
- Other returns: returns from raising goats and poultry (for BD-2); fish and vegetable (BD-10); and selling manure (BD-25).
- Net cash farm income (NCFI): Cash receipts minus cash expenses of the farm.
- Profit margin: Net cash farm income divided by total farm returns.
- Farm assets: All assets related to the farm (land, cattle, machinery, buildings, etc.)
- Exchange rate used: 1 US$ = 59.63 Tk.
- Sources of data: IFCN data collection based on expert estimations and statistics, year 2002.

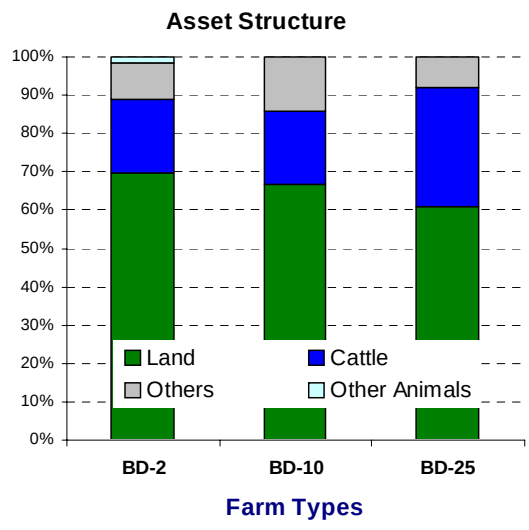

Total Returns of the Farm
1000 US$/ Farm
18
16
14
12
10
8
6
4
2
0
16.576
6.795
1.362
BD-2
BD-10
BD-25


Return Structure
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Dairy
Crops
Other Farm Activities
BD-2
BD-10
BD-25


Net Cash Farm Income (NCFI)
1000 US$/ Farm
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3.270
2.882
0.898
BD-2
BD-10
BD-25


Profit Margin
70%
60%
50%
40%
30%
20%
10%
0%
BD-2
BD-10
BD-25


Farm Assets
1000 US$/ Farm
24
21
18
15
12
9
6
3
0
23.155
17.617
4.503
BD-2
BD-10
BD-25
Farm Types


Asset Structure
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Land
Cattle
Others
Other Animals
BD-2
BD-10
BD-25
Farm Types

3.6 Farm Comparison: Dairy Enterprise Approach

Cost of Milk Production

Milk production costs are very similar, 22.4 and 22.9 US$/100 Kg ECM milk for the largest (BD-25) and the smallest farm (BD-2) respectively. The absence of any apparent economies of scale can be explained by the following factors: (1) BD-2 reduces its production costs by grazing its animals on public land for free and has low marketing costs by directly selling its milk at farm gate ; while (2) BD-25, by having a relatively small farmland area allocated to its dairy enterprise, is forced to purchase most of its feed, raising production costs, and the farm's large volume of milk produced requires haulage to the processing plant for around 0.85 US$/100 kg milk (paid by the farm). In a 'typical' year BD-25 culls 6 of its lowest producing cows which leads to high replacement costs and increases what is referred to as 'Other Means of Production') on the graph.

Return Structure

The returns per 100 kg ECM produced range from 28.0 to 29.85US$. This variation of 1.85 US% per 100 kg ECM is mainly attributable to differences in the milk returns achieved. The returns from the sale of livestock (heifers and cull cows) vary between 4.35 to 4.70 US$ per 100 kg ECM. The market value of the non-cash benefits (manure used by the household) are over three and a half times higher in BD-2 than in BD-25 (0.73 and 0.20 US$ per 100 kg ECM respectively).

Cost Structure

On the smaller farm, the main component of the production costs are the opportunity costs for family labour since BD-2 has its cows grazing in communal lands for 2 to 4 hours per day and someone must vigilate them at all times. Thus, for BD-2 only 24 percent of the production costs are cash expenses. The two larger farms employ workers and use more purchased feed such as concentrates and fodder, which increases the cash costs significantly (75 and 85 percent of total cost). Furthermore, the two larger farms have a 3-year loan each, whereas the small farm has none.

Contrary to expected economies of scale, BD-25 has higher feed costs and higher costs for 'other means of production' per litre of milk than BD-10. The higher costs of BD-25 for 'other means of production' are mainly a result of purchasing cows in or near lactation while the other farms raise their replacements.

Farm Income

All farm types cover their production costs from the *profit and loss account* and produce a positive farm income. Per 100 kg milk this income is highest, 21.80 US$ on the small farm (BD-2). The profit margin in the dairy enterprise ranges from 20 to 76 percent of the total farm returns. The figure for BD-10 differs significantly from the whole farm margin. It seems that in this farm the margins non dairy farm activities are above the dairy activities.

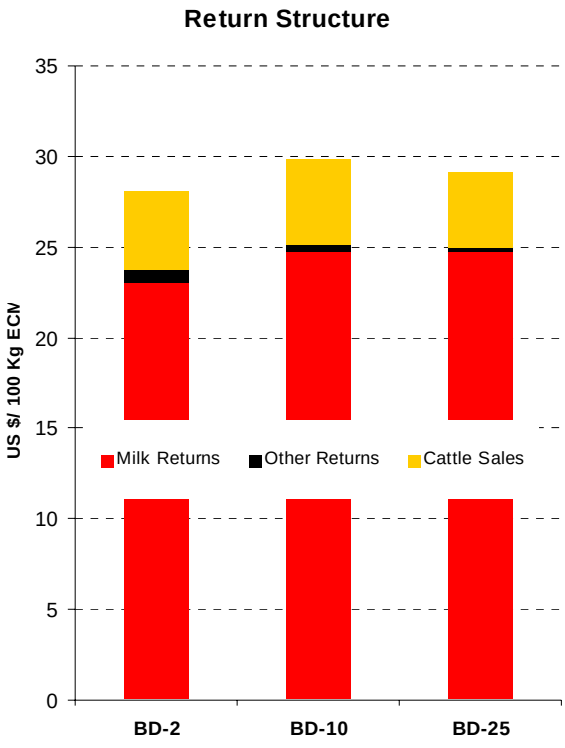
Entrepreneurial Profit and Returns to Labour

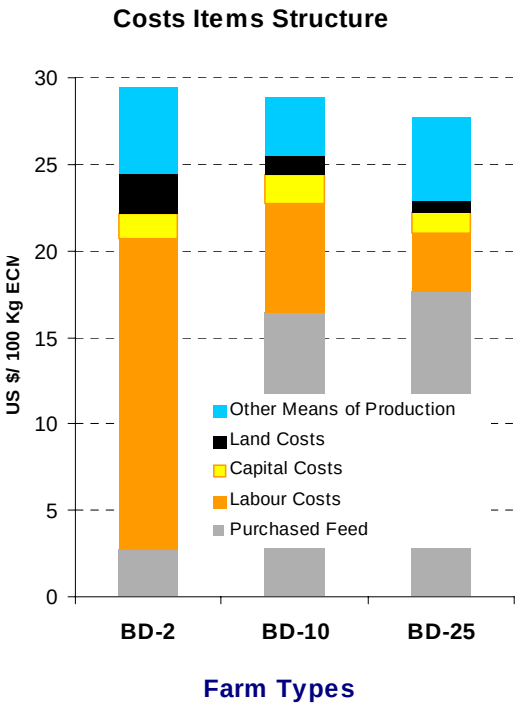
All the farms cover their full economic costs and generate an entrepreneurial profit from 0.15 to 2.37 US$ per 100 kg milk. The returns to labour on the larger farms (wage level earned by working on the dairy farm) are higher than the wage level in the area around the farms.

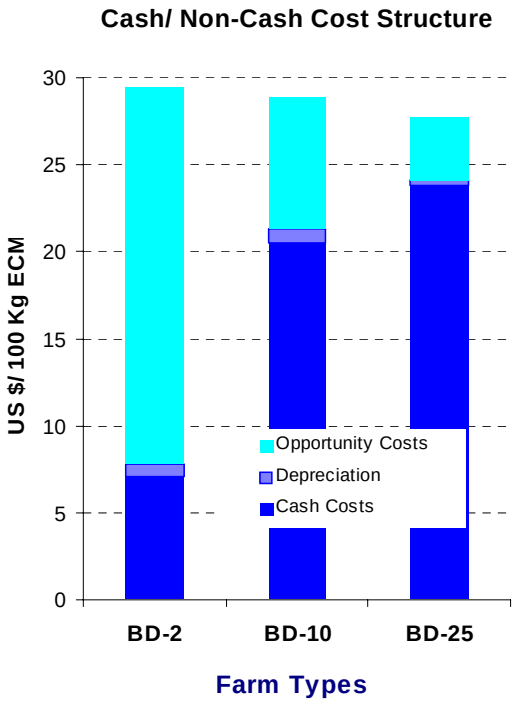
Explanations of variables; year and sources of data:

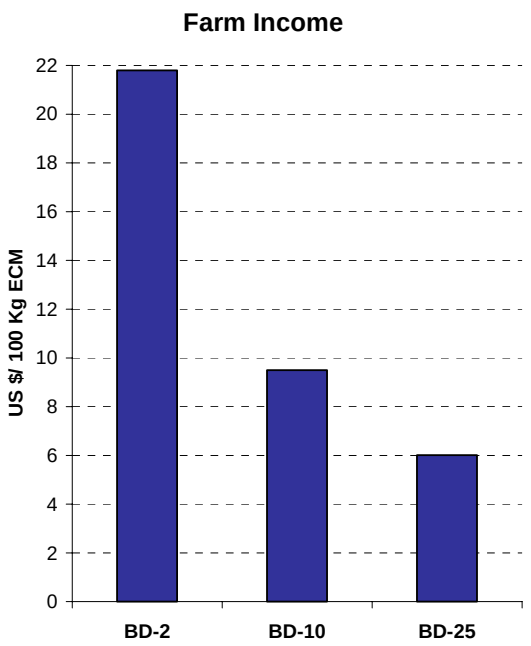
- Explanations of variables and IFCN method: s. Annex 2 and 3
- Other returns: Manure at market value (for that used at home and on own farm).
- Sources of data: IFCN data collection based on expert estimations and statistics, year 2002.

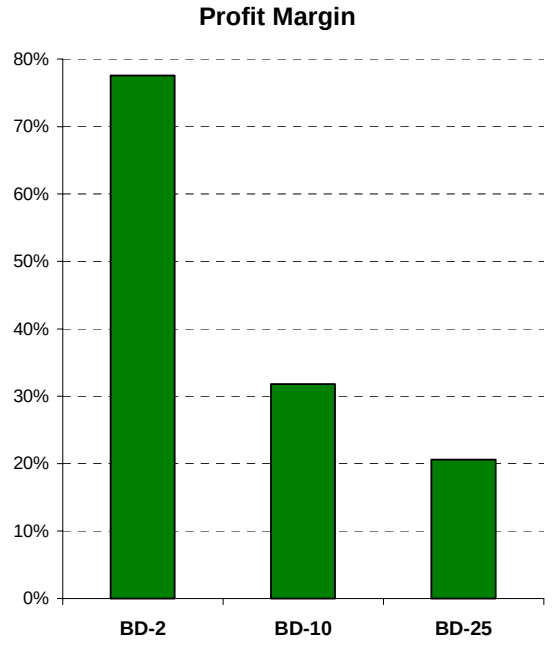

Costs of Milk Production Only
US $/ 100 Kg ECM
35
30
25
20
15
10
5
0
Opportunity Cost
Other Costs- Non Milk Returns
Milk Price
BD-2
BD-10
BD-25

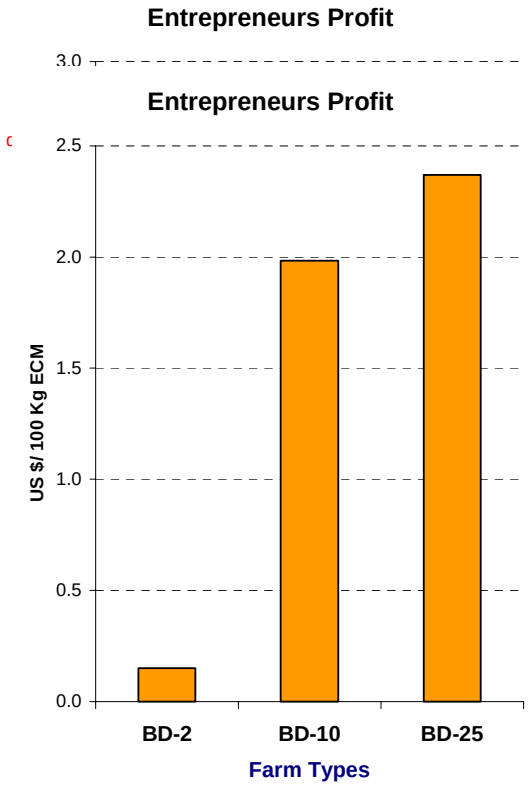

Return Structure
US $/ 100 Kg ECM
35
30
25
20
15
10
5
0
Milk Returns
Other Returns
Cattle Sales
BD-2
BD-10
BD-25

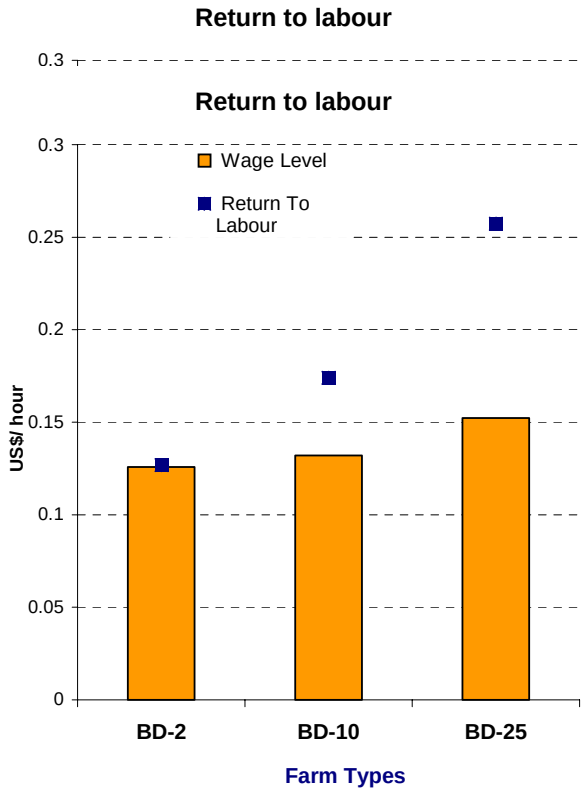

Costs Items Structure
US $/ 100 Kg ECM
30
25
20
15
10
5
0
Other Means of Production
Land Costs
Capital Costs
Labour Costs
Purchased Feed
BD-2
BD-10
BD-25
Farm Types

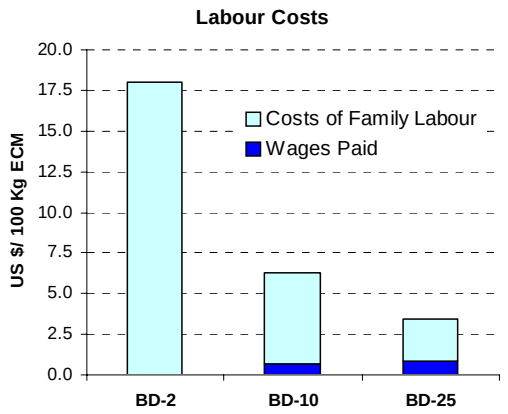

Cash/ Non-Cash Cost Structure
US $/ 100 Kg ECM
30
25
20
15
10
5
0
Opportunity Costs
Depreciation
Cash Costs
BD-2
BD-10
BD-25
Farm Types

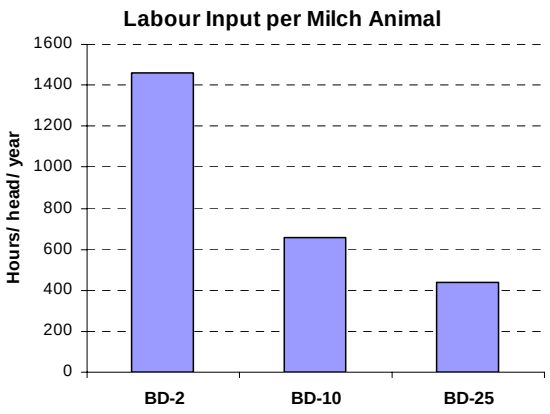

Farm Income
US $/ 100 Kg ECM
22
20
18
16
14
12
10
8
6
4
2
0
BD-2
BD-10
BD-25

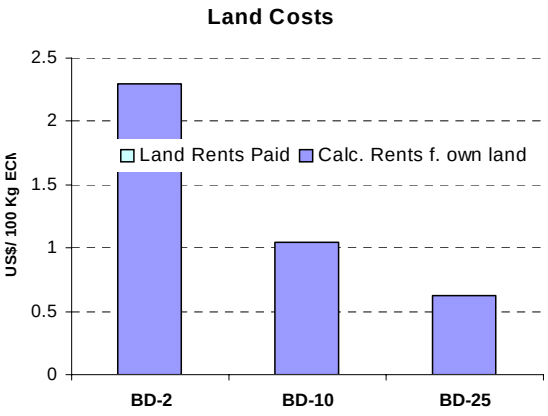

Profit Margin
80%
70%
60%
50%
40%
30%
20%
10%
0%
BD-2
BD-10
BD-25

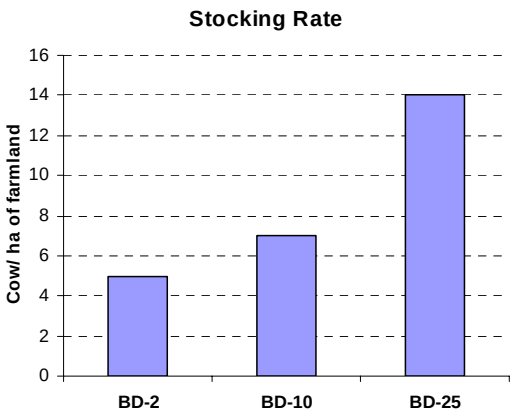

Entrepreneurs Profit
Entrepreneurs Profit
US $/ 100 Kg ECM
3.0
2.5
2.0
1.5
1.0
0.5
0.0
BD-2
BD-10
BD-25
Farm Types

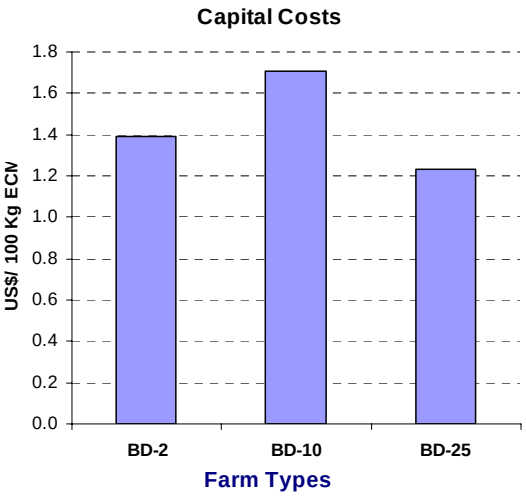

Return to labour
Return to labour
Wage Level
Return To Labour
US$/ hour
0.3
0.25
0.2
0.15
0.1
0.05
0
BD-2
BD-10
BD-25
Farm Types

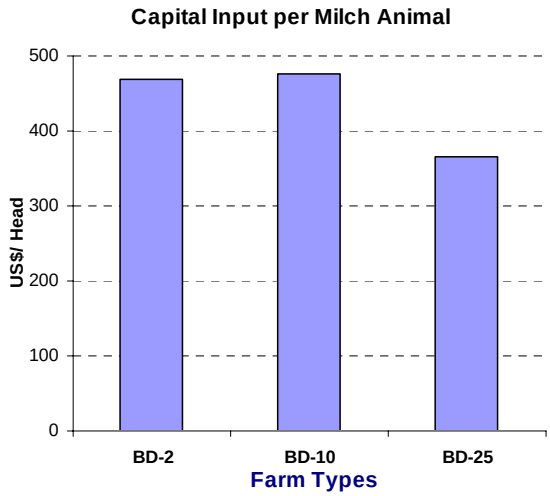

Labour Costs
US $/ 100 Kg ECM
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Costs of Family Labour
Wages Paid
BD-2
BD-10
BD-25


Labour Input per Milch Animal
Hours/ head/ year
1600
1400
1200
1000
800
600
400
200
0
BD-2
BD-10
BD-25


Land Costs
US$/ 100 Kg ECM
2.5
2
1.5
1
0.5
0
Land Rents Paid
Calc. Rents f. own land
BD-2
BD-10
BD-25


Stocking Rate
Cow/ ha of farmland
16
14
12
10
8
6
4
2
0
BD-2
BD-10
BD-25


Capital Costs
US$/ 100 Kg ECM
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
BD-2
BD-10
BD-25
Farm Types


Capital Input per Milch Animal
US$/ Head
500
400
300
200
100
0
BD-2
BD-10
BD-25
Farm Types

3.7 International and Regional Dairy Farm Comparisons

For the comparisons in this section, two typical (small and large scales) dairy farms were chosen for selected countries representing the regions of South Asia, Oceania, Central and Western Europe and North America. The comparisons should only be considered to provide indicative results and generalizations should not be made.

Milk Yields

Milk yields per cow range from 960 to 10,000 kg per year. These differences are due to different production systems, genetic potentials and farm management. Only the larger Indian farms, which are very well managed and rely on European dairy genetics reach milk yields around the 4,000 kg mark, equal to the yields of New Zealand cows.

Within Asia, there are two interesting trends and opportunities for development: (1) lactating animals in small farms in Pakistan yield 44 and 35 percent more than those of small farms in India and Bangladesh. And (2) a lactating cow in the large Indian farm yields 77 and 100 percent above the yields of cows in large farms in Pakistan and Bangladesh. Small Pakistani farms may reveal directions for small scale farm development in South Asia, while the large Indian dairy farm may do so for 'large-scale' dairy in South Asia.

Returns to the Dairy Enterprise

Milk prices range from a low 10 US$/100 kg in Pakistan to a high 29 US$/100 kg in the USA. In South Asia, Bangladesh dairy farmers receive the highest price of over 23 US$/100kg, which is 1.28 times what New Zealand farmers get. This high price seems to be due to the strong demand for milk in relation to the relatively low production and availability.

With a couple of exceptions, cattle returns are more relevant for small farms than for the large ones. 'Other Returns' which includes milk and manure utilized on the farm and or by the farm family are very important for all Asian farms, but particularly for small dairy farms. Direct payments are only a feature of Poland, Germany and the USA.

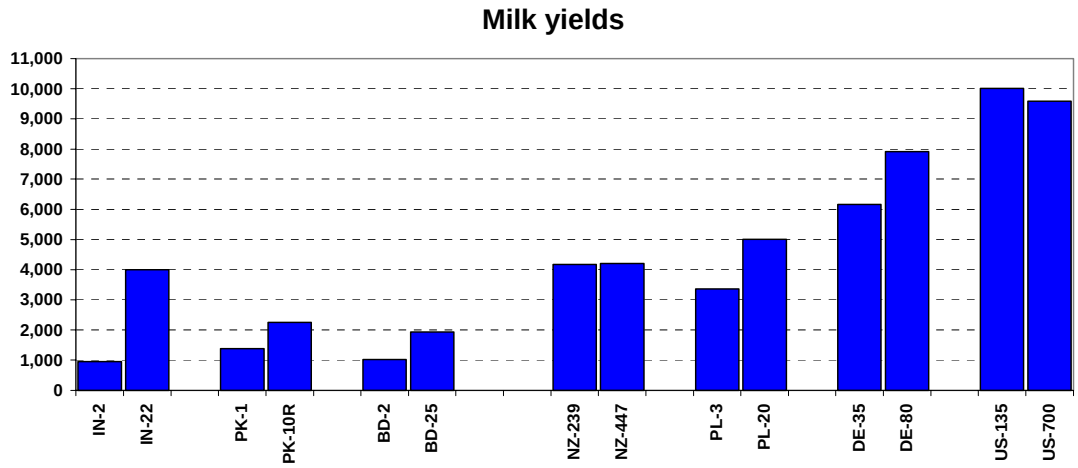
Cost of Milk Production Only

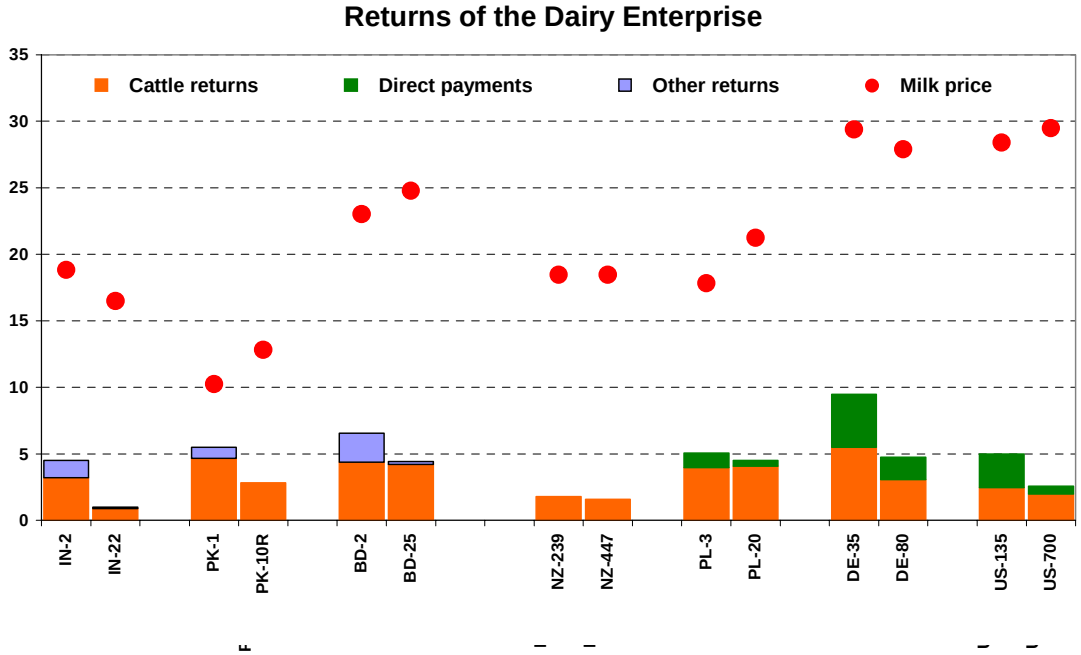
This indicator describes the long term competitiveness of milk producers. Results indicate the following:

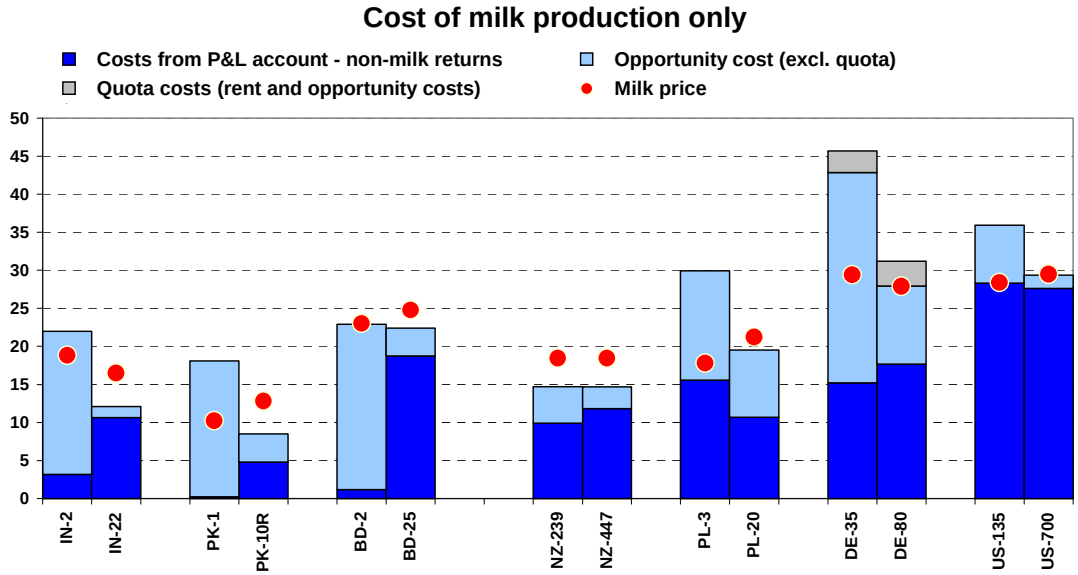
- Costs within countries, particularly within India, Pakistan, Poland and Germany differ significantly. This is a clear indicator of strong structural change in the future.
- In all small farms the main cost component are the opportunity costs of family labour.
- The Indian and Pakistani milk producers are more competitive than those of Western Europe (Germany) and the USA. The cost difference is more than 10 US $ per 100 kg milk.
- The small scale farmers in South Asia are more competitive than their small scale counterparts in Poland (and presumably other EU accession countries).
- Average sized farms in South Asia have higher production costs (by 20 to 50 percent) than New Zealand dairy farms.
- Large sized dairy farms in Pakistan and India have lower costs than New Zealand farms and can be competitive milk producers in the future on the world market by having a competitive dairy chain.
- The farms in Bangladesh will have difficulties to compete against imports for the world market and also from the other countries in South Asia such as India and Pakistan.

Explanations of variables; year and sources of data:

- Country codes: IN=India, PK=Pakistan, NZ=New Zealand, PL=Poland, US=USA, DE=Germany
- Sources of data: Dairy Report 2003, data refer to the year 2002.


Milk yields
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
IN-2
IN-22
PK-1
PK-10R
BD-2
BD-25
NZ-239
NZ-447
PL-3
PL-20
DE-35
DE-80
US-135
US-700


Returns of the Dairy Enterprise
Cattle returns
Direct payments
Other returns
Milk price
35
30
25
20
15
10
5
0
IN-2
IN-22
PK-1
PK-10R
BD-2
BD-25
NZ-239
NZ-447
PL-3
PL-20
DE-35
DE-80
US-135
US-700


Cost of milk production only
Costs from P&L account - non-milk returns
Opportunity cost (excl. quota)
Quota costs (rent and opportunity costs)
Milk price
50
45
40
35
30
25
20
15
10
5
0
IN-2
IN-22
PK-1
PK-10R
BD-2
BD-25
NZ-239
NZ-447
PL-3
PL-20
DE-35
DE-80
US-135
US-700

3.8 Margins in the Dairy Chain: Farmer to Consumer

In this section, the margins in the dairy chain in Sirajganj are analysed. Due to practicality and comparability among dairy channels, it is assumed here that each dairy channel buys one kg of 4.5 percent fat milk, processes it into their most popular liquid milk product, without adding any other ingredient (i.e. water, milk powder, etc.) and sells milk and cream, if extracted, at local (retail) prices.

Although there is a value-adding business through combining locally produced milk with imported milk powder and water to produce dairy products, this is beyond the scope of this analysis. Therefore, these dairy chain calculations should be seen as an exploratory exercise intended to support other sections of this study.

The Dairy Channels

Co-op 3.5 %: Co-operative buying milk at 4.5 percent fat and selling at 3.5 percent fat.

Sweetshop 1.5 %: Private local processor buying milk at 4.5 percent fat from the milkman, extracting fat and casein to produce sweet dairy products, and selling milk at about 1.5 percent fat. The fluid milk business is marginal.

Direct sale 4.5 %: Dairy farmer selling milk directly to the consumer with 4.5 percent fat.

The 'Co-op' represents the formal sector whereas the others represent informal channels.

Input Costs of the Dairy Chain

Milk prices paid to the farmer by the co-operatives are slightly lower (12 percent) than the prices paid by the 'sweetshop', through its milk collectors, commonly known as milkmen. Due to the high milk demand from nearby population centres and the competition with dairy cooperatives operating in the area, these travelling milkmen often pay higher prices than the competition as a way to secure supply for the sweetshops in urban areas.

Returns of the Dairy Chain

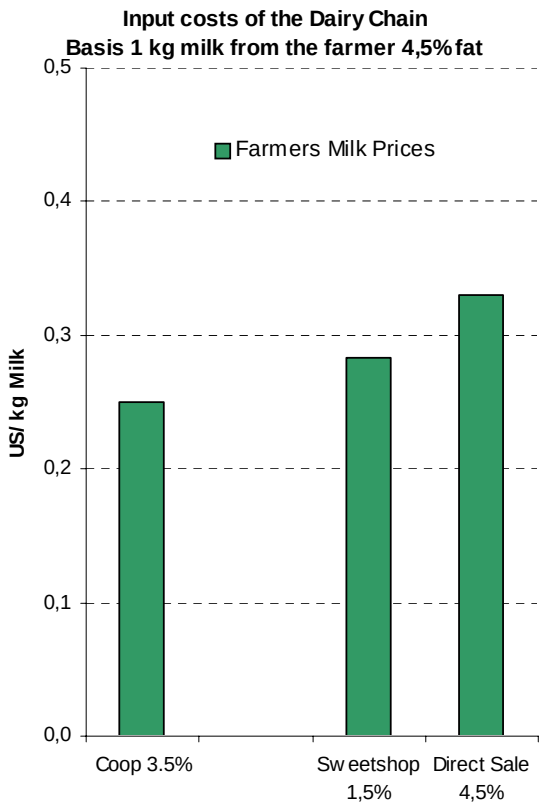
The average consumer prices are 0.48 and 0.42 US$ for the milk and cream produced from an initial kg milk in the formal and informal sectors respectively. The formal sector's 15 percent higher premium is largely due to its milk pasteurisation and packaging. However, this difference between the sectors will diminish as other value adding steps are considered. The sweetshops are versed in adding value to the milk by separating and adding value not only to the cream but also to the casein and the whey. The Bangladeshi consumers seem to pay less attention to the fat content of their milk than their Indian or Pakistani counterparts; which might partially explain the low number of buffaloes in Bangladesh.

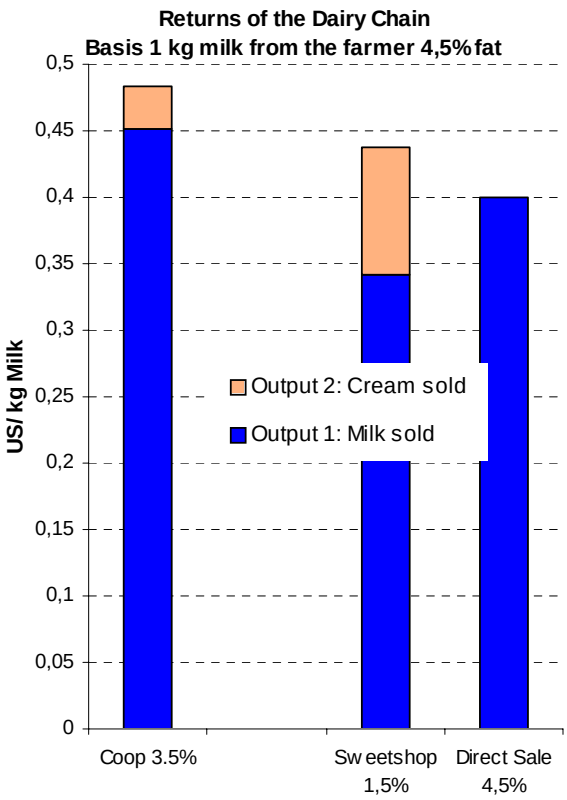
Margins (Output - Input Value)

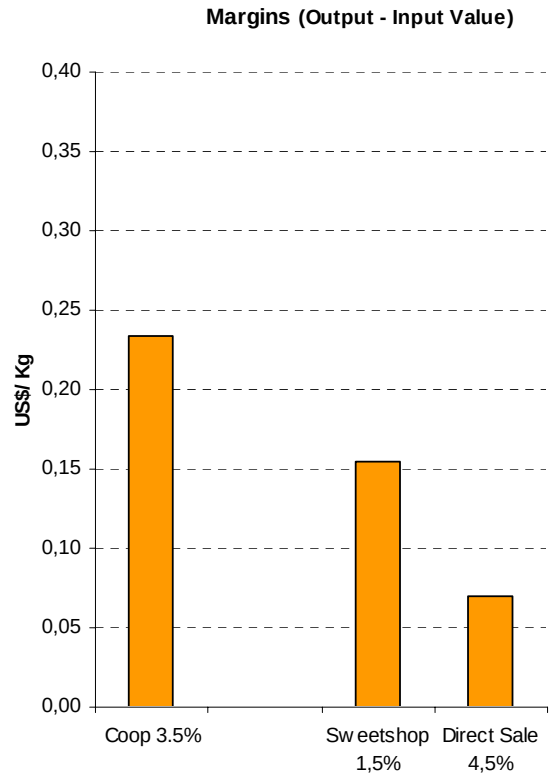
The margins attained from processing and retailing vary between 0.07 and 0.23 US$/kg milk by dairy channel. The formal sector (co-op) has a 50 percent higher margin than the informal sector (sweet shop). Farms selling their milk directly have the lowest margin as they do not participate in the 'cream business'. It should be mentioned that in the analysis for the farm selling directly the marketing costs were included in the production cost. The formal channels and the sweetshops have about half and one quarter of the margin of European dairy chains (0.3 to 0.5 US$/kg).

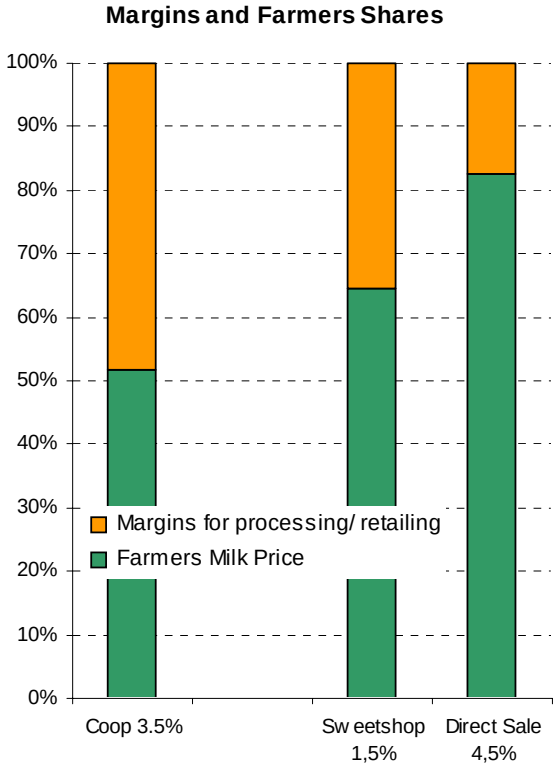
Margins and Farmers' Shares

Farmers shares in the total consumer prices are higher in the informal sector(sweetshop) than in the formal one (65% vs. 53%).


Input costs of the Dairy Chain
Basis 1 kg milk from the farmer 4,5% fat
US/ kg Milk
0,5
0,4
0,3
0,2
0,1
0,0
Farmers Milk Prices
Coop 3.5%
Sweetshop 1,5%
Direct Sale 4,5%


Returns of the Dairy Chain
Basis 1 kg milk from the farmer 4,5% fat
US/ kg Milk
0,5
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
Output 2: Cream sold
Output 1: Milk sold
Coop 3.5%
Sweetshop 1,5%
Direct Sale 4,5%


Margins (Output - Input Value)
US$/ Kg
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
Coop 3.5%
Sweetshop 1,5%
Direct Sale 4,5%


Margins and Farmers Shares
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Margins for processing/ retailing
Farmers Milk Price
Coop 3.5%
Sweetshop 1,5%
Direct Sale 4,5%

ANNEX 1 METHODOLOGICAL BACKGROUND

Introduction

In this annex we will present the methods and sources of information used to collect data about the Indian dairy sector and how the costs of production for the selected typical production systems are calculated.

This project has followed the framework used by the International Farm Comparison Network (IFCN). IFCN is a world-wide association of agricultural researchers, advisors and farmers. These participants select typical agricultural systems in key production regions in their individual countries. In 2002, the number of participating countries extended to 24 countries that represent 74 percent of the world milk production.

Within this scientific Network, FAL-Federal Agricultural Research Centre (Germany) through its Institute of Farm Economics and Rural Studies is acting as the co-ordination centre for scientific issues.

The Central Objectives of IFCN

The central objectives of the international farm comparison network are:

1. To create and maintain a standardised infrastructure through which production data of the major agricultural products (milk, beef, wheat, sugar, etc.) and from major producing regions of the world can be effectively compared and discussed.

2. To analyse the impact of the structure of production, technology applied and country-specific policies on the economic performance of agribusinesses, their costs of production and global competitiveness.

Methods and Principles

In order to achieve these objectives, IFCN employs the following **methods and principles**:

Direct contact with the production protagonists. A team of advisors and farmers is put together to set up the typical production models and to revise the final results. This approach brings the results closest to reality.

The principle of 'Total Costs'. IFCN considers both direct costs and margins, and the indirect (fixed) costs (i.e. depreciation and interests of the infrastructure used) and the opportunity costs for owned assets and production factors (i.e. family labour, land, capital).

A single and homogeneous method is utilised to calculate the costs of production for all participating countries. The IFCN standard is not the only truth, but a) it is scientifically correct, b) it includes all the existing production costs, and c) it creates transparency and international comparability in the arena of costs of agricultural production. Each IFCN member and client can reorganise the costs at his convenience and present them in the particular format of his country while he maintains an internationally comparable set of results.

The concept of setting (regional) typical agricultural models. A team of country experts, advisors and producers is formed to identify and set up the typical regional production models for each agricultural product. Typical production models must represent the common production structures in the region or country.

In the case of dairy production, for example, a working team composed of advisors, consultants and producers is formed as a panel. The first working step is to define the typical milk production systems of the major dairy regions in country. This model may be a 4-cow farm, feeding mostly cut grasses to fully confined animals, combine milk production with some other agricultural activities such as wheat and rice production in 3 ha of irrigated owned land, and milking is done by hand twice a day.

The second working step is to collect all the needed information from these typical models. For this, IFCN has developed a standard questionnaire. It is crucial that these data collected should neither reflect an individual farm (too many particularities may hurt the ability to generalise the results) nor be an arithmetic average (an average does not show much about the technology and the economics involved). The typical model should rather represent real and common situations of the region and show clearly the predominant technology and infrastructure. Such models will be preferred by analysts.

The model TIPI-CAL (**T**echnology **I**mpact and **P**olicy **I**mpact **Cal**culations) is utilised for the simulations of these typical models and the calculations of their costs of production. TIPI-CAL can be easily shared with all IFCN members since it is a spreadsheet in MS-Excel. This model is a combination of production (physical data) and accounting (economic data). TIPI-CAL also consists of both a structure of costs of production and a simulation component (without optimisation). The simulations can be done for a period of up to 10 years in order to evaluate the growth, investments, policies or market conditions. For each year, TIPI-CAL produces a 'Profit and Loss Account', a balance and cash flow statement.

Allocation of costs of production. When the typical milk production systems have several agricultural activities besides dairy, fixed costs and expenses (i.e. depreciation) are distributed to each activity according to their use. For example, the depreciation of the machinery, which is used, for the dairy and the crop enterprises is allocated according to the hours worked in each.

Data about farm and off-farm household economics. IFCN takes into account all activities of the typical production systems, plus all the off-farm incomes and expenses realised by the owner and his family. This more complete picture of the typical model is necessary to obtain reliable information about the current economic situation of the model (and the household) and about the future of the farm (simulations).

All the methods and principles above have been applied in this project. Full panels were not set up since these models have already been part of the IFCN activities for the year 2002. The IFCN fieldwork experience supports that the analysis of costs of production shows no significant difference between the participation of one advisor and a 'full panel'. Therefore, it was decided that an IFCN scientist first visit each and every model, talk with the owners to collect project-specific information, analyse the data and then have the results cross-checked by local experts and farmers.

The analysis of costs of production and the competitiveness of the typical models are found in parts 3.6. The graphs follow the same structure as those in the '**IFCN Annual Dairy Report**'. The main objectives of this report are a) to analyse the main typical milk production systems in the district of Sirajganj, Bangladesh, and b) to assess the impacts of risks and changes made to key farm variables on the economics of the small-scale-dairy-farm household. This report shows the comparative world position of the Bangladeshi dairy industry, a comparison of the costs of production for the main milk production systems in Sirajganj, and a modelling chapter.

The modelling chapter utilises the simulation capability of TIPI-CAL in order to assess the effect of changing prices (for all models), policies, production practices and technology, and farm risks assessments for the small-scale dairy model.

For more information about IFCN, visit www.ifcnnetwork.org and www.ifcndairy.org

Cost Calculations

The cost calculations are based on dairy enterprises that consist of the following elements: Milk production, raising of replacement heifers and forage production and/ or feed purchased for dairy cows and replacements.

The analysis results in a comparison of returns and total costs per kilogram of milk. Total costs consist of expenses from the profit and loss account (cash costs, depreciation, etc.), and opportunity costs for farm-owned factors of production (family labour, own land, own capital). The estimation of these opportunity costs must be considered carefully because the potential income of farm owned factors of production in alternative uses is difficult to determine. In the short run, the use of own production factors on a family farm can provide flexibility in the case of low returns when the family can chose to forgo income. However, in the long run opportunity costs must be considered because the potential successors of the farmer will, in most cases, make a decision on the alternative use of own production factors, in particular their own labour input, before taking over the farm. To indicate the effects of opportunity costs we have separated them from the other costs in most of the figures.

For the estimations and calculations the following assumptions were made:

Labour costs

For hired labour, cash labour costs currently incurred were used. For unpaid family labour, the average wage rate per hour for a qualified full-time worker in the respective region was used.

Land costs

For rented land, rents currently paid by the farmers were used. Regional rent prices provided by the farmers were used for owned land. In those countries with limited rental markets (like NZ), the land market value was capitalised at 4 per cent annual interest to obtain a theoretical rent price.

Capital costs

Own capital is defined as assets, without land and quota, plus circulating capital. For borrowed funds, a real interest rate of 6 per cent was used in all countries; for owner's capital, the real interest rate was assumed to be 3 per cent.

Depreciation

Machinery and buildings were depreciated using a straight-line schedule on purchase prices with a residual value of zero.

Adjustments of fat content

All cost components and forage requirements are established to produce ECM (energy corrected milk with 4.0 percent fat and 3.3 percent protein).

Adjustment of VAT

All cost components and returns are stated without value added tax (VAT).

Adjustment of milk into ECM

The milk output per farm is adjusted to 4 percent fat and 3.3 percent protein. Formula: ECM milk = ((total marketable milk production * 0.383*milk fat in percent)+ (total marketable milk production * 0.242*milk protein in percent) + (total marketable milk production * 0.7832))/3.1138.

Farm Economic Indicators (IFCN Method)

+ Total receipts =

- \+ Crop (wheat, barley, etc.)
- \+ Dairy (milk, cull cows, calves, etc.)
- \+ Government payments

- Total expenses =

- \+ Variable costs crop
- \+ Variable costs dairy
- \+ Fixed cash cost
- \+ Paid wages
- \+ Paid land rent
- \+ Paid interest on liabilities

= Net cash farm income

+ Non cash adjustments =

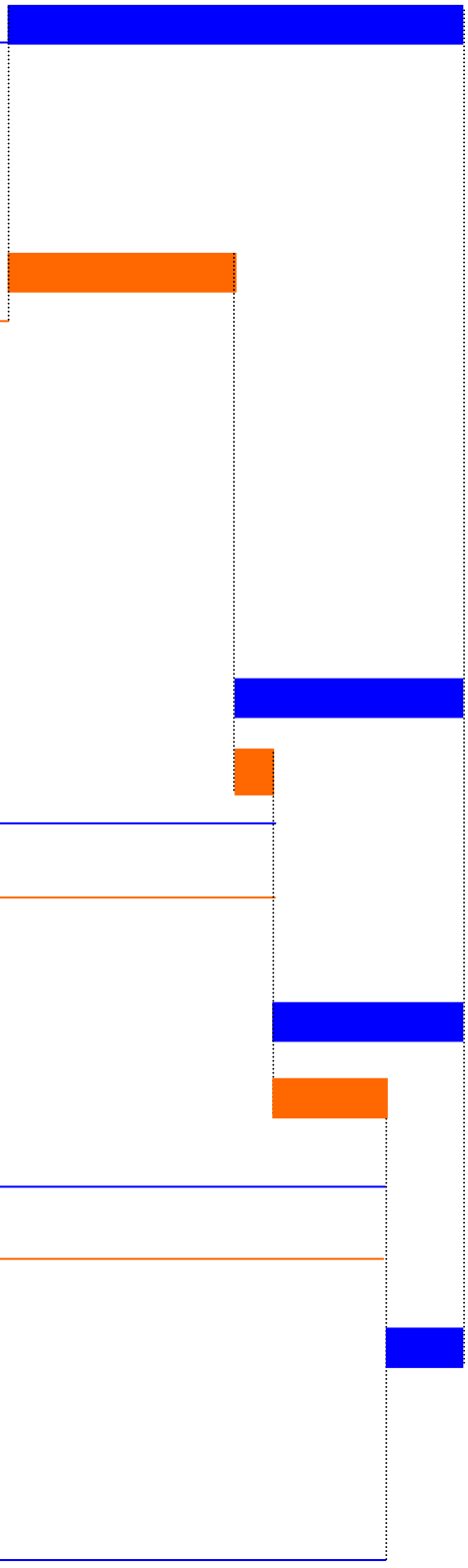
- \- Depreciation
- +/- Change in inventory
- +/- Capital gains / losses

= Farm income (Family farm income in Dairy Report 2001)

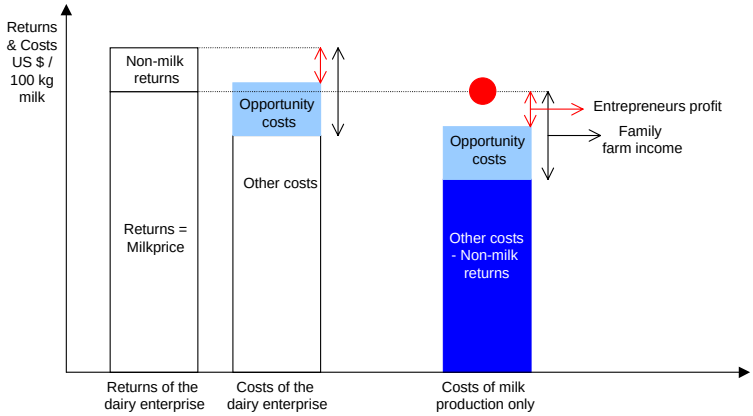
- Opportunity costs =

- \+ calc. interest on own capital
- \+ calc. rent on land
- \+ calc. cost for own labour

= Entrepreneurs profit



Cost of Milk Production Only



Method

The total costs of the dairy enterprise are related to the total returns of the dairy enterprise including milk and non-milk returns (cattle returns and direct payments). Therefore the non-milk returns have been subtracted from the total costs to show a cost bar that can be compared with the milk price. The figure beside explains the method.

Other costs: Costs from the P&L account minus non-milk returns (cattle returns and direct payments, excl. VAT).

Opportunity costs**:** Costs for using own production factors inside the enterprise (land * regional land rents, family working hours * wage for qualified workers, capital: Own capital * 3 percent).

Returns of the Dairy Enterprise:

Milk price: Average milk prices adjusted to fat corrected milk (4 percent excl. VAT).

Cattle returns: Returns selling cull cows, male calves and surplus heifers + /- livestock inventory (excl. VAT).

Other Returns: Selling/home use of manure

Costs by Cost Items

Costs for means of production: All cash costs like fuel, fertiliser, concentrate, insurance, maintenance plus non-cash costs like depreciation for machinery and buildings (excl. VAT).

Labour costs: Costs for hired labour + opportunity costs for family labour.

Land costs: Land rents paid + calculated land rents for owned land.

Capital costs: Non-land assets * interest rate (equity * 3 percent, liabilities * 6 percent).

Quota costs: Payments for rented quota and depreciation for quota bought.

Cash and Non-Cash Costs

Cash Costs: Cash costs for purchase feed, fertiliser, seeds, fuel, maintenance, land rents, interest on liabilities, wages paid, vet + medicine, water, insurance, accounting, etc (excl. VAT).

Depreciation: Depreciation of purchase prices for buildings, machinery and quotas (excl. VAT).

Opportunity costs: Costs for using own production factors (land owned, family labour input, equity).

Economic Results of the Dairy Enterprise

Farm income per farm: Returns minus costs from P&L account of the dairy enterprise.

Farm income per kg milk: Farm income per farm (dairy enterprise) / milk production

Profit margin: Share of farm income on the total returns: Farm income divided by the total returns.

Entrepreneurs profit: Returns minus costs from P&L account of the dairy enterprise – opportunity cost allocated to the dairy enterprise.

Net cash farm income: Cash receipts minus cash costs of the dairy enterprise or: Farm income + depreciation

Return to labour: Entrepreneurs profit plus labour costs (wages paid plus opportunity costs) divided by total labour input.

Average wages on the farm: This figure represents the gross salary + social fees (insurance, taxes, etc.) the employer has to cover. Calculation: Total labour costs (wages paid plus opportunity costs) divided by the total hours worked. To calculate this the number of hours worked by the employees and the family has been estimated by experts.

Labour input: The estimation of hours worked and the valuation of these hours is extremely difficult especially in family farms. In the IFCN network this method will be intensively discussed and improved during the next workshops.

Labour costs: Paid wages and opportunity costs for own labour of the dairy enterprise.

Land costs: Paid land rents and opportunity costs for own land (calculated rent) of the dairy enterprise.

Stocking rate: Number of dairy cows (young stocks excluded) / ha of total farmland.

Capital costs: Paid interests and opportunity costs for own capital (excluding land capital and quota capital). For equity 3 percent and for liabilities 6 percent interest rate is used in all countries. This reflects the method of "capital using costs" developed by Isermeyer 1989.

Capital input: Total Assets (land, buildings, machinery, cattle)/ number cows.

ANNEX 2 INFORMATION ON BANGLADESH AND SIRAJGANJ

Items	Bangladesh (Area in Acres)	Sirajganj (Area in Acres)	% of BD
Number of holdings	17,828,187	399,875	2.24
% of small holdings	79.87	79.06	
% of medium holdings	17.60	18.22	
% of large farm holdings	2.52	2.72	
Operated area			
Operated area of all holdings	20,484,561	453,387	2.21
Average operated area per holding	1.15	1.13	
Operated area of all farm holdings	19,957,144	422,845	2.12
Average operated area per farm holding	1.69	1.79	
Homestead area	1,318,415	37,296	2.83
Average homestead area per holding	0.07	0.09	
Average homestead area per non-farm household	0.05	0.06	
Average homestead area per farm holding	0.09	0.11	
Cultivated area	17,771,339	348,677	1.96
Average cultivated area per farm holding	1.50	1.47	
Net temporary cropped area	16,450,528	340,944	2.07
Average net temporary cropped area per farm holding	1.39	1.44	
Gross cropped area	28,616,451	629,832	2.20
Intensity of cropping (%)	174	185	
% of HYV rice to gross cropped area	36.7	37.3	
Wheat local	508,042	15,856	3.12
Wheat HYV	1,013,947	24,983	2.46
Average bovine animal per holding	1.25	1.04	
Average goat-sheep per holding	0.82	1.04	
Average poultry per holding	7.10	5.90	
Agricultural labour			
Number of agricultural labour household	6,401,453	108,417	1.69
% of all holdings	35.91	27.11	

Small: A farm holding having a minimum operated/cultivated area of 0.05 to 2.49 acres.
Medium: A farm holding having an operated area 2.50-7.49 of lands
Large: A farm holding having an operated area of 7.50 acres and above

Source: Census of Agriculture, 1996 and Bangladesh Bureau of Statistics (2001), GOB, Dhaka.

ANNEX 3 MAJOR MILK PROCESSORS IN BANGLADESH

Name of the Enterprise	Average milk sales ($\times 10^3$ litres/day)	Market share (%)
Milk Vita	110	62.16
Arong	38	21.48
Amomilk	4	2.26
Shelaida	4	2.26
Bikrampur	3	1.69
Savar Dairy	3	1.69
Aftab Dairy	5	2.82
Safa Dairy	3	1.69
Tulip Dairy	7	3.95
Total	177	100

Source: Saha, G. C. and. Haque, S.A.M.A. (2001). (From Milk Vita's primary data. 2000)

ANNEX 4 DESCRIPTION OF THE DAIRY CHAIN CALCULATIONS

		Formal Milk Channels	Informal Milk Channels	
		Coop 3.5%	Sweetshop 1,5%	Direct Sale 4,5%
Variables	**Units**			
Dairy Processing activities based on 1 kg milk bought from the farmer				
INPUTS				
Input: Milk from the farmer				
Quantity	Kg	1	1	1
Fat Content	% estimation	4.5%	4.5%	4.5%
Protein Content	% estimation	3.5%	3.5%	3.5%
Purchase Price	US$/ Kg	0.25	0.28	0.33
FARMERS MILK PRICES	**US$**	**0.25**	**0.28**	**0.33**
OUTPUTS				
Output 1: Milk sold	Description	**Standard**	**Creamless**	**Whole**
Quantity	Kg	0.966	0,900	1.0
Fat Content	%	3.5%	1.5%	4.5%
Protein Content	% estimation	3.1%	3.5%	3.5%
Consumer Price	US$/ Kg	0.47	0.38	0.40
Output 2: Cream sold				
Quantity cream	Kg	0.034	0.1	0,000
Fat content of cream	%	30%	30%	0
Quantity of fat	Kg	0.03	0.03	0
Consumer price for cream	US$/ Kg	0.96	0.96	0
TOTAL CONSUMER PRICES	**US$**	**0.48**	**0.44**	**0.4**
MARGINS				
Sum of all Returns	US$	0.48	0.44	0.4
-Farmers Milk Price	US$	0.25	0.28	0.33
FINAL MARGINS	**US$**	**0.23**	**0.155**	**0.07**

Notes: Exchange rate: 60 Tk. per US$

1- Milk handlers in Sirajganj use multiple methods and accurate information on them is seldom shared. For this preliminary calculations, we found necessary to collect the most important variables and use a standard and simplified method to compare the main dairy channels.

2- The assumptions of the method chosen are: 1- each channel buys one Kg 4.5 % fat milk from the farmer, 2- each channel processes this Kg milk into its most popular milk plus cream when applicable, 3- no other input is added (i.e. water, fat, milk powder, etc.), and 4- this milk and cream are valued at the (final) consumer market prices in Sirajganj.

3- The selected method is weakest at analysing the Sweetshop channel since it makes its main business from non-fluid milk products (which are completely excluded by this method).

Source: Prices and processing channels were gathered in Sirajganj through personal communications; fat and protein contents for the Informal sector are based on assumptions from the Authors.

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