Policy Barriers for Dairy Value Chain Development in Bangladesh with a Focus on the North West Region

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1 Background and objectives

CARE Bangladesh is implementing the Gates Foundation funded project "Strengthening Dairy Value Chain in Bangladesh" in nine districts in the North and Northwest of Bangladesh for a period of 4 years (2007-2011). The vision of success of the project is that targeted landless and smallholding households in North and Northwest Bangladesh have more sustainable livelihoods through incorporation into a strengthened milk value chain. The specific objectives of the project are:

- To improve milk collection systems in rural and remote areas;
- To improve access to inputs, markets, and services by mobilizing groups of poor farmers, producers, and *char* dwellers
- To improve the milk transport network
- To ensure access to quality service at the producer level and
- To improve the policy environment.

The objective on 'improve the policy environment' is proposed to be built on the project's success to create a policy environment that supports the incorporation of small farmers into the value chain, since this is essential for a significant and sustainable impact on the development of the dairy sector. The approach is based on the need for facilitation of sustainable private sector development. Incorporated into this approach is an understanding that market-driven interventions are key to successful programming for the poor. This paradigm is particularly relevant to CARE's strategy to promote women's economic development as wage earners, entrepreneurs and consumers.

To help CARE undertake this task on a sound basis, a study on 'National assessment of policy barriers to the development of dairy value chain' was planned. Specific objectives of the policy study were to:

a. Review existing policy positions on government tax, tariff and subsidy policies as they effect small scale producer's production, input supply, processing etc. of formal and informal dairy value chains of Bangladesh.
b. Identify specific policy positions that are crucial for the development of the dairy sector of North and North West Bangladesh in the light of the project proposal and its target beneficiaries and also considering the current project phase
c. Accumulating into a report based on the above findings information and specific recommendations to share with the producers, government, chambers, other dairy value chain actors and supporters, influencer and other stakeholders during the project implementation period.
d. To detail a policy framework which the project need to follow towards improving the policy environment in both project period and beyond and how.

A policy is generally defined as a deliberate action by a government or public authority to alter a naturally occurring condition or a condition shaped by past actions to optimize or maximize common good or welfare of citizens in general or a specific targeted part of the economy or segment of the population. A policy targeted to a specific segment of the economy or population to achieve certain goal may indirectly affect other segment(s) of

the economy or population with positive or negative consequences, so the net outcome of any policy action may be larger or smaller than the immediate or direct outcomes.

The Government of the People's Republic of Bangladesh has adopted a provisional National Livestock Development Policy document (MOFL, 2007). The general objective of the Policy is as follows:

> "To provide the enabling environment, opening up opportunities, and reducing risks and vulnerability for harnessing the full potential of livestock sub-sector to accelerate economic growth for reduction of rural poverty in which the private sector will remain the main actor, while the public sector will play facilitating and supportive role."

The specific objectives of the National Livestock Development Policy are:

1. To promote sustainable improvements in productivity of milk, meat and egg production including processing and value addition;
2. To promote sustained improvements in income, nutrition, and employment for the landless, small and marginal farmers; and
3. To facilitate increased private sector participation and investments in livestock production, livestock services, market development and export of livestock products and by-products.

The documents has briefly discussed the background and then proposed specific key policy action in each of the following areas

i. Dairy Development and Meat Production;

ii. Poultry Development;

iii. Veterinary Services and Animal Health;

iv. Feeds and Fodder Management;

v. Breeds Development;

vi. Hides and Skins;

vii. Marketing of Livestock Products;

viii. International Trade Management

ix. Access to Credit and Insurance; and

x. Institutional Development for Research and Extension

With respect to the dairy sector, the document stated that daily farming in Bangladesh is affected by myriads of constraints such as: (i) limited knowledge and technical skills of smallholder dairy farmers; (ii) scarcity of feeds and fodder; (iii) poor quality of feeds; (iv) frequent occurrence of diseases; (v) limited coverage of veterinary services including poor diagnostic facilities; (vi) lack of credit support; (vii) limited milk collection and

processing facilities and low prices at collection points; (viii) lack of insurance coverage; (ix) absence of market information; (x) lack of appropriate breeds; and (xi) absence of a regulatory body.

To overcome the above constraints, proposed policy framework for dairy development is:

1. Cooperative dairy development (Milk Vita model) would be expanded in potential areas of the country;
2. Successful pro-poor models for community-based smallholder dairy development including appropriate contact farming schemes would be replicated;
3. Smallholder dairy farming, integrated with crop and fish culture would be promoted;
4. Supply chain based production, processing and marketing of milk and milk products would be promoted;
5. A National Dairy Development Board would be established as a regulatory body to promote dairy development;
6. "National Dairy Research Institute" would be established to carry out research in various aspects of dairying.

A critical review of the policy document or its relevant part focused on dairy is beyond the scope of this paper. However some of the constraints identified in the document hindering dairy sector growth and the related policy actions proposed to overcome them will feature directly or indirectly in the analysis of policy barriers for dairy value chain development in this paper. References to these points will made where appropriate.

The value chain is a relatively new concept in the marketing literature. The concept was first developed as a business idea by Porter (1985) as a systematic way of examining all the activities a firm performs and how they interact for analysing the sources of competitive advantage. He stated that each link in a value chain consists of a bundle of activities (value activities), and these bundles are performed by a firm to "design, produce, market, deliver and support its product". "Value activities are the discrete building blocks of competitive advantage". In the following decade since it was published, the idea became one of the most discussed and most misunderstood in the whole of the management arena as it has been taken in a number of different directions.

One of the most widely quoted definition of value chain is "the full range of activities which are required to bring a product or service from conception, through the intermediary phases of design, production, delivery to final consumers, and final disposal after use" (Kaplinsky, 2000). Major elements to be considered in the analysis of any value chain for a commodity include (a) actors along the chain and their functions and interrelations, (b) governance mechanisms for the chain and roles of actors e.g. power relations and principal drivers of the chain functions, (c) impact of upgrading products, services and processes within the chain, and (d) distribution of benefits among actors within the chain (Kaplinsky, 2000; Kaplinsky and Morris, 2001; Schmitz , 2005; Rich et al., 2008). Thus analysis of a value chain encompass wider issues than supply chain which only shows physical flow of goods or services from production to consumption through intermediate stages of value addition.

In order to understand policy barriers to ‘dairy value chain’ development that affect “small scale producers’ production, input supply, processing etc in Bangladesh”, it will be necessary to understand, first of all, the characteristics of the dairy production and marketing system and dairy consumption pattern, and their determinants. It will be evident that ‘value chain’ is only one aspect of the process of dairy development and some of the policy barriers may be specific to dairy value chain but others may be related to the livestock sector development in general and may only indirectly affect dairy value chain.

The report is organized as follows: In section 2, growth performance of the dairy sector in recent years is discussed briefly. In section 3, factors influencing dairy sector growth is discussed with a focus on the impact of tax and tariff policies, role of the formal processing sector, breeding policy and breeding services, and investment, credit and subsidy. In section 4, summary and implications for the SDVC project are discussed.

2 Recent trend in dairy sector growth and its implications

The livestock sector currently accounts for about 3% of GDP and 15% of employment. During 1996-2006, livestock output grew at the rate of 4.1% compared to 3.4% for crop and horticulture and 4.6% for fisheries (Table 2.1). The share of milk in the total value of livestock sector output increased from 26% in 1990-91 to 30% in 2000-01 then decreased to 24% in 2005-06, primarily because the share of meat, especially poultry meat and eggs, increased (Table 2.2). These changes have been prompted by rapid growth in demand for livestock products due to income and population growth and urbanization. The income elasticity of demand for milk was estimated to be 1.62 compared to 1.19 for meat and eggs in 1995-96, and these were projected to be 0.65 and 0.63 respectively in 2020 (Hossian and Bose, 2000). Expenditure elasticity of demand for milk and meat only in the urban areas in 2007 was estimated as 0.95 and 1.36 (Islam and Jabbar, 2009). Such demand led pattern of growth in the livestock sector is part of phenomena called 'livestock revolution' observed throughout the developing world (Delgado et al., 1999).

Table 2.1 Annual growth rates (%) in population and national output, 1990-2006

	1990-96	1996-00	2000-06	1996-06
Population	2.0	1.6	1.3	1.4
GDP	4.6	5.4	5.7	5.5
Agriculture	1.8	5.3	3.2	3.6
Crop and horticulture	-0.1	4.6	2.6	3.4
Livestock	2.4	2.7	5.1	4.1
Fisheries	7.8	8.9	1.8	4.6
Forest and related	2.9	4.7	4.8	4.7

Source : Shahabuddin (2008)

Table 2.2 Share of livestock sector in GDP and composition of livestock sector output, selected years

	1990-91	1995-96	2000-01	2005-06
Agriculture share in GDP (%)	37.6	32.4	19.5	17.0
Livestock share in GDP (%)	2.7	3.1	3.0	2.9
Value of livestock output, Million Taka[a]	14102	19706	61241	80075
Share of milk (%)	26	29	30	24
Share of meat (%)	55	51	46	49
Share of other products (%)	19	20	24	27

a. Output valued at 1984-85 constant prices

Source: Annual budgets, Ministry of Finance.

The macro statistics shown above however hide the fact that national statistics on production and consumption of milk in the country is poor and inconsistent, so the growth rates shown above should be interpreted with caution. Production estimates for several recent years are shown in Table 2.3. The FAO also reported similar production figures (http://faostat.fao.org/site/573/DesktopDefault.aspx?). However, the basis of these estimates is unclear.

Table 2.3 Dairy animal population and milk production in Bangladesh, 2001/02 -2008/09

Year	Production (MMT)	% yearly change	Population (millions)			
			Cattle	Buffalo	Goat	Sheep
2001-02	1.78	-	na	na	na	na
2002-03	1.82	2.2	22.53	1.01	17.69	2.29
2003-04	1.99	9.3	22.60	1.06	18.41	2.38
2004-05	2.14	7.5	22.67	1.11	19.16	2.47
2005-06	2.27	6.1	22.80	1.16	19.94	2.57
2006-07	2.28	0.4	22.87	1.21	20.75	2.68
2007-08	2.65	16.2	22.90	1.26	21.56	2.78
2008-09	2.66	0.4	22.98	1.31	22.40	2.88

Source: Bangladesh Economic Review 2009, Ministry of Finance, p. 93

To illustrate the implausibility of the above production estimates, let us consider figures for the year 2005-06 for which consumption estimates based on the Household Income and Expenditure Survey are also available. For that year, out of total reported production of 2.27 million tons, cow and buffalo milk output was reported as 0.80 million tons or 35% of total production while goat and sheep milk was 1.44 million tons or 65%. The volume and share of goat and sheep milk seem highly improbable given that according to the agricultural census, in 2005-06 there were 23.7 million heads of cattle and buffaloes against 22.5 million heads of goats and sheep in the country (Table 2.3).

Moreover, the estimated production of 2.27 million tons in 2005-06 gives per capita per day availability of about 43 ml equivalent of liquid milk from domestic production alone. But the Household Income and Expenditure Survey conducted by the BBS the same year found per capita daily consumption of milk as 32 gm : 30 gm in rural and 36 gm in urban areas (BBS, 2007) [1]. On that basis total consumption in the country was about 1.70 million metric tons but this volume included domestically produced as well as imported products. In 2005-06, about 55,000 tons of powder milk was imported which was equivalent to about 0.46 million tons of liquid milk.[2] If this is deducted from total consumption, consumption from domestic production comes to about 1.24 million metric tons, which is about 55% of the reported total production of 2.27 million tons. Then how to explain the balance of about 1.03 million tons of production? Where has it gone?

If it is assumed that out of the total consumption of 1.24 million tons from domestic production, 0.80 million tons was cow and buffalo milk output as reported above, we

[1] Based on the 2000-01 Household income and Expenditure survey, BBS reported rural and urban per capita daily consumption of milk as 29 and 32 gm, which was lower then that in 2005-06.
[2] One kg full cream powder milk is equivalent to 8.33 kg liquid milk or vice versa (FAO).

get 0.44 million tons as the balance representing goat and sheep milk output. The latter seems to be a more reasonable figure for goat and sheep milk output in relation to its population as it represents 35% of the total consumption of 1.24 million tons from domestic production.[3] Therefore, it is highly probable that in case of goat and sheep milk output, 0.44 million tons has been inadvertently recorded as 1.44 million tons in the FAO and GOB data sets, and thus inflating the overall output by about one million tons and also distorting the shares of cow and buffalo vs goat and sheep milk in the statistics.[4]

Out of the estimated 1.70 million tons of consumption in 2005-06, 27% came from imported products. This share varied to some extent from time to time but has shown an increasing trend. Given this shortfall in domestic production and high income elasticity of demand for milk mentioned earlier, there is good potential for growth in the dairy sector. Attainment of high growth rate in the sector has the potential to get millions of smallholder producers and others involved in milk processing and marketing out of poverty through employment and income generation. Dairy generates more regular cash income, and dairy production, processing and marketing generate more employment per unit value added compared to crops (Asaduzzaman, 2000; Omore et al., 2002). Small scale commercial dairy production and related backward and forward linkage activities in marketing, input supply, etc. have the potential for significant employment generation and poverty alleviation. The problem is to identify, develop and test appropriate institutional arrangements for linking production, marketing and processing activities to improve smallholder access to urban markets at competitive cost. Improving smallholder competitiveness will require appropriate technology and services (e.g. breed and breeding services, feed and health inputs) specifically targeting smallholder needs for improving productivity.

[3] Even this seems on the high side because predominant Black Bengal breed of goats are low milk yielder and few goats and sheep are regularly milked for human consumption, most milk is fed to kids.

[4] One plausibility is that the reported livestock population figures are not fully accurate. Problems with reported livestock statistics were reviewed in the past (see Jabbar, 1989) and dissecting the currently reported statistics further may be a useful exercise but lies beyond the scope of this paper.

3 Factors influencing dairy sector growth

Dairy sector growth is a function of many factors including policy. Technology and policy interventions can contribute to growth in dairy production by altering the opportunities and incentives for changes in the diary system from semi-subsistence to market oriented production even for smallholders owning one or two cows. Technologies in relation to feed and veterinary inputs and services are essential for improving productivity and reducing per unit cost of production. General macro economic and dairy sector related economic policies, especially tariff and taxation policies, can contribute to growth by influencing competitiveness of the domestic producers. Policies for technology delivery, regulation of input and output markets and investment in infrastructure can alter market institutions and transactions costs. Critically, policies can partially determine the winners and losers of structural changes in the sector, determine market participation of smallholder vs larger producers, and employment generation and incomes at both farm and market level.

3.1 Modelling impact of technology and policy on dairy growth

Growth is a time dependent phenomenon so multivariate analysis based on time series data is sometimes used for assessing the effect of policy along with other factors on growth. Such a model was used by Staal et al. (2008) to relate milk production and its key determinants separately for 5 countries in South Asia (Bangladesh, India, Nepal, Pakistan and Sri Lanka) for the period1970-1999 for which comparable data sets were available. Results for Bangladesh are presented along with some results for other countries to compare performance and contributing factors. The general form of the model is represented as follows:

$$\ln(y_{i,t}) = \alpha_i + \sum_k \beta_k \ln\left(X_{i,t-n,k}\right) + \gamma \ln\left(SK_{i,t-n}\right)$$

where y represents per capita milk production in country i and year t as an indicator of dairy sector growth, α represents country i's specific characteristics influencing development of the dairy sector not captured by other variables, X are k exogenous variables embodying policies, infrastructure, technology, human capital, demand and other variables affecting dairy development and SK is the stock of milking animals. All explanatory variables are lagged n periods. Some of the variables usually make direct contribution to output while other make contribution indirectly, and some factors for which a direct measure could not be identified or specified, a suitable proxy was used. The model was estimated by generalized least squares and technical details of the estimation can be found in Staal et al. (2008). After trying with a larger set of specific variables, the set that gave the best results in terms of explanatory power was chosen. Before discussing the results, the specified variables are briefly defined.

Milk producer's price as a ratio of import price was used as a dairy related policy variable. This ratio is influenced by dairy related tax, tariff, import quota and other restrictions, and indicates the degree of protection or competitiveness of domestic producers. The various instruments mentioned above have been variously used by each of

the study countries at different times depending on own economic circumstances and overall macroeconomic conditions but the composite effect of those policies have been generally reflected in the domestic price as a ratio of import price. In theory, a higher degree of protection may stifle growth by providing adequate revenue from low production while very low competitiveness may also stifle growth due to insufficient income generation and incentive.

Three macro-economic policy variables used in the model are GDP growth, degree of openness of the economy measured by trade as % of GDP, and domestic credit to the private sector as a % of GDP. These factors may influence growth respectively through demand creation for goods, through creating competitive or non-competitive production environment and through investment incentive and environment. Three factors related to dairy demand that may influence dairy growth are level of domestic milk consumption, share of processed milk in total output, and GDP per capita. Higher values of each of these may induce higher growth in the sector.

Three factors related to input market are feed supplied to livestock, number of tractors as a proxy for mechanization and crop sector growth, and number of television sets per 1000 population as a proxy for access to information. Mechanization releases land and feed used for draught animals which may be used to raise more or better yielding cows. Better crop sector growth may also enhance feed supply and increase demand for milk due to higher crop income.

Four factors related to dairy technology and human capital that may influence growth are number of milking animals, milk yield per animal (reflecting breed or genetic quality resulting from breed related policy and investment), research and development expenditure in the agriculture sector (a proxy for better supplied technology) and illiteracy rate (a proxy for quality of labour and management). Because of predominant mixed farming system and the interactions between crop and livestock, R and D expenditure in agriculture is considered more relevant than R &D expenditure in dairy or livestock alone, for which data is also difficult to find.

The estimated parameters for the model are shown in Table 3.1. Dairy growth rates in four countries except Sri Lanka for three distinct periods and percentage contribution of each factor in the equation to the growth rate are shown in Table 3.2. It appears that per capita milk output increased at the rate of 4-6% in India and Pakistan especially in the last two decades and less than 3% in Nepal. In Bangladesh, the rate was negative during 1980-89 and less than 1% during 1990-99. The percentage contribution of a factor is self explanatory as it is derived from the coefficients of the regression estimates in Table 3.1.

It appears that growth of the dairy sector in the selected countries during 1970-1999 has been positively and significantly associated with GDP growth rate, domestic consumption level of milk, milk yield per animal, feed supplied to livestock, number of tractors per hectare and number milking animals. Higher values of these variables were associated with higher growth in milk output per capita as would be normally expected. On the other hand, growth of the dairy sector has been negatively associated with television sets per 1,000 people and R&D expenditure in agriculture per hectare ($). These may indicate that dairy sector did not benefit from overall increase in research

expenditure in agriculture. And dairy also did not benefit from expansion of television network for information dissemination or perhaps television was not a good proxy for access to information.

Table 3.1 Determinants of change in milk production per capita in South Asia

Variable	Coefficients
Milk producer's price as a ratio of import price	0.02
Openness (Trade as % of GDP)	-0.08
GDP growth (%)	0.73**
Domestic credit to private sector (% of GDP)	-0.01
Level of domestic consumption (litres)	0.21**
Share of formally processed milk in total output (%)	0.04
GDP per capita (in 2000 US$)	0.09
Feed supplied to livestock (tons of maize equivalent)	0.15*
Number of tractors per hectare	0.23***
Television sets (per 1,000 people)	-0.16**
Milking animals: cows and buffalos (heads)	0.19**
Milk yield (lt/milking animal)	0.23**
R&D expenditure in agriculture per hectare ($)	-0.25**
Illiteracy rate (%)	-0.27
Time trend	0.02**
Bangladesh-1970s[c]	0.20***
India	1.61***
Sri Lanka	-0.94
Pakistan	1.09***
Nepal	0.14
Constant[b]	-44.38*

Note: *, ** and *** indicate statistically significant at the 10%, 5% and 1% respectively.
a/ Production measured in metric tons
b/ Constant term represents country effect of Bangladesh-1980-1999. Country effects for other countries than Bangladesh are obtained by adding the country coefficient and the constant term
c/ Dummy variable taking value of 1 when Bangladesh and year 1970
Source: Staal et al. (2008)

But nearly all the policy related variables – both dairy policy and macro-economic policy- were apparently not significantly associated with growth in the dairy sector. These include milk producer's price as a ratio of import price, share of formally processed milk in total output, openness of the economy (trade as % of GDP), domestic credit to private sector (% of GDP), GDP per capita, and illiteracy rate. Some of these variables may be partly affected by multicollinearity yet their lack of influence on dairy sector growth appears consistent in all the countries under study. Among these, the macro policy variables are supposed to influence dairy growth indirectly so their lack of statistical significance may not be surprising. But two policy variables directly related to the dairy sector i.e., milk producer’s price as a ratio of import price and share of formally processed milk in total output, also did not play any significant role in the dairy sector growth. It appears that the benefits of various instruments of tax, tariff and import restrictions used in these countries did not reach the dairy producers to provide them

Table 7. % contribution[a] of different factors to the annual growth rate of milk production per capita in South Asia, 1970-1999

	Bangladesh			India			Nepal			Pakistan		
Year	1970-1979	1980-1989	1990-1999	1970-1979	1980-1989	1990-1999	1970-1979	1980-1989	1990-1999	1970-1979	1980-1989	1990-1999
Per capita growth rate in milk production	**3.59**	**-2.43**	**0.26**	**4.31**	**5.40**	**4.01**	**1.95**	**2.00**	**2.55**	**1.70**	**4.82**	**6.34**
Milk producer's price as a ratio of import price	0.20	-0.12	-0.09	-0.02	-0.09	-0.06	0.02	-0.05	-0.33	-0.05	-0.02	-0.11
Dairy policy	**0.20**	**-0.12**	**-0.09**	**-0.02**	**-0.09**	**-0.06**	**0.02**	**-0.05**	**-0.33**	**-0.05**	**-0.02**	**-0.11**
Openness (Trade as % of GDP)	0.25	-0.05	-0.34	-0.19	-0.05	-0.38	-0.23	-0.27	-0.47	-0.18	-0.05	-0.05
GDP growth	-0.01	0.04	0.11	0.07	0.06	0.05	0.02	0.13	-0.04	-0.12	0.11	-0.20
Domestic credit to private sector (% of GDP)	-0.20	-0.17	-0.05	-0.07	-0.06	0.03	-0.11	-0.09	-0.10	0.03	-0.04	0.01
Macro policy	**0.03**	**-0.19**	**-0.28**	**-0.19**	**-0.05**	**-0.30**	**-0.32**	**-0.24**	**-0.61**	**-0.27**	**0.02**	**-0.24**
Domestic consumption of milk production (lt)	0.51	0.54	-0.19	0.65	1.16	0.83	0.56	0.34	0.45	0.47	0.60	1.18
GDP per capita (2000 US$)	0.02	-0.01	0.06	0.06	0.26	0.19	-0.01	-0.08	-0.05	-0.04	0.01	0.29
Share of formally processed milk in total output (%)	0.00	-0.02	0.04	-0.04	-0.08	0.09	-0.01	0.06	0.04	0.00	0.01	0.01
Demand	**0.52**	**0.51**	**-0.10**	**0.68**	**1.34**	**1.10**	**0.54**	**0.33**	**0.44**	**0.43**	**0.62**	**1.48**
Feed supplied to livestock (tons of maize equivalent)	0.27	0.39	0.30	0.30	0.42	0.53	0.56	0.00	0.84	0.59	0.84	0.67
Number of tractors	2.76	1.04	0.19	3.63	2.43	1.60	3.90	1.53	0.92	3.64	3.12	1.41
Television numbers (per 1,000 people)	-0.97	-0.93	-0.87	-1.35	-0.97	-1.94	-2.27	-1.68	-2.10	-1.10	-0.95	-1.95
Input markets and labour	**2.06**	**0.50**	**-0.38**	**2.58**	**1.88**	**0.19**	**2.19**	**-0.15**	**-0.34**	**3.38**	**3.27**	**0.45**
Yield (lt/milking animal)	0.00	-0.43	0.00	0.26	0.51	0.51	-0.29	-0.35	0.19	0.02	-0.26	0.84
R&D in agriculture per hectare ($)	-2.46	-2.51	-1.31	-2.98	-1.43	-0.88	-2.43	-1.05	-0.86	-3.32	-2.60	-1.14
Illiteracy rate (%)	0.18	0.17	0.22	0.31	0.36	0.41	0.27	0.25	0.36	0.25	0.26	0.32
Technology and human capital	**-2.28**	**-2.77**	**-1.09**	**-2.41**	**-0.56**	**0.04**	**-2.45**	**-1.15**	**-0.31**	**-3.30**	**-2.86**	**-0.30**
Other[b]	**3.04**	**-0.36**	**2.20**	**3.67**	**2.88**	**3.05**	**1.95**	**3.26**	**3.70**	**1.50**	**3.80**	**5.06**

a. Defined as the change in the variable multiplied by the respective estimated coefficient (in Tab 6) expressed in percentage. The sign of the contribution would depend, on the sign of the estimated coefficient and on the direction in the change of the variable, e.g. a positive coefficient together with a positive change in the variable result in a positive contribution to growth while a positive coefficient and negative growth in the variable results in a negative contribution to growth

b. Other includes the effect of milking cows, the time trend and an error term.

Source: Staal et al. (2008)

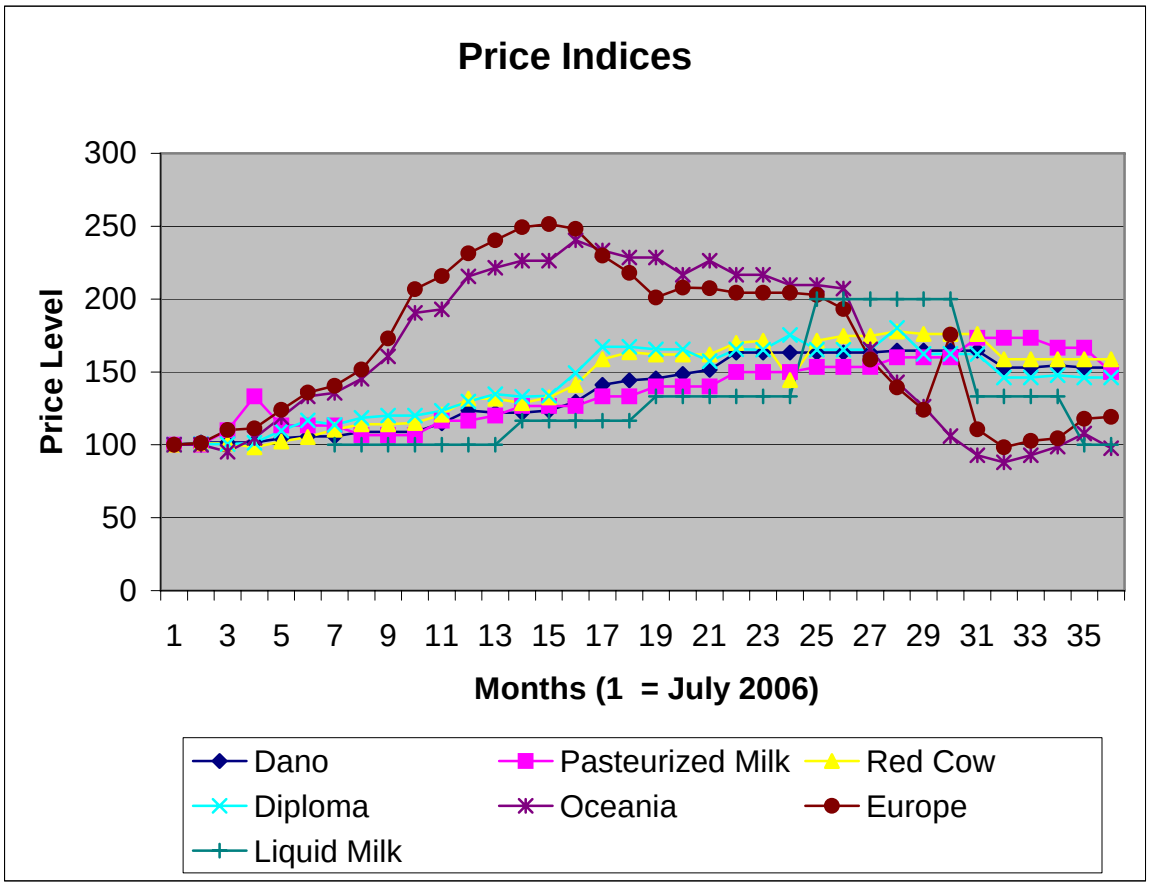
adequate incentive to produce more. The formal processing sector also did not play any significant role in the growth of the sector partly because in some countries it still handles a small share of milk in relation to the informal sector, and partly because the formal sector has failed to provide adequate incentives to producers to increase productivity and production. The role of tax and tariff policy and of the formal processing sector in growth in Bangladesh is discussed in more detailed with more recent information below.

3.2 Role of tax and tariff on dairy sector growth

The multivariate model has shown that in Bangladesh, growth rate during 1970-99 was small and some technology and input market factors contributed to it but tax, tariff and other import restricting policies had no significant impact on dairy sector growth. This lack of linkage between tax and tariff policy and dairy growth is further illustrated by comparing price indices of milk in the global market (represented by European and Oceania markets), and retail prices in Dhaka of powder milk (three most important brands), pasteurized milk and raw fresh milk for the period July 2006 – June 2009 (Figure 3.1). This was a period of volatility in the market. Tax and tariff rates on imported dairy products for the three years are also shown in Table 3.3.

Prior to June 2006, global dairy prices were relatively stable for some time but since June prices started rising quite rapidly and by September 2007 the index was 250% compared to June 2006. From about September 2007 global prices fell again until December 2007 then remained fairly stable until June 2008 then continued to fall rapidly and reached the June 2006 level by March 2009 and remained fairly stable until June 2009. But Dhaka retail prices of imported powder as well as domestic pasteurized milk started rising in June 2006 and continued to rise slowly and steadily until December 2008 when the index was about 180% compared to June 2006, then fell slightly and remained at about 150% of the June 2006 local as well as global price index. In case of raw milk, the trend followed powder and pasteurized milk until June 2008, then it jumped suddenly by about 75% following a scare created by discovery of melamine in some brands of imported powder milk, so some consumers of powder milk quickly shifted to raw milk or pasteurized milk creating extra demand. This situation lasted for about six months and then raw milk price fell suddenly to its original six months earlier level, remained there for about 3 months, then fell again to the June 2006 level as in the case of global powder milk prices. Informal traders in Dhaka made supernormal profit during the melamine crisis through unscrupulous means. Dairy processors also made money at the expense of both producers and consumers showing serious callousness about food safety on the one hand (see Box 1). and lack of any interest to transfer the benefits of the high market price to producers on the other (see below)

Figure 3.1 Indices of prices of powder milk in Europe and Oceania markets and powder and liquid milk in Dhaka retail market, July 2006-June 2009



Source: Global price: http://future.aae.wisc.edu/data/weekly_values/by_area/1705?tab=prices;
Powder and pasteurized milk price : Department of Agricultural Marketing, unpublished data;
Liquid milk price : survey of milk traders, Dhaka city liquid milk markets.
Also see Appendix A1 and A2 for raw data.

During 2006-07, tax and tariff rates remained unchanged throughout the year so domestic price rise of powder milk could be explained by global price rise to a great extent. In the 2007-08 budget, total tax and tariff on imported powder milk was raised to about 142% compared to the 62% rate the year before in spite of the fact that at the time of budget preparation global milk prices were still rising, so the rationale for tax increase was difficult to understand. So part of the explanation for further increase in domestic prices of powder milk in the initial months of 2007-08 could be found in the increased tax and tariff rates. But global prices started falling by 3-4 months into the financial year and tax and tariff rates remained in force throughout the year, but powder milk price increased steadily throughout the year defying any relationship with the tax and tariff rates. The tax and tariff rates remained at the same level in 2008-09 in a situation of rapidly falling global prices but domestic price still continued to rise steadily up to half way through the financial year, then fell slightly, again defying any relationship with the tax and tariff rates. And throughout this three year period, retail prices of pasteurized and raw milk in Dhaka simply followed the trend of powder milk price.

Table 3.3 Tax and tariff rates on imported dairy products, 2006/07 to 2009/10

	Total tax and tariff by year (%)			
Product type	2006-07	2007-08	2008-09	2009-10
Milk&Cream In Powder Forms >1.5% Fat Sweet Or Conc. In Ret.Pk.=<2.5kg	64.22	142.93	142.48	86.44
Milk&Cream In Powder Forms >1.5%Fat,Notsweetened R.Pkt.=<2.5kg	64.22	142.85	142.48	86.44
Milk&Cream In Powder Forms<=1.5%Fat,Con... Or Sweet.,In Reta.Pk.Upto 2.5kg	64.22	142.85	142.48	86.44
Milk & Cream Of >1%But<=6% Fat,Not Concentrated Or Sweetened, Nes	32.32	56	56	33
Milk & Cream Of >6% Fat,Not Concentrated Or Sweetened, Nes	32.32	56	56	55.86
Milk And Cream Of <=1% Fat,Not Concentrated Or Sweetened, Nes	32.32	56	56	33
Concentrated Milk And Cream, Unsweetened (Excl. In Solid Form)	49	93.72	93.31	55.86
Milk & Cream Of >6% Fat,Not Concentrated Or Sweetened, Wrapped/Canned upto 2.5 kg	49	56	89.75	55.86
Milk & Cream Of>1%But<=6%Fat,Not Concentrated Or Sweetened,Wrap./Cann. upto 2.5 kg	49	93.72	93.31	55.86
Milk And Cream In Granule Or Solid Forms Of >1.5% Fat,Sweetened, Other	49	93.72	93.31	55.86
Milk And Cream In Granules Or Solid Forms <=1.5% Fat,Conc. Or Sweetned,Nes	49	71.93	111.28	40.58
Milk And Cream Ingranule Or Solid Form >1.5% Fat,Not Sweetened, Nes	49	71.93	111.28	40.58
Milk And Cream Of <=1% Fat,Not Concentrated Or Sweetened, Wrapped/Canned upto 2.5 kg	49	93.72	93.31	55.86
Tax components (%)				
CD - custom duty	25	25	25	25
SD - supplementary duty	15	20	20	20
VAT- value added tax	15	15	15	15
AIT - Advance income Tax	3	3	3	3
IDSC - infrastructure development surcharge	4	0	0	0
ATV - Advance Trade Vat	0-1.5	0-1.5	0-1.5	2.25
TTI - Total tax index	0	28-78.4	28-78	33-86.44
Others	0.3-0.7	0	0	0

Source: Bangladesh Economic Review, Ministry of Finance, various issues,

Box 1 Milk Quality and Safety: Melamine contamination and artificial milk production

In October 2008, following the discovery of melamine contaminated milk in China, there was serious public concern in Bangladesh about quality of imported powdered milk. Laboratory tests found different levels of melamine in a number of brands imported from different countries. But test results also varied between different laboratories so lack of consensus about test results delayed policy action on the suspected brands, which created public outrage and concern. Powdered milk traders continued to sell suspected brands even after a High Court ruling, in response to a public interest writ petition, ordered to stop trading of suspected brands. It took several more days for law enforcing agencies to come out to enforce the court order which allowed the traders to hide much of the stocks.

Liquid milk traders, especially traditional *gowalas,* took advantage of this uncertainty and increased milk price. Moreover, they also increased milk supply by mixing increased quantities of powdered milk with liquid milk, and selling those as fresh cow milk. Since water and powder milk adulteration is a fairly common practice, consumers concern increased as they suspected that the melamine contaminated powdered milk would end up in the market through the traditional liquid milk sellers.

To make the situation worse, The Daily Prothom Alo, a popular daily newspaper, reported (on 1-2 November 2008) that on 31 October 2008, their investigation in Pabna and Sirajgonj districts, the main milk shed for Dhaka city, revealed that traditional milk traders have been producing *artificial milk* using chemicals and they reportedly have been supplying that milk to BRAC, Pran, and Akij dairies for processing and selling as pasteurized milk. The paper published a trader's artificial milk production factory (see Box 2). This practice has emerged in response to inadequate supply of fresh milk in relation to demand of the processing plants. The process of making artificial milk apparently runs like this: traders separate cream and solid (*sana*) from milk purchased from producers, then in the remaining milk-water (normally called *ghoal*) they mix iron cutting oil at the rate of two drops per litre, which makes the colour of milk-water fully white like full milk. Then they add cream, powdered milk, sugar, salt, sodium carbonate and milk essence in appropriate proportion to prepare artificial milk. Further, peroxide and formalin are added to extend shelf life for delivery to milk collection points of processors,

After the above news paper report, public health and law enforcing authorities have reportedly identified and captured several staff/agents of BRAC, Pran, Aftab and Akij dairies and several milk traders with artificially prepared milk and/or materials and equipment for preparation of such milk, and imposed financial penalty at varying rates. While this quick response was commendable, it was disappointing to see that the management authorities of the relevant dairies did not take responsibility for failing to maintain food safety norms and to protect the health of ordinary consumers. The artificial milk issue subsided for a while but another newspaper, The Daily Star, reported on 25 February 2009 arrest of a milk trader in Jhenidah district with fake milk manufacturing equipment and raw materials which he has been using to regularly supply fake milk to the local BRAC purchase centre. The BRAC purchase centre staff reported to the law enforcers that they were unaware about the practice and could not detect the adulteration with their normal testing procedure. So quality control of milk along the supply chains remains a major concern.

Box 2 An artificial milk production factory in Pabna district

৮ পৃষ্ঠা

প্রথম আলো

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ছানার পানিতে মেশানো হচ্ছে রাসায়নিক পদার্থ। ছানায় মেশানো হচ্ছে ময়দা। শাহজাদপুরের চরাচিথুলিয়া থেকে তোলা ছবি—প্রথম আলো

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জাকির হোসেন ও এনামুল হক খোকন

পাবনার বিভিন্ন এলাকা এবং সিরাজগঞ্জের শাহজাদপুর ও উল্লাপাড়ায় নকল তরল দুধ তৈরি হচ্ছে। সিরাজগঞ্জের স্বাস্থ্য বিভাগ প্রাথমিক তদন্ত করে নকল দুধ তৈরির বিষয়টি নিশ্চিত হয়েছে। তারা নকল দুধ তৈরির বিভিন্ন উপদানসহ কয়েকটি প্রতিষ্ঠানের দুধের নমুনা সংগ্রহ করে পরীক্ষার জন্য ঢাকায় মহাখালীতে অবস্থিত জনস্বাস্থ্য ইনস্টিটিউট পাঠিয়েছে।

গত সপ্তাহে পাবনার সাঁথিয়া, বেড়া, সোনাতলা এবং চলতি সপ্তাহে সিরাজগঞ্জের শাহজাদপুর ও উল্লাপাড়ার বিভিন্ন এলাকায় সরেজমিনে গিয়ে স্থানীয় লোকদের কাছ থেকে এই নকল দুধ তৈরির ঘটনা নিশ্চিত হওয়া গেছে। স্থানীয় ঘোষদের নকল দুধ তৈরির বিষয়টি এলাকায় জানা ঘটনা।

নকল দুধ বানানো হয় যেভাবে: অনুসন্ধানে জানা গেছে, গ্রামগঞ্জ থেকে প্রতিদিন দুধ কিনে আনে ঘোষেরা (দুধ ব্যবসায়ী)। সেই দুধ থেকে প্রথমে ননি আলাদা করা হয়। এরপর ওই দুধ থেকে ছানা তৈরি হয়। ছানা তুলে নিলে যে পানি থাকে, তা হলো নকল দুধের মূল উপাদান। ছানার পানিতে প্রথমে লোহা কাটার জন্য ব্যবহৃত কাটিং ওয়েল (হার্ডওয়্যারের দোকানে বিক্রি হয়) প্রতি লিটারে দুই ফোঁটা হারে মেশানো হয়। এতে ছানার পানি পুরোপুরি সাদা রং ধারণ করে। সেই সাদা পানিতে নামমাত্র ননি, গুঁড়ো দুধ, চিনি, লবণ, খাবার সোডা (সোডিয়াম কার্বনেট) ও দুধের কৃত্রিম সুগন্ধি (অ্যাসেন্স) মিশিয়ে তৈরি করা হয় নকল দুধ। এই দুধ বেশি সময় ভালো রাখতে এতে মেশানো হয় পার-অক্সাইড ও ফরমালিন। সাঁথিয়ার একজন দুধ ব্যবসায়ী নাম প্রকাশ না করার শর্তে জানান, এক মণ দুধ তৈরিতে আড়াই থেকে তিন কেজি ননি, এক কেজি চিনি এবং পরিমাণমতো খাবার সোডা ব্যবহার করতে হয়।

বিশেষজ্ঞরা যা বলেন: সিরাজগঞ্জের সিভিল সার্জন ডা. তওফিকুল ইসলাম বলেন, যেসব উপাদান ব্যবহার করে দুধ তৈরি করা হচ্ছে, তা মানবদেহের জন্য ক্ষতিকর। এ দুধ খেলে কিডনি ও যকৃৎ ক্ষতিগ্রস্ত হতে পারে। তিনি বলেন, 'নকল দুধ তৈরির বিষয়টি জেনে আমি উপজেলা স্বাস্থ্য কর্মকর্তাদের চিঠি দিয়েছি। তাঁরা যেন বিষয়টি পরীক্ষা করার জন্য কার্যকর ব্যবস্থা গ্রহণ করেন।'

ঢাকা জনস্বাস্থ্য ইনস্টিটিউটের জনস্বাস্থ্য ও পুষ্টি বিশেষজ্ঞ ডা. শাহ মাহফুজুর রহমান ও ডা. মো. মুকিম আলী বিশ্বাস বলেন, ফরমালিন, পার-অক্সাইড, কাটিং ওয়েল—সবই রাসায়নিক এবং মানবদেহের জন্য ক্ষতিকর। তাঁরা এরপর পৃষ্ঠা ১৭ কলাম ৪

বাঘাবাড়ী বন্দরের আসাদুলের ছানার কারখানায় ড্রামভর্তি ছানার পানি। এ পানি দিয়েই তৈরি হয় নকল দুধ —প্রথম আলো

Source: The Daily Prothom Alo, 31 October, 2008

So, retail prices of powder, pasteurized and ordinary raw milk in Dhaka and in other urban markets had no rational link with the global price trends and the existing tax and tariff rates rather market power of powder milk importers and the dairy processors determined the price trends. Rise in the global prices of powder milk was immediately transferred to the consumers through the retail market, indeed it was transferred at a higher rate over a longer period than the global price trend would justify. The domestic dairy processors and raw milk traders simply took advantage of the market by taking imported powder milk as the price leader. But the benefits global or domestic retail market price was not transferred to the producers to provide them incentives to increase production, rather the opposite happened. Dairy processors reduced purchase of raw milk from producers either (a) because the market for pasteurized milk shrunk slightly due to some consumers' shift towards lower price powder milk or (b) because processors found it more profitable to mix cheaper powder milk (either directly imported by them or purchased from local market supplied by powder milk importers) with liquid milk for pasteurization or (c) both of the above. Objective data could not be procured to verify which of the above had actually happened.

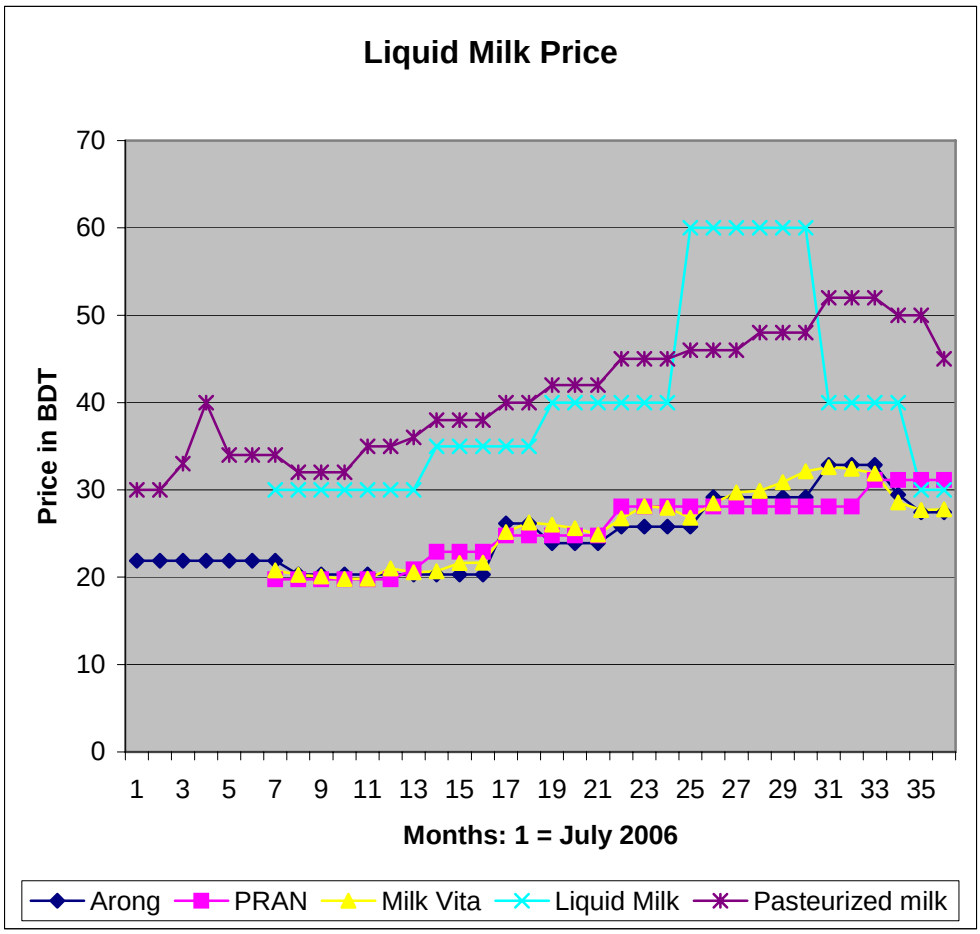
In June 2006, retail price of pasteurized milk in Dhaka was Taka 30 per litre while farm gate collection price of raw milk was about Taka 22 (Figure 3.2). Although domestic dairy processors responded quickly to the post June 2006 global price rise and local powder milk price rise by increasing pasteurized milk price, they did not increase collection price of raw milk from producers for almost eighteen months rather lowered the collection price for a couple of months when they reduced their retail price after an initial rise. Then collection price was increased but at a slower rate than the rise in the retail price of pasteurized milk, so the gap between collection price of raw milk and retail price of pasteurized milk widened over time. Pasteurized milk price was decreased to some extent after the highest peak in December 2008 but collection price was also decreased so the wider gap remained in force.

Thus, analysis of the price trends and tax and tariff rates over the last three years show lack of any rational functional linkages between global, urban retail and producer prices of milk and the lack of effectiveness of tax and tariff to establish these linkages to bring synergy between prices at various levels for the benefit of consumers and producers. It is clear that imperfect dairy market in the country have made policies ineffective for dairy sector growth. This is probably the reason why in the regression analysis over the longer period, policy factors turned out to be not significant contributors to growth.

Given this background, the rationale of tax and tariff policy adjustments announced in the 2009-10 budgets appears questionable. For several months prior to the 2009-10 budget declaration, the dairy processors lobbied strongly with the government to increase tax and tariff on imported powder milk and reduce tax on local production of powder milk because of low global prices for powder milk and consequent decreases in domestic retail prices to allow the domestic dairy industry to remain competitive. During that time, some processors not only reduced farm gate collection price of raw milk but also reduced the volume of daily collection arguing that they were not able to compete with low cost imported powder milk. This created problems for milk traders and smallholder producers

who regularly supply to the processors. Some traders threw away hundreds of litres of milk on the road for several days to protest against the refusal of processing enterprises to take delivery. In reality, these dramatic actions did not really help the cause of milk traders and small producers rather it helped the processors lobby to impress upon the government more strongly that they would not be able to really help the milk producers if the government did not revise tax and tariff rates in the way they wanted. And they succeeded as new tax and tariff policies suited to the processors were announced in the budget for 2009-10 (see Box 3). But the situation on the ground did not change. On 7 July, The Prothom Alo, the national daily, reported that milk producers and traders in the northern districts continued to suffer due to reduced milk collection and lower price paid by processors. On 12 August 2009, the Daily Star, another English language daily, reported similar situations prevailing in the northern districts.

Figure 3.2 Indices of prices of raw and pasteurized milk in Dhaka city and collection price of raw milk by processors at farm gate, July 2006 – June 2009



Source: Unpublished data from processors and the Department of Agricultural Marketing; Dhaka city milk markets

So it is highly likely that the adjusted tax and tariff rates may keep retail price of imported powder milk at a reasonably high level which will allow dairy processors to keep retail prices of pasteurized milk at a reasonably high level, thus making consumers to bear the actual burden of tax and tariff. But there are no indications that the benefits of high consumer prices will be transferred to the producers to provide incentives for increased production. If tax, tariff and subsidy policy is expected to provide incentive to producers as well as protect consumers, such instruments should be better administered at the producer end rather than at the import end. Producers may be provided price support or subsidy to increase production or processors may be provided subsidy where justified directly linking evidence of purchase from producers (see more later).

Box 3: Dairy related tax and tariff proposals in the 2009-10 budget

Import duty

- To offer protection to the local dairy industry, I propose to impose 5% regulatory duty in addition to 12% customs duty on milk powder imported in bulk.
- Import of milk based food preparations (H S Code 1901.90.10) in bulk is subject to 20% supplementary duty. As there is no difference in duty structure between locally packed products and products packed outside, the local packaging industries are affected. I therefore propose to withdraw 20% supplementary duty on the import of this item in bulk.

Value added Tax

- To protect the interest of the domestic dairy industries, I propose to withdraw 2.5% supplementary duty applicable on the processing of liquid milk converted into powdered milk. Moreover, to make the VAT more bearable, I propose to fix tariff value for powder milk at Tk 100/kg. This would result in only Tk15/kg as VAT instead of current Taka 50/kg. I have already put forward my proposals to protect this industry while presenting the proposals on import duty. I hope this expedite the development of the dairy industry.

Source: Budget speech at the Parliament by the Finance Minister

3.3 Role of formal processing sector in dairy sector growth

In the multivariate model, share of formal processing sector in total milk market did not appear to play a significant role in long term growth in the dairy sector. In order to understand the reason behind this situation, it is necessary to analyze the evolution in dairy production and marketing systems in the country.

The present dairy production systems in the country have evolved over time and can be divided into two main but overlapping parts: semi-subsistence and market oriented production systems. Each has an associated marketing system, which can be described respectively as traditional and improved, the latter encompassing the formal processing sector. The basic features of these systems are summarized in Figure 3.3.

The semi-subsistence system is the precursor of the present market oriented system. Livestock have been an integral part of the smallholder crop-livestock production systems that dominate Bangladesh agriculture. In these systems, livestock have been performing multiple functions including utilization of low quality feeds such as crop

residues and other byproducts to produce high quality nutritious food (milk and meat) for human consumption, draught power and manure for crop production and hides and skins for local manufacturing industries and for export. Livestock also generate cash income, serve as a form of savings and investment, and provide security against risk of crop failure and natural disasters. However, milk, ruminant and poultry meat and eggs are the principal products in terms of value of output.

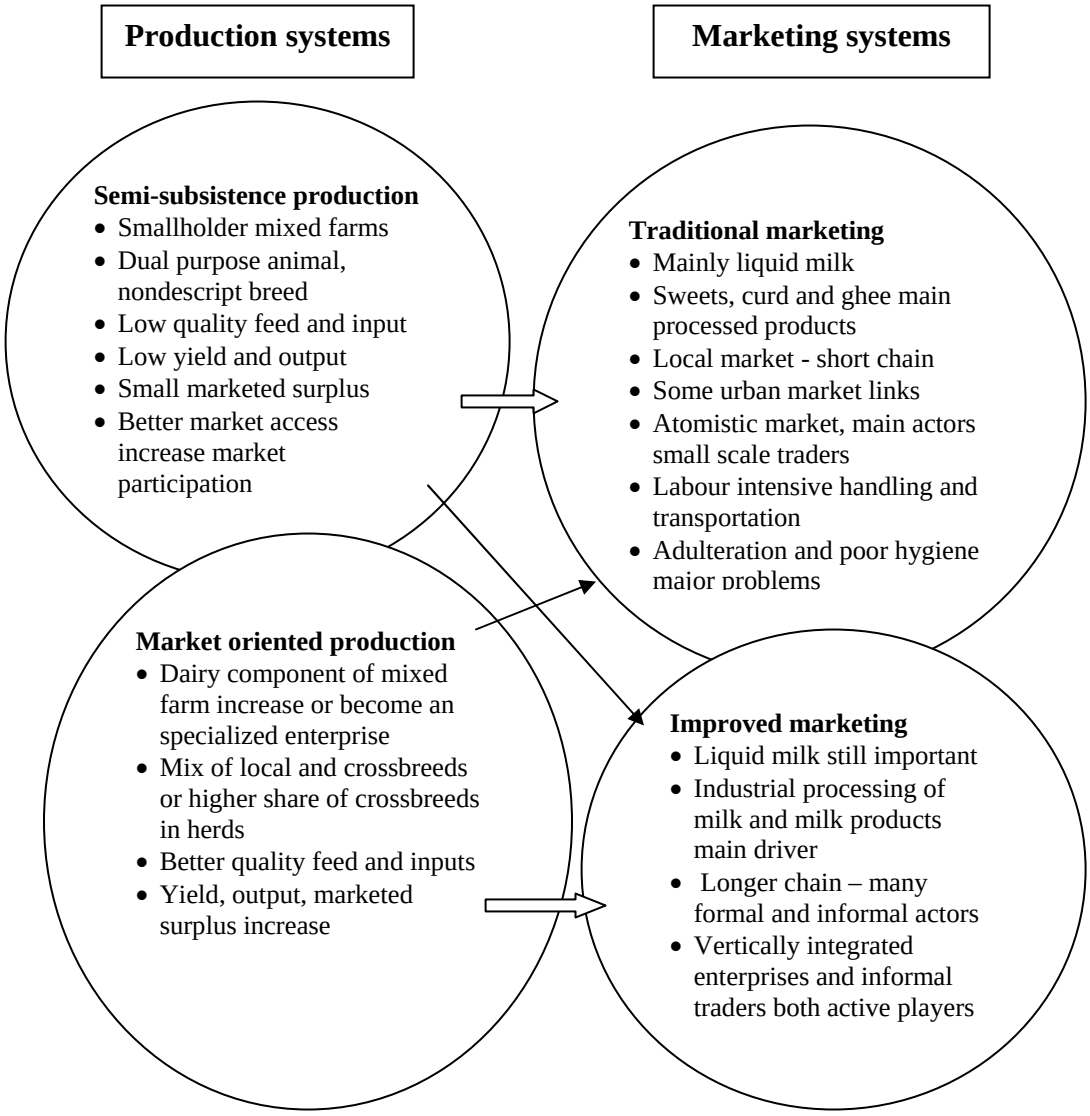
Generally local non-descript dual purpose breeds of cattle well adapted to the local environment that harbour many diseases have been raised. So milk yield has been generally low- on average 1-2 litres per day. Since the 1950s, the low average yield has been further adversely affected by the fact that population pressure and scarcity of land and feed have forced many smallholders to use their cows for draft as well as milk and reproduction as they could not maintain both males for draught and cows exclusively for milk and breeding. The milk yield and reproductive performance of these cows have been adversely affected due to work stress and nutritional inadequacy (Jabbar and Green, 1983; Alam, 1995) [5]. Currently about 50% of the cows of smallholders are used for draught purposes, which limits the milk production potential of the dairy population. In some pockets in the country, buffaloes also provide some milk. Goats (and a small number of sheep in some pockets) also provide milk. However, the discussion in this paper is focused mainly on cattle.

Milk production has been primarily for home consumption; previously only a small proportion of households sold any surplus milk. Also selling milk and using cows for draught purposes were both considered as taboos or low status activities (Jabbar and Green, 1983). However, poverty and resource limitations have led to change in the norms in the society and rearing dairy animals for selling milk have become an accepted, al bait a desirable, means of increasing income of the poor. Micro- credit has played a major role in this transformation of norms and smallholder activities by allowing poor people to acquire dairy animals for income generation.

A survey among rural households revealed a U-shaped behaviour in terms of sale of milk. Landless and marginal farmers who had inadequate cereal production to satisfy family needs but had milk cows sold the entire or a high proportion of milk output to buy cereals – a simple case of trading how value nutritious food for low value but high calorie food which was the basic requirement. As land size and self sufficiency in cereal from own production increased, share of milk output sold decreased and home consumption increased. Milk production and sales increased again more as a commercial activity as land size increased further and cereal self sufficiency or surplus production was achieved (Jabbar and Ali, 1988). Of course, the trajectories of the U-shaped curve may not always be as smooth as described because there might be local variations in the circumstances and the dynamics of the agricultural activities. In limited areas of the country where enhanced market access have been provided by formal milk processing industries, smallholder participation in dairy market has also increased along with more affluent producers.

[5] Dual purpose breeds usually mean breeds in which males are used for draught and females for milk and reproduction. When cows are also used for draught, they may be described as draught cows or milk-and-draught cows, but they are not described as dual purpose in the usual sense.

Figure 3.3 : Stylized classification of the present dairy production and marketing systems



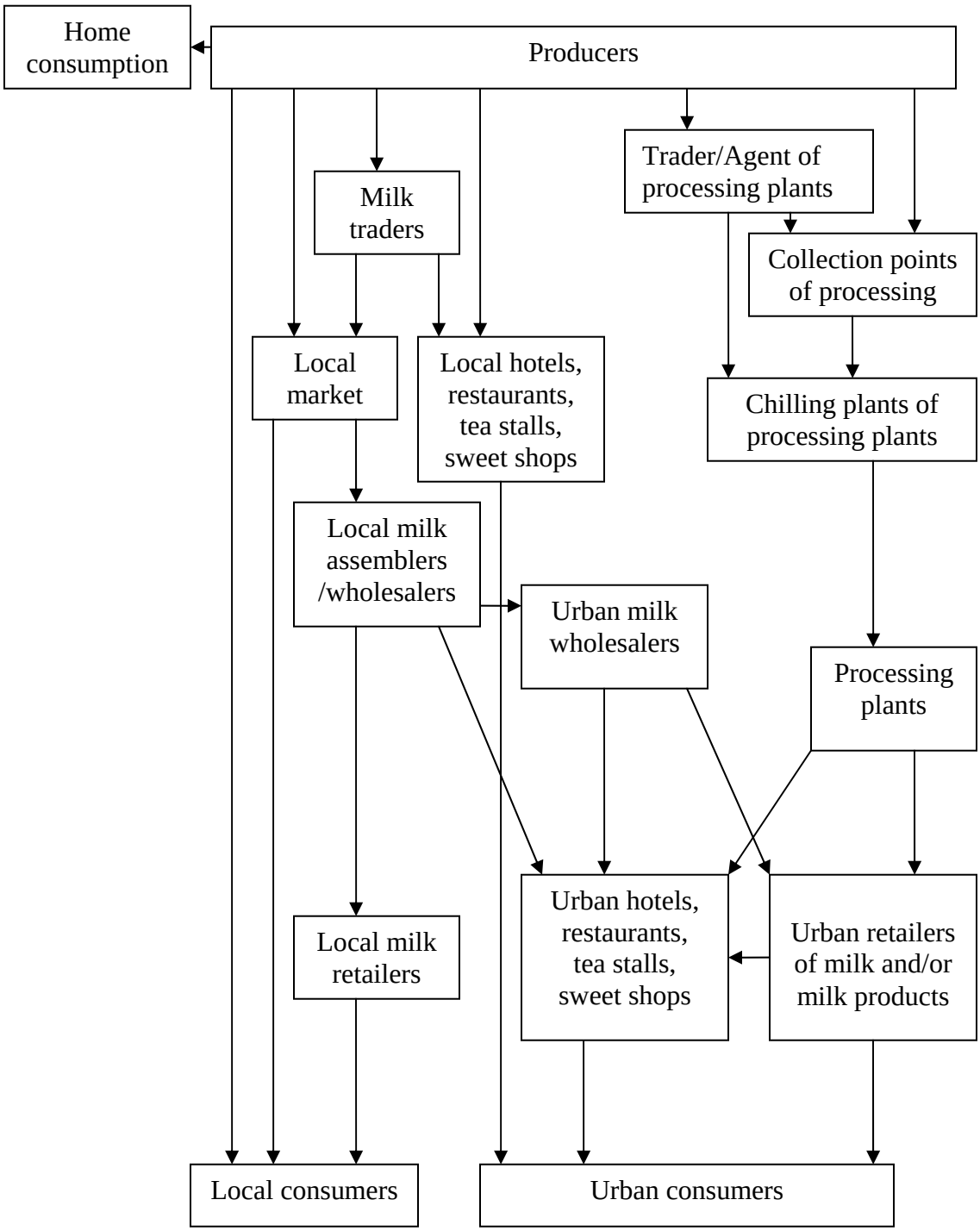
Liquid milk for consumption is the main product in the traditional system, while traditional sweets, yoghurt and ghee are the main processed products. Milk is traditionally consumed in the country in liquid form (boiled to avoid spoilage and infection from micro organisms) and in the form of sweets and curd; a small portion is converted into ghee (clarified butter). Taking the country as a whole, most of the milk is marketed through informal channels by small scale producers and traders to local consumers and processors (for making sweets, curd and ghee) in both rural and urban areas (Figure 3.4). Market chain is usually short connecting producers and consumers directly or through small scale local traders called *ghoshes* or *gowallas* (see Box 4 for some case studies).

Some areas serve as milk sheds of specific urban centres in which case longer market chains involving multiple actors link producers and consumers. Dhaka city is the largest single urban consumption centre and Chittagong and Khulna cities are also large consumption centres. Collection, transportation and retailing by traditional milk sellers are fairly labour intensive activities, so is traditional processing for sweet making. Adulteration with water, though illegal, is the most important problem in this system, especially for ordinary consumers who can't readily test for water adulteration and judge quality. Sweet makers overcome this problem by paying on the basis of solids extraction rate, i.e. yield of *sana* per litre of liquid milk.

Within this general pattern of traditional production and marketing systems, there are a few pockets in the country, which serve as milk sheds for the Dhaka city, where improved Indian breeds like Haryana and Tharparker and later Pakistani breeds Red Sindhi and Shahiwal were introduced either as pure breed or for improving local breeds through crossing. In these areas, a good proportion of mixed farms have adopted dairy as a major market oriented activity alongside crop production. In more recent times, exotic blood of Jersey and Friesian has also been introduced in these areas through artificial insemination programme for improvement of local breeds with a view to improve milk yield. A survey in 2000 in Pabna and Mnikganj districts, which are part of the milk shed of Dhaka showed that about 80 % of the sample herds in these areas had less than 5 dairy cows, but had some crossbred in their herds. The larger herds had higher proportion of crossbreeds or exclusively crossbreed (Jabbar et al., 2005). Another survey on 247 commercially oriented dairy farms and 53 non-commercially oriented farms in Pabna, Rangpur and Faridpur districts found that average dairy herd size (excluding other animals) was respectively 3 and 2 heads and in the former case 83% of the dairy animals were crossbred while none was crossbred in the latter case (Jabbar et al., 2009).[6]

[6] For the purposes of this study, a commercial dairy farmer was defined as one raising dairy cows for milk production primarily for regular selling in the market though a small amount might be kept for household consumption. A non-commercial dairy farmer was defined as one who might keep one or two milk producing cows primarily for home consumption of milk and for occasional sale if there was a surplus (Jabbar et al., 2009)

Figure 3.4 Marketing chains for domestically produced milk and dairy products



Note: addition of distribution channel for imported milk in this figure will make it complex , hence not shown.

Source: Jabbar et al. (2009)

Box 4: Case studies on milk marketed through informal channels

A survey of 40 farms by Kar (2003) in Sadar and Trishal Upazilas of Mymensingh district showed that average production of milk per indigenous cow and cross bred cow was 1.2 litres and 7.1 litres respectively. About 80 percent of total production of milk was sold and the producer families consumed 20 percent. Four market channels were used by the sample smallholder dairy farmers but volume of milk passing through each channel was not reported :

- Dairy farmer-→ Small milk trader→ Consumers [home delivery]
- Dairy farmer-→Small milk trader→ Sweet-meat shop
- Dairy farmer-→ Small milk trader→ Tea stall and
- Dairy farmer-→Small milk trader→ Milk market → Consumers

A survey in Rangpur and Bogra districts showed the following marketing channels for milk (Amin, 2000):

Rangpur :

- Farmer → Milk trader (Doodhwala)→Sweetmeat shop (35%)
- Farmer → Milk trader(Doodhwala)→Urban consumers(65%)

Bogra:

- Farmer → Milk trader(Ghosh)→Sweetmeat shop (27%)
- Farmer → Milk trader(Ghosh)→Urban consumers(59%)
- Farmer → Milk trader(Ghosh)→Tea- stalls (14%).

Based on a survey in three districts- Sylhet, Mymensingh and Bogra- Miah (2002) found that 78% of the smallholder dairy producers in his sample sold their produce to consumers, 19% sold to *Gowala* (ghosh or doodhwala) and 3% to tea stalls (Table below). Higher proportion of rural producers sold milk to *Gowala*, compared to peri-urban and urban producers while direct sale to consumers was higher among peri-urban and urban producers. So it is clear that the smallholder producers in rural and peri-urban areas have less direct access to the urban market, because their small amount of milk does not justify additional transport costs for travelling to urban markets.

Percentage of producers in different locations selling milk to different outlets

Customers	Rural	Peri-urban	Urban	All areas
Goala	38	14	3	19
Tea stall	-	5	3	3
General public	62	81	94	78
• *Home delivery*	*26*	*50*	*64*	*46*
• *Sale at farmgate*	*14*	*6*	*27*	*15*
• *Sale at market*	*22*	*25*	*3*	*17*
Total responses	100	100	100	100

This market oriented production activities in the milk sheds have been supported by an improved marketing system introduced by Milk Vita in 1973 involving formation of dairy producers' cooperatives and establishment of milk collection, cooling and processing facilities and retailing networks in the Dhaka city. This effort created a dual structure in milk marketing. While milk collection for industrial processing into pasteurized milk and other dairy products (butter, ghee, yoghurt, ice cream) has been the driving force in the improved production and marketing systems in the selected milk sheds, traditional systems of production and marketing remained operational among some small scale producers in the milk sheds as well as in the rest of the country. Even some market oriented producers may sell milk in the traditional marketing outlet during flush

season. Although there was no entry barrier in the dairy processing industry, the growth of the formal sector was very slow. The geographical scope of the improved production and marketing systems increased over time along with expansion of the crossbreeding programme as well as industrial processing facilities and related infrastructure and organizations by Milk Vita as well as entry of several private dairy processors in the industry in the late 1990s (Table 3.4). Milk Vita expanded its processing capacity slowly in phases (Table 3.5) while Aarang dairy of BRAC entered the industry in 1998 then expanded rather quickly (Figure 3.5).

Table 3.4 Inventory of milk processing plants and their processing capacities and number of producers supplying milk in 2007

Sl no	Name of dairy enterprise and year of establishment	Current processing(chilling) capacity, litres/day	Approx. no. of producers supplying milk
1	Milk Vita (1973)	200,000	150,000
2	Aarang- BRAC dairy (1998)	80,000	70,000
3	Pran Dairy (2001)	40,000	30,000
4	Amomilk (1996)	10,000	5,000
5	Ultra-Shilaidah Dairy (1998)	10,000	4,000
6	Aftab Dairy (1998)	8,000	4,000
7	Tulip Dairy (1998)	3,000	2,000
8	Grameen-Danone (2007)	1000	CLDDP members
9	Rangpor Dairy (2007)	8,000	7,000
10	Akij Dairy (2007)	4,000	500
11	Bikrampur Dairy (1998)	(10,000)	6,000
12	Grameen/CLDDP (1999)	(7,000)	6,000
13	Savar Dairy (1974)	3,000	Government farm
	Total	383,000[a]	284,500[b]

Author's note:

a. Reported capacity of some of the enterprises may not be fully accurate as different numbers have been found for the same enterprise in different sources. Some enterprises have lower chilling capacity than processing capacity while others have the same capacity for chilling and processing. However, additional processing/chilling capacity might have been added since 2007.

b. There is a possibility of double counting farmer suppliers as in a given area, the same producer may supply milk to more than one processing firm at different times during a year.

Source: Haque (2007)

Table 3.5 Processing capacity of the Bangladesh Milk Producers' Cooperative Union Ltd created over time

Location	Distance from Dhaka (Km)	Nature of plant	Capacity/ day (Litre)	Date of installation
Mirpur	10	Processing	110,000	May 1976
Tangail	100	Chilling	10,000	June 1975
Manikgonj	90	Chilling	10,000	Sept 1975
Takerhat	190	Pasteurization	25,000	Dece 1977
Baghabari	125	Processing	162,000	Nov 1977
Srinagar	30	Processing	5,000	May 1994
Rangpur	300	Chilling	10,000	Decr 1995
Bhangura	155	Chilling	5,000	Oct 1999
Lahirimohanpur	155	Chilling	10,000	Nov 2000
Bhairab	75	Chilling	5,000	April 2001
Raipur	208	Chilling	10,000	Feb 2002
Natore	265	Chilling	5,000	Jan 2003
Islampur	170	Chilling	5,000	May 2003
Gabtaly	220	Chilling	5,000	Jan 2004
Domer	370	Chilling	5.000	July 2004
Satkhira	330	Chilling	5,000	July2005
Noagaon	300	Chilling	5,000	July 2005
Ramganj	200	Chilling	5,000	Nov 2005
Shibpur	75	Pasteurization	50,000	April 2006
Lalpur	250	Chilling	5,000	May 2006
Moulovibazar	250	Chilling	5,000	May2006
Khulna	350	Chilling	5,000	June 2006
Chirir Bandar	367	Chilling	5,000	Sept 2006
Subarnachar	250	Chilling	5,000	Jan 2008
Sunagazi	180	Chilling	5,000	Jan 2008

Source: BMPCUL unpublished data

Figure 3.5. Distribution of chilling centres of Milk Vita and Aarang Dairy (BRAC)

However, the traditional and the improved systems operate in parallel and in some areas overlapping each other. The overall coverage of the improved marking system still remains fairly small both in terms of the volume of milk handled and the number of producers supplying milk to the system. Out of about 3.5 million households that own at least one dairy cow, less than 300,000 or about 8% have access to the formal milk marketing channels. The formal processing sector has installed capacity to process about 384,000 litres per day or only 11% of the 1.24 million tons of milk produced annually.[7] Actual utilization is much lower as some of the smaller processors have limited access to retail market.

Past dairy development efforts through cross-breeding, milk collection and processing for urban markets were limited to a small milk shed in a tiny part of the country where producer cooperatives and groups have expanded market opportunities for producers (Shaha, 2002; Bari, 2002). The private dairy processing enterprises that entered the industry at a later stage have also been operating primarily in the already developed milk sheds to benefit from the existing infrastructure created by the public sector as well as Milk Vita while making some effort to expand their operational areas elsewhere only recently so the impact of that expansion is yet to be felt.[8] Milk collection from a tiny proportion of farms in limited areas in the country combined with the low farm gate price paid in relation to urban retail price and global price as discussed earlier largely explains why the formal processing sector has failed to serve as a significant pull factor for dairy growth in the country. Although various dairy enterprises, especially Milk Vita, played a key role in expanding the formal processing sector, their functioning mechanisms also had limitations which did not allow wider smallholder participation in the formal market through increased milk production. as illustrated with the cases of Milk Vita, Aarang Dairy and the Grameen Dairy project.

3.3.1 Evolution of Milk Vita

During its establishment stage, it was envisaged that Milk Vita would be organised along the Indian Amul pattern and serve as a vehicle for smallholder based dairy development in the country. Hence, the objectives of Milk Vita were stated as follows (Shaha, 2002):

- to raise subsidiary income of poor, landless and marginal farmers living in relatively remote rural areas of the country by way of purchasing their

[7] Recall that if the reported 2.27 million tons output was accurate, formal sector processing capacity would be only 6% of output.

[8] Similar behaviour was shown by the private dairy sector in India after the market was liberalized and NDDB monopoly was removed from the processing sector- they invested in processing and started collecting milk from the command areas of NDDB Cooperatives. While NDDP investment was of a public good nature, private processors in showing lack of interest in expanding investment in infrastructure in new areas considered the possibility of externality of the benefits of their investment in an open market environment.

produced milk at a reasonable price through a guaranteed market under the co-operative fold, and

- to ensure the regular supply of safe, hygienic and nutritious milk and milk products to city dwellers at a fair price.

Over time, in addition to the above objectives, Milk Vita also included the provision of following services to member farmers in order to improve productivity of cows:

- free of charge medicare (preventive and curative) for all cattle belonging to co-operative society members, with emergency services for 24 hours daily
- free of charge vaccination and AI services for upgrading local breeds
- fodder extension advisory services to improve yields of raw milk
- arrangement with the government to access government owned *bathans* (pasture grazing land) for grazing cattle belonging to milk co-operative farmers
- distribution of primarily processed balanced concentrated cattle feed (crude form) at break even price or on a 'no profit no loss' basis to the member farmers.
- training on better animal husbandry practices for the farmers
- imparting knowledge and information through routine display of audio-visual shows regarding improved cattle keeping practices and co-operative management
- arrangement of training/study tours for the member farmers in order to get them acquainted with up-to-date knowledge on dairy farming.

Based on these principles and objectives, the rural milk-producing farmers are organized into *samities* or associations of a size ranging from 16 to 246 members. The agreement between Milk Vita and a member farmer is very simple. Any farmer located in Milk Vita's operating area is eligible to join an existing society or take initiative to organize a new society under the umbrella of Milk Vita. To continue the society's membership, a member should supply at least 100 litres of milk in 100 days in a year. The *samity* is managed by a committee formed by its members. For each group there is a common centre or location for milk collection where individual members bring their milk. A salaried person employed by the primary cooperative society collects milk and records the daily amount delivered in the passbook of the individual farmer-member. At this point there is no arrangement for recording quality of milk. All the collected milk is then sent to the nearest cooling plant of Milk Vita**,** where the volume of milk of each *samity* is recorded along with the quality standard on the basis of fat content. Thus quality is recorded for the bulked amount supplied by each *samity*, and any quality difference between individual members of a *samity* is ignored. Price is fixed by the central office of Milk Vita on the basis of fat percent of milk, and payment for milk is made to the *samity* weekly in arrear. The *samity* in turn distributes the proceeds on the basis of volume of milk supplied by the individual members. Concentrate feeds and

veterinary services are provided on credit, if requested, and the dues are deducted from the sale value of milk (Shaha, 2002).

Over time, Milk Vita has developed into a vertically integrated enterprise[9]. In addition to collection, processing and distribution of processed products to retailers, it has adopted programmes on concentrate feed production, vet services, AI services and credit disbursement. Its feed production programme was established primarily to provide balanced feed for the society members in Bhaghabari. It has later expanded the programme to cover all other areas served by its chilling plants throughout the country**.**

Between 1990 and 2000, number of primary societies and membership increased from 258 and 30,000 to 518 and 60,000 respectively (Table 3.6). A good number of new farmers join every year who receive interest-free credit for cattle purchase. In 2006, Milk Vita had 1053 village milk producers' co- operative societies with over 125,000 farmer-members. Between 1990 and 2006, the volume of milk collection increased 12 times and nominal price of milk increased by 88% (Table 3.7). It is claimed that the co-operative members receive a reasonable price in relation to the local market price, based on quality of the milk and have a guaranteed market for their milk. The traditional middlemen, g*hoses or gowalas,* who had exploited farmers by paying low prices and cheating when weighing milk, have been replaced by the farmer groups. The co-operative farmers are also given compensatory prices against the volume of their milk supplies. Compensatory price is paid when there is profit of the enterprise, which results from many factors but low milk price paid to members may be an important one, so ploughing back profit is a way to provide incentive to members to continue as members (Haque, 2007).

Risk reduction is an important cited reason for joining the cooperative society. Risk is an important feature of dairy farming. Most of the farmers in Bangladesh are generally risk averse, i.e., they normally choose the less revenue-risky business. There are two types of risks: price risk and production risk. Price risk is an important contributor to revenue variability. The biological nature of production and its perishability is one of the important causes of price instability. Lack of access to distant urban markets also gives less remunerative price. Dairy has the potential to provide regular cash income even under variable price, hence can be considered as a good vehicle for income and food security, but it is also a risky enterprise for poor farmers due to a relatively large capital investment in the animal, poor access to veterinary services leading to risk of diseases and mortality. Another risk arises from the fact that there are inadequate

[9] Vertical integration refers to the extent to which successive stages involved in the production of a particular product or service are performed by different firms, or the converse, the extent to which a firm performs different successive stages in the production of a particular product. Vertical integration is also used to describe the action of a firm in acquiring or constructing facilities for carrying out productive stages, which formerly either preceded or succeeded its original productive activities (Needham, 1973). So a firm or enterprise is vertically integrated when it integrates both the input supply and output marketing sectors.

numbers of bulls in the villages so many farmers are not able to service their cows in time when they are in heat, hence conception rates are low. Also upgrading local breeds with the insemination of some exotic germplasm is considered a suitable way to raise milk productivity.

Table 3.6. Growth of cooperative societies and services provided to members

Year	No. of primary societies	No. of members (000)	No. of vet. treatments (000)	No. of vaccinations (000)	No. of artificial inseminations (000)
1991-92	258	30.50	31.26	16.04	14.89
1992-93	268	34.82	32.66	19.87	21.62
1993-94	298	36.30	48.56	26.01	23.25
1994-95	322	42.50	60.68	28.65	16.25
1995-96	314	45.61	71.16	38.50	15.48
1996-97	358	47.99	92.57	35.61	22.52
1997-98	358	48.33	101.77	42.84	23.58
1998-99	390	49.36	98.03	60.27	28.58
1999-00	450	59.62	68.75	60.03	37.42
2000-01	518	60.00	81.34	36.28	44.47
2001-02	590	65.00	100.30	68.23	60.77
2002-03	748	65.50	103.28	124.31	58.07
2003-04	904	66.00	158.84	143.44	58.94
2004-05	1053	101.00	230.61	214.89	59.62
2005-06	1323	125.00	253.95	152.05	63.34
2006-07	1581	137.64	178.18	174.85	57.10

Source: BMPCUL, Unpublished data

Market and price risk arises because dairy farms in Bangladesh are located far away from major urban markets, so they face several problems in marketing including inability to sell milk at desired times due to lack of buyers, inadequate transport facilities to carry milk to markets, uncertain prices and low bargaining power.

Overcoming production, health and marketing problems is a major motivation for joining the cooperative. By becoming a member, farmers have access to health and AI services and assured market outlet for output. Farmers not being able to deal with distant urban markets individually, Milk Vita initially tried to reduce price risk through an assured purchase arrangement. In order to reduce production risk, a scheme of feed supply and provision of veterinary services was undertaken. There

is no insurance system for dairy animals in Bangladesh but assured vet services helps to reduce mortality and diseases. Since 1998, AI service has been provided to members in the 14 upazilas where chilling plants are located and the insemination is done at the *samity's* premises free of cost for the first service as well as any required repeat service(s). Semen of Friesian and Jersey breeds is imported and some amount is also produced at Milk Vita's semen production centre. Number of vaccinations, vet treatments and AI services provided over the years are summarized in Table 3.6.

Table 3.7 Milk collection and price paid to the farmers by Milk Vita

Year	Milk collected		Average Fat content (%)	Average Price	
	(Million litres)	Index		Taka /litre	Index
1990-91	6.22	100	4.4	10.77	100
1991-92	6.48	104	4.6	11.68	108
1992-93	10.24	165	5.0	11.57	107
1993-94	12.05	194	5.1	11.77	109
1994-95	17.45	281	4.4	13.49	125
1995-96	18.33	295	5.2	14.33	133
1996-97	19.46	313	5.0	15.67	145
1997-98	26.52	426	4.7	15.87	147
1998-99	29.47	474	4.4	15.85	147
1999-00	33.99	546	4.7	16.10	149
2000-01	41.32	664	4.6	16.50	153
2001-02	53.81	865	4.5	16.16	150
2002-03	56.84	914	4.4	19.91	185
2003-04	62.79	1009	4.3	16.88	157
2004-05	66.80	1074	4.2	17.38	161
2005-06	73.65	1845	4.1	19.42	180
2006-07	67.99	1184	4.00	20.26	188

Source : BMPCUL unpublished data

Access to technical knowledge and management skills is another advantage of joining a cooperative society. Though raising cattle including indigenous cattle breeds is an age old practice of the smallholder mixed farmers in the country, most dairy farmers start commercial dairy farming using improved breed and technology without acquiring proper technical knowledge and management skills. As there is no organized system of training on dairy farming, Milk Vita provides its member-farmers initial training in the management of dairy animals, fodder production, health care, advanced technology and also provides extension advice on a regular basis.

Until 1990, Milk Vita did not perform very well and its processing capacity remained underutilised. However, since 1990, Milk Vita has expanded its network of milk collection points in several milk sheds and has increased its collection and processing substantially with a soft loan from the Government, which made its

operation profitable for some years, then apparently it has been undergoing losses again due to undue interventions from labour union and overstaffing of its plants. During the past year, it has earned profit once again. Milk Vita has also contributed to a small increase in milk productivity in its operational areas through the supply of AI services, extension and concentrate feeds and credit, but the extent of productivity increase is unclear.

Although in theory members own Milk Vita and manage it through the Managing Committee in accordance with bylaws made and approved by its members according to laws on cooperatives, in practice it has been observed that they exert little real power in the day to day management of the organisation at local and national levels. The Managing Committee is comprised of nine members of which six including the Chairman and the Vice-Chairman are elected out of the office bearers of the primary milk producers' co-operative societies and the remaining three are nominated by the government. The managing committee is an honorary body which implements its decision through the organizational set up headed by the General Manager (Chief Executive), who is a paid employee. So the executive and government nominated members exert the greatest influence on the functioning of the organization due to weakness of the elected members and due to the lack of regular meetings and discussions for major policy decisions like price determination, investment in new facilities, sourcing funding for investment, strategy for marketing etc that determine the competitiveness and profitability of the enterprise. For example, several chilling plants are operating at much below capacity because they have been established at locations having poor milk supply hinterland and transport connection, and these decisions were made administratively without proper assessment and involvement of members, perhaps because of political or administrative pressure.

While Milk Vita has played key role in popularizing pasteurized milk and spearheading the process milk industry in the country, for which it deserves much credit and appreciation, it is also apparent that there have been room for enhancing efficiency of Milk Vita's operations. An area that deserves adequate objective assessment of cost effectiveness is its input and services provision programme and the possibility of other options for introducing more competitive provision of these services.

3.3.2 Evolution of Aarang Dairy of BRAC

The Bangladesh Rural Advancement Committee (BRAC) is the largest national NGO operating in the country as well as abroad. The BRAC is committed to poverty reduction and empowerment of the poor through providing credit, training and technical assistance. The BRAC's involvement in dairy processing and marketing has evolved over time. The BRAC is a not for profit organization serving the poor but, like several of its other profit making enterprises, its dairy processing enterprise called Aarang Dairy, established in 1998 is an income generating activity

registered under the company act. The enterprise consists of a dairy processing plant, about 70 chilling plants and collection centres, AI service facilities, feed manufacturing and selling facilities, all run on commercial principles. The Aarang Dairy collects milk from different parts of the country through its collection points-cum-chilling plants located at various places in milk producing areas (Figure 2). These plants are of smaller size compared to those of Milk Vita, so each plant has a smaller supply hinterland or service area but they are more widely distributed than Milk Vita's chilling plants.

Milk is not usually collected directly from dairy farmers but through milk supply agents, most of whom are traditional milk traders or *gowalas* but may also include some dairy farmers who are engaged in milk trade as an additional income earning activity. Aarang Dairy provides milk cans to the agents for collecting and bulking milk and sometimes advances money unofficially to ensure regular supply of milk. An agent contract a number of farmers willing to sell milk, preferably regularly, to Aaring Dairy and collects milk from their doorsteps, and supplies to a specific chilling plant of Aarang Dairy. It is unclear how and at what stage of the supply chain the quality of milk is tested.

Aarang Dairy follows almost the same procedure as Milk Vita in setting buying price of milk and making weekly payment. Price paid depends on market price so it may vary over months and seasons. The production risk is fully borne by the farmer. Recently Aarang Dairy has started to give farmers a membership card, though the objective of this is unclear.

BRAC Feeds and BRAC AI, two separate companies within the BRAC family, respectively provide feeds and AI and vet services to milk producers through input retailers under different marketing arrangements unrelated to each other and to the purchase of raw milk. BRAC Feeds sells feeds from its feed manufacturing plant through its dealers and agents. BRAC AI provides AI services through BRAC trained AI workers at the farmer's door step at a cost. BRAC trains such AI workers to encourage them to work in their own locality to earn additional income. They operate in 410 upazilas in the country including the upazilas where Aarang's milk collection points are located (cf Figure 3.5). The fee for AI is Tk. 100 per service - base or repeat. Out of this, Taka 70 is refunded to BRAC as payment for the semen and Taka 30 is retained by the AI provider as his/her remuneration. Semen is either imported or produced at BRAC AI's own bull centres where Friesian cross and Shahiwal cross bulls are maintained. Feeds and AI services are provided on credit by the suppliers if requested by the farmers but Aarang Dairy does not take any direct responsibility for loan disbursement and collection.

It is sometimes claimed that BRAC AI's services are more efficient (e.g. conception rate is higher) than DLS or Milk Vita provided AI services. However, the true cost effectiveness of BRAC Feeds and BRAC AI's services has not been objectively assessed. Moreover, the lack of any functional coordination or linkage among its feeds, AI and milk collection operations cast serious doubt if its overall operations any more efficient or cost effective than the other providers of these inputs and services.

3.3.3 Grameen/Community Livestock and Dairy Development Project

Grameen Motsho Foundation- a subsidiary of the Grameen Bank - started experimenting with a crop-livestock-fish farming integrated project with landless and marginal farmers with UNDP funding in 1998. The purpose was to provide micro credit facility to groups of about five members to acquire livestock (goats, poultry, cattle) for fattening or milk production as appropriate to increase income and household nutrition. A group of members could also lease ponds for fish raising or lease land for vegetable or other crop production. Livestock credit included a mandatory insurance policy to cover risk of disease and mortality, and 2.5% of purchase value of the stock was deducted from the approved credit as premium of insurance. The project provides the members access to inputs (feeds, AI) and vet services at cost and imparts training to improve knowledge on better management of livestock. The project also included establishment of four dairy processing plants to be located in selected project sites and owned jointly by village group members (75% share) and Grameen Motsho Foundation (25% share). Members are obliged to sell milk to the dairy enterprises which process into products that can be marketed locally. They can also sell surplus milk to other bigger dairy enterprises like Milk Vita and Bikrampur Dairy accessible in the respective areas. Profits are shared among members. Where members have adequate number of cows to produce enough dung to run a biogas digester, they can access additional loan to establish a digester to generate energy for cooking, lighting etc and use the slurry as manure (Mitra and Hossain, 2002).

Although there is no independent evaluation of the performance of the initial years of the project, the Grameen Bank, apparently based on positive results during the pilot years, expanded the scheme to include a milk processing plant to make micronutrient fortified yoghurt for selling to poor people in the locality to improve nutrition. This enterprise has been undertaken as a joint venture with Danone, a multinational, of France. This is running at a pilot scale since late 2007 and has been dubbed as a social business. In addition to supplying nutrient rich yoghurt for the poor, the enterprise has been also expected to create employment and income among distributors and retailers of yoghurt and small scale milk producers, all of whom are expected to be primarily members of the Grameen family (Yunus, 2007).[10]

Given Grameen Bank's operational principles of collateral free micro credit for undertaking income generating activities, the obligation of small group members to sell their milk to the group owned processing plant makes this a special type of organisational arrangement which is theoretically a self regulated and self managed entity but in practice a project guided and supervised by Grameen Bank. This is still

[10] Yunus (2007) stated that Danone shared 50% of the US$1.1 million initial investment cost. To participate in this venture, Danone's expressed motive was 'a joint investment in which no profit would come to Danone'. But it is unclear if the share of initial investment was in effect a grant or an investment for profit but the profit would be retained by the company for reinvestment. Although Danone did not want to take back profit, it is unclear who would bear any losses, including possible accounting losses in the initial years. Perhaps the MOU with Danone has the details that are not spelled out in the book.

a small venture and if the principle can be internalised by the groups, then scaled up and a true self governed and self managed cooperative organization emerges that is vertically integrated, then it may approach the structure of Milk Vita except that unlike Milk Vita and Aarang Dairy, Grameen-Danone is not targeting Dhaka or other big cities as the primary market outlet for products rather the declared objective is to make this product available in rural areas specially among the nutrient deficient poor. Already it is observed that the venture is not able to collect enough milk from its members or even from the locality to fully utilize the processing capacity. Its location being in the supply hinterlands of Milk Vita and other processors, it has to compete for milk collection with them. Some amount of its product is already sporadically appearing in the urban markets, which is contrary to its declared goal. Whether this is due to inadequate local market or a strategy to create an alternative outlet for surplus output to serve the urban poor, or the middle class and the rich who may appreciate its value more and also pay more, is unclear at this point.

3.3.4 Summary on role of the processing sector in growth

It appears that both Milk Vita and Aarang Dairy (and other private dairy processors as well) involved in milk collection and processing to meet high urban market demand are interested in maximizing milk collection from current production to utilize their processing facilities. Both Milk Vita and Aarang Dairy have input supply programme to improve productivity but these are highly inadequate, uncoordinated, and in case of Aarang Dairy separate from the milk collection programme, and without any clear objectives for long-term development of the dairy sector to ensure sustained long-term supply. Assured market, regular payment and access to veterinary services are the main motivations for farmers to get into supply agreements with these enterprises. Milk being a perishable product, most dairy farmers is concerned with problems of assured buyer of milk and timely payment for the product marketed. The problem of market access is more pronounced among relatively larger dairy producers as evidenced by a recent survey which revealed that a higher proportion of large farms sold milk to Milk Vita and Aarang collection points than did smallholders (Jabbar et al., 2005). Smallholders outside the operational areas of the dairy processors remain largely disconnected from the large urban markets. A survey among farmers involved in supply arrangements with Milk Vita and Aarang showed that more than 94% of the sample dairy farmers under Milk Vita as well as Aarang considered the availability of assured market for milk as the main motivation behind their decision to participate in the arrangement (Table 3.8). The second most important reason (69% of the sample farmers gave this response) was timely payment for output delivered. Access to veterinary service was also an important reason for getting into agreement with Milk Vita (28% of respondents) but none chose Aarang for veterinary service rather it was chosen by 12% respondents due to good price. This seems reasonable in view of the poor veterinary services provided by the public sector. Other factors such as access to information, extension advice, technology, credit and feeds did not feature in the minds of most of those who made arrangements with Milk Vita or

Aarang for milk supply though both the organizations provided these inputs and services directly or indirectly.

Table 3.8 Main motivations to make arrangement with Milk Vita and Aarang Dairy to supply milk

Reason for getting into supply arrangement	Milk Vita farmers (n=86)	Aarang farmers (n=58)	All farmers (n=144)
First reason (% sample respondents)			
Assured buyer of output	94	93	94
Timely payment for output	6	5	6
Access to credit for inputs	-	2	1
Second reason (% sample respondents)			
Timely payment for output	69	69	69
Access to veterinary services	28	-	17
Good price of output	2	12	6
Time saving for sale of milk	-	5	2
Stable price of output	-	3	1
Assured buyer of output	-	3	1
Advance payment of milk	-	3	1
Access to credit for inputs	-	2	1
Access to technical advice on dairy	1	-	1
Near to house	-	2	1

Source: Jabbar et al. (2009)

Though both Milk Vita and Aarang Dairy are expected to honour agreements with their clients and members for regular purchase of milk at reasonable prices, a survey shows that 47% of farmers supplying milk to Aarang Dairy experienced conflict during the past year with their agents about delivery and price occasionally or often. Such conflict arose mainly due to delayed payment of sales proceeds. About 10% of the respondents did not answer and the remaining sample farmers did not experience any conflict with the agent during the past year. During field visits, one of the complaints from Milk Vita members was that Milk Vita sometimes refused to take delivery of agreed amount milk or amount of milk offered, especially in the flush season, when supply might exceed expectation, as the milk collectors might not have enough logistic preparation to handle extra milk. On the other hand, Milk Vita field staff also mentioned that some farmers sometimes failed to deliver agreed and expected volume of milk as they sold milk in the local market to take advantage of better price. However, these types of contract violations by both Milk Vita and the member farmers were not mentioned during formal survey, perhaps because both the parties were defaulters at one time or another. Enforcement of agreement is a key for proper functioning of the milk supply chains, especially if it is an integrated value chain. To this end, appropriate formal contractual arrangements and associated rules and norms need to be identified and effected.

Thus, it appears that large and increasing dependence on import may shape the domestic dairy processing and marketing industry in a way that may not serve the interests of smallholder producers because such industries, especially in the private sector, may focus on maximizing collection from principal and well endowed milk sheds and not invest on infrastructure and services necessary to support productivity improvement and milk collection from large number of small producers scattered throughout the country. They would expect the public sector to make those investments so they can reap the harvest.[11] Moreover, formal processing industries may promote larger scale producers for the sake of their own economies of scale in milk collection and marketing in the absence of positive support for smallholders even though some of them, especially Milk Vita and Aarang, are supposed to serve smallholders by virtue of their mandate to help alleviate poverty. If dairy processors are interested to play a role in dairy development, they need to share responsibility with the public sector for infrastructure development and service provision for productivity improvement of smallholders and they have to go beyond collecting milk from a small number producers in a limited part of the country and also pay them a price that represents a fair share of the retail price of milk.

3.4 Breeding policy and its impact

In the multivariate model, the variable 'yield per animal' was statistically significant implying that increased yield made a significant contribution to long term growth in dairy sector output. Yield per animal increased because of some changes in the genetic composition of the national herd due to the introduction of exotic blood. Though exotic blood was introduced in the country by the British long time ago, by about 1990, only about 5% of the cattle population was crossbred having exotic blood of some proportion with wide variation across districts. The rate was about 11.7% in 62 villages covered by intensive artificial insemination programme; in urban areas, the ratio was about 20% and in sub-urban and rural areas about 10%. Only 27.6% of cattle owners in these villages had crossbred cattle (Alam,1995). More recent figures for crossbred cattle population are not available but it is assumed that about 3 million or 13% of 22.9 cattle population in the country in 2007-08 were crossbred. So the changes in the genetic composition of the cattle population have been slow. Moreover, it has been chaotic due to the absence of a scientifically based long term breeding policy for dairy development in the country, and the dairy processors have added to that chaos through their own breeding services offered to farmers. Therefore, limited yield increase in the recent past should not misguide the need for formulation and implementation of a proper breeding policy for sustained development of the dairy sector.

[11] For example, one private dairy processor wrote "…If the supply of milk can be ensured in an area, private entrepreneurs will automatically invest in chillers and other processing facilities" (Chowdhury, 2009).

3.4.1 Choice of breeds for improvement

Any breeding policy aimed at long term development of breed(s) for a given context essentially has three main components – choice of breeds for development, strategy for multiplication and dissemination of the chosen breeding material, and regulations for protection of property rights, trade and quality control.

The local non-descript cattle population in Bangladesh have evolved by adapting to its climatic conditions, severe feed constraint and disease incidence. Producers have continuously improved them through careful selection and grading. Formal scientific intervention in breed development is a more recent phenomenon. Efforts to improve Indian local zebu cattle through crossbreeding and grading were started by the then British Government in the middle of the 19th century by crossing with European breeds. In Bengal initial effort for genetic improvement of cattle was made through importing better quality Indian breeds e.g. Haryana, Tharparkar, Red Sindhi, Shahiwal from the western part of India to the areas currently comprising Pabna and Sirajganj districts and adjoining areas. The cross breeding activity was introduced in Bengal much later. However, the British efforts in India to improve cattle quality through crossbreeding with their exotic breeds met with little success. About forty years after the cross breeding programme was launched, Robert Wallace, a Scottish professor of agriculture, made the following observations and recommendations after an extensive visit to India including Bengal: (a) various European breeds have been introduced in all varieties of Indian climatic conditions in pure form or cross with native cattle but they performed poorly as they could not adapt well to local climatic conditions and other stresses; and (b) local breeds could only be improved by selection of good specimens from among themselves, as no imported cattle could possess the qualities of endurance and long suffering attained in the local breed by generation of semi-starvation (Wallace, 1888, p. 52-59).

Wallace's recommendation was based on the approaches and experiences of the developed countries in terms of breed development. They improved their local breeds through selection and grading and at a later stage crossing among best performing breeds or breed lines. In the same way best performing Indian breeds e.g. Haryana, Tharparker, Red Sindhi, Shahiwal, developed in the subcontinent through long periods of natural and farmer selection could be further developed in the same way the European breeds were developed and at a later stage crossing with European breeds could be considered for further grading rather than directly crossing these with European breeds from the beginning to upgrade them. Unfortunately, this ideal path was not followed for livestock breed improvement in India or later in East Pakistan and in Bangladesh rather the strategy the British left behind i.e., crossbreeding using exotic blood as the main or only strategy for breed improvement, was continued.

In Bangladesh, till today, a science based rational and pragmatic breeding policy has never been formulated and adopted. Various breed improvement efforts have been made through different projects and programmes using crossing zebu with exotic blood as the strategy with no sustained success. Selective breeding (selection and grading) of improved indigenous cattle never found any place in a consistent manner in breeding

research and cattle breeding programme to this day. The BAU Mymensingh established a research dairy farm in 1958 and acquired stocks of several exotic breeds for experimental purposes. However, the university's breeding research has a rather poor history as there was no long term goal of the breeding research programme, and nearly all breeding stocks have been lost one way or another and no historical records on breeds research have been preserved in a manner to build accumulated evidence on breed performance. The Central Cattle Breeding Station (CCBS) established in 1960 at Savar under the Department of Livestock services has been pursuing a breeding programme involving several imported breeds – both exotic and improved Indian and Pakistani breeds- and maintaining a large number of breeding lines. In the absence of a national policy on breeding strategy for breed choices, experimentation at the station had no long term goal and associated strategy to maintain record and accumulate knowledge for longer term breed development in the country. Breeding experiments were designed following short term project objectives so the goals changed very frequently as new projects were implemented with mostly donor funds. Consequently, many breed lines were some times maintained without any clear idea on breed attributes or criteria, other than milk yield, for comparison of breed lines and help make final choices. Also there was no long term strategy on how these lines would be multiplied and disseminated if found suitable on the basis of the chosen criteria or attributes. Breeding services have been provided – initially though bull stations and natural service and later through artificial insemination (AI) services - without keeping proper long term records of blood levels of parent materials or the progenies. The breeding strategy was more appropriate for commercial cattle/dairy farming somewhat practiced at the station, which was not likely to succeed in a situation where small-scale producers maintained few local cattle on crop residues (Jabbar and Green, 1983; Jabbar and Ali, 1988).

A breeding policy document suggested by the DLS and provisionally approved by the government in 1982 included the following main points (quoted in Alam,1995):

- For operation of the breeding policy, the country would divided into urban, sub-urban and rural areas
- In urban and sub-urban areas, crosses of pure Friesian bull and pure Shahiwal cow would be used to upgrade cattle in urban and sub-urban areas. In rural areas bulls with 50% Friesian blood and 50% local blood would be used. This area wise mating system would ultimately result in 50% or more *Bos Taurus* blood in upgraded animals.
- Dairy and Cattle Improvement farm Savar would be the nucleus for maintaining breeding stocks and production of breeding bulls. Rajshahi Dairy Farm would maintain Friesian, Shahiwal and upgraded local animals and Sylhet Dairy Farm would maintain Shahiwal and Chittagong Red Cattle.
- If required, breeding materials (semen/cattle) might be imported

The basis of the choice of breeds and their promotion in some geographic areas were not explicitly stated or explained. However, these policy choices were not consistently implemented so expected results did not materialize. Rather the expansion of AI services by the DLS and other organizations made the situation worse (see later). In 1983-84, out of 26 breeding animals kept at the CCBS, there were 2 Jersey, 5 Friesian, one Red Sindhi,

one Shahiwal and the remaining 17 were of various combinations of the above breeds. At the district AI centres, out of 87 animals, there were two Red Sindhi, two Shahiwal, one Friesian and 82 of various combinations of the above (Jabbar and Ali, 1988). Currently the CCBS has 145 breeding cattle of various breeds and breed combinations. In 2008-09, 1.7 million dozes of semen were produced from these animals (Table 3.9).

Table 3.9 Breeds of cattle kept at the Central Cattle Breeding Station, Savar, 2008-09

Breed	**Number of cattle**	**Semen production, 000 dozes**
Shahiwal	10	-
Friesian	2	39.6
Local	8	116.1
Red Chittagong Cattle	2	5.0
Shahiwal x Friesian	30	1556.9
Local x Friesian	93	
Local x Friesian x Friesian	-	
Shahiwal x Friesian x Friesian	-	
Total	145	1717.6

Source: DLS, unpublished data

The new 'National Livestock Development Policy' formulated in 2007 and provisionally adopted by the then care-taker Government in 2008 has a section devoted to breed development (MOFL, 2007). The policy document recognized that "lack of a breeding policy, use of inappropriate breeds, weak infrastructure (human capacity, national service delivery, breeding farms), limited technical know how has constrained the development of improved breeds". The document discussed several other problems and issues regarding breed development and finally made recommendations for a plan of action targeted to three types of farms (high, medium and low level of input and management) over three time periods – up to 5 years, 6-10 years and 11 yrs and beyond-and specific breeding related activities including choice of breeds and mating schemes for each farm type in each time period. Details of these choices and action plans are given in the policy document but once again the scientific basis of these choices is not clear. For example, Holstein-Friesian has been recommended for high and medium input systems while a decision on the choice of Jersey has been put on hold until further experimentation. Similarly, Red Chittagong cattle has been recommended for promotion in low input systems even though the long term project that evaluated this breed for adaptation outside Chittagong district stated emphatically that "the performance and adaptability of Red Chittagong Cattle under the smallholder subsistence farming conditions of Bangladesh other than Chittagong district is unknown. Animal identification, registration and milk recording system for implementing breed improvement programme successfully in the field are yet to operate in Bangladesh. System for the production of progeny tested Red Chittagong bull remains to be done" (Bhuiyan, 2008, p.19). Therefore, this new policy has also made a clear choice in favour of promotion of Friesian and Red Chittagong for productivity improvement and seriously underemphasized or ignored the need for improvement of best performing local breeds of cattle through selection and grading alongside the on-going crossbreeding programme with exotic blood. In reality, best

performing local breeds are preferred by producers because of better disease resistance, ability to thrive on roughages and less requirement for high cost technologies (Rahman, 2003).

A survey was conducted recently among 128 livestock experts representing DLS, various universities, research institutions and development agencies, and 196 dairy farmers of different sizes from 10 districts to solicit their opinion on criteria to be used in breed selection and their relative weight in breed evaluation and selection, and based on these criteria degree of suitability or performance of a number of breeds in Bangladesh conditions. It appears that both experts and farmers have considered milk yield is the most important criteria for choice of breed for cattle improvement in the country but they have listed a number of other criteria to be considered for breed selection such as reproductive performance, body size, disease risk, feed requirement and feed conversion efficiency etc (Table 3.10). Although relative weights of these criteria differ between experts and farmers, it is imperative that they need to be incorporated in any programme for breed evaluation and selection.

Table 3.10 Experts' and farmers' opinion on criteria for breed selection and their relative weights in selection

Criteria	Experts' opinion Average weight (%)	Farmers' opinion Average weight (%)
Milk yield	33	46
Reproductive performance	12	5
Body size	10	14
Climatic adaptability	11	4
Beef yield and quality	10	11
Disease risk and vulnerability	9	5
Feed requirement and feed conversion efficiency	9	8
Draught quality of male offspring	3	6
Temperament	3	1
Total weight	100	100

Source: Jabbar et al. (2009)

When each of these criteria was applied to assess suitability or performance of Friesian, Jersey, Red Sindhi, Shahiwal, Pabna improved, Red Chittagong and local breeds for improvement of cattle, relative rank of a breed varied to some extent between the individual criteria and also between experts but farmers. When all the criteria were considered for overall choice of a breed, the order of choices for experts and farmers are summarized in Table 3.11. It appears that experts considered all the breeds except local almost equally suitable and local is also not too far behind for improvement of cattle in Bangladesh. Farmers also considered these breeds suitable with minor difference among the breeds except that the average rating was about half that given by experts. These results imply two things. First, choice of breeds for cattle improvement can be made out

of a larger array of breeds rather than just Friesian and Red Chittagong as has been done in the Livestock Policy document. Second, experts' rating of suitability of these breeds are higher perhaps because they have used knowledge based on research and on-station performance records while farmers' ratings are based on experience in diverse and rough real world situations. Lower rating by farmers imply that level of performance of these breeds have to be improved significantly if wide adoption is to be expected.

Table 3.11 Experts' farmers' rating of suitability or performance of selected breeds of cattle in Bangladesh based on multiple criteria

Breed based on multiple criteria	Experts' rating Average out of 10	Farmers' rating Average out of 10
Shahiwal	7.0	**3.4**
Pabna improved	**7.4**	2.6
Friesian	6.9	3.3
Jersey	7.1	2.4
Red Sindhi	6.7	2.8
Red Chittagong	7.0	2.6
Local	6.2	2.6

Source: Jabbar et al. (2009)

Given these perspectives of experts and farmers, it is conceivable that the implementation of the new breeding policy will lead to a cattle population with varying proportion of exotic blood of different breeds but may lead nowhere in terms of long term breed development in the country. Indiscriminate breeding with choices limited to two specific breeds without proper progeny records may also lead to eradication of locally adapted best performing genetic resources from the country.[12]

3.4.2 Artificial insemination service

Natural service requires large number of bulls. In the smallholder traditional production systems, many large farms had their own bulls and many local communities had access to free grazing bulls donated to the community by local elites. But bull : cow ratio in the country has been declining due to increased population pressure on land, which adversely affects fertility rate of the national herd due to inadequate number of bulls available for natural service at the appropriate times and frequencies. Consequently need and demand for AI as a breeding technique has also increased. AI allows rapid genetic improvement, economization of breeding programme and control of reproductive diseases of domestic animals. This is possible because a few highly selected males produce enough spermatozoa to inseminate thousands of females per year.

[12] Indian dairy development has been aided to some extent by increased crossbred cattle in some key states in the north and west of the country while elsewhere in other states crossbred population is quite small. However environmentalists expressed concern about negative consequences of indiscriminate crossbreeding on indigenous genetic resources and loss of diversity in the genetic composition of Indian livestock (Khurana, 1997).

The Veterinary College in Mymensingh started providing limited number of AI services to farmers outside the college campus in 1958, which was later expanded by the Bangladesh Agricultural University. The DLS started AI service delivery around the Savar station in 1969 and expanded it in other part of the country gradually. DLS remained the only major supplier of this service until Milk Vita and BRAC started offering service respectively in 1988 and 2000. The DLS currently runs two major projects on breed evaluation and breeding service delivery mechanism. One is called "the artificial insemination activities, extension and embryo transfer technology project" launched in 2002 for strengthening the ongoing AI activities throughout the country. The objectives are: (i) production of high productive animals, (ii) to increase the number of quality breeding bulls as well as quantity of semen, (iii) to familiarize and encourage AI activities at grass root level and to the private entrepreneurs, (iv) to practice embryo transfer technology in the nucleus herd at CCBS and (v) to establish a nucleus herd at CCBS with animals of high genetic merit. Under this project, about 1000 inseminators have been trained at the CCBS, Savar. Another on-going project undertaken through the CCBS in 22 districts is the "Breed up-gradation through progeny test" for improvement of cattle genetic resources of Bangladesh. In this programme emphasis is given to maintain Pure Native line, Pure Sahiwal line and Native × Exotic cross line through bull dam identification and testing of potential young bulls followed by growth trial for final selection. Major objectives of the project are (i) production of superior proven bulls, (ii) identification of high yielding cows and heifers, (iii) year-wise genetic gain and productivity improvement of cattle through planned mating, (iv) conservation and improvement of Native (Deshi) cattle genetic resources, (v) production and identification of superior animals suitable for Embryo Transfer (ET) and (vi) increasing milk and meat production.

DLS, BRAC, Milk Vita and BAU together currently provide over 2 million dozes of inseminations per year throughout the country (Table 3.12). However, the distribution is not uniform as some areas with concentration of commercial dairy are served by more than one service provider while some other areas may be served by a single service provider or none at all. They also deliver semen of different breeds and charge different prices. BRAC is pursuing a policy of delivering service at or near the door step of the farmer while farmers need to reach DLS's service centres to obtain a service. This also justifies the higher fee charged by BRAC's service providers.

Conception rate is about 47% for DLS and Milk Vita compared to about 60% for BRAC and BAU (Barua, 2006; Bhuiyan, 2009). However, these rates have to be interpreted with caution as it is unclear if repeat inseminations have been properly adjusted in all cases in calculating conception rates. Moreover, conception rates might also vary depending on the breed of the cow (local vs crossbreed and with different level of exotic blood), the level of nutrition, which again is likely to vary depending on breed and output produced (milk vs milk and draft power for example), and management. Most likely costlier BRAC service as well as Milk Vita service is being taken by commercial dairy farmers and they obviously want to make sure they receive the service at optimal time to achieve successful conception. Quality of service is of essence for the service provider who has a stake in the success as his/her income depends on the successful outcome of the service.

On the other hand, DLS service is open to all kinds of farmers with animals of varying quality so the success rate is likely to be low.

Table 3.12 Characteristics of AI services provided by different organisations in Bangladesh

Particulars	Service providers			
	DLS	Milk Vita	BRAC	BAU
Year of starting	1969	1988	2000	1958
Area of operation (No. of Upazila) at present	451	14 (Milk Vita operational areas)	410	6 (Mymensingh district)
No. of AI done in 2007-08 (‘000’) approx.	1811	70	200	10
Breed used for semen production	Shahiwal, Friesian, local and various combinations	Friesian and Jersey	Friesian Cross, Shahiwal Cross	Friesian Cross Shahiwal-Red Sindhi Cross, Pabna, Red Chittagong
Type of semen used	Frozen- 60% Liquid- 40%	Frozen	Frozen	Frozen
Place of service	Centre based	Samity’s place	At farmer’s doorstep	BAU AI centre & Sub-centre
Charge (Tk.) for first service	Frozen – 30 Liquid - 15	Free	100	45
Charge for any repeat service	As above	Free	100	30
Conception rate (%)	46.5	47.4	61.5	60.0
No. semen production centre: Frozen Liquid	29 61	1 0	1 0	1 0
Service provider	Field Assistant /AI Volunteer	Field Assistant & Inseminator)	AI worker	AI technician

Source: Unpublished data from DLS, BRAC, Milk Vita, BAU and Barua (2006)

Though detailed research data is not available, it is generally observed that a major reason for poor performance of AI is high incidence of reproductive problems and calf mortality (Rahman, 2003). Repeat breeding, anoestrus condition, incidence of reproductive disorders are common problems among smallholders adopting crossbreeding with exotic semen. Still birth and delivery difficulties are also reported in case of smaller size cows using crossbreeding with exotic semen. Although AI is a simple technique, proper administration of the technique and its follow up during the pregnancy period requires good understanding of reproductive health of the animals, which the ordinary AI technicians or paravets employed by different service providers may not have.

It appears that the AI programme in the country is not a coordinated programme of different organizations. Each service provider has the short term goal of providing insemination service to maintain fertility and milk production so that there is adequate

supply of milk for collection to run their processing industries. Quality of service and fees differ widely which has some rationality. Quality control and competition should give farmers the best possible options for this service. Sometimes AI and exotic genetic material are used synonymously. But AI is merely a technique. What material is to be disseminated through this technique has to be determined by appropriate breeding policy because AI and other breeding techniques will determine the future make up of national cattle population. But there is really no agreed and adopted breeding policy in the country for long term genetic improvement through delivery of appropriate genetic material. The latest provisional policy at work is not based on sound scientific logic so its implementation is unlikely to be successful for desirable breed development in the country. Since no progeny record is maintained by any of the service provider, long term improvement in genetic make up and productivity of the individual and national herd can't be assessed or even guessed. Yet without such records and their continuous monitoring and evaluation, long term breed development and genetic improvement can't be achieved. And without such achievement, improvement of dairy industry will also be impossible.

An objective assessment of the efficiency of the delivery chains of different AI providers, and their cost effectiveness is required in order to find better delivery mechanisms for AI as it will become increasing important for improving national herd productivity irrespective of the nature of genetic composition of the herd and the type of genetic material promoted.

3.5 Role of investment, credit and subsidy on growth

Statistics on direct investment in the dairy sector or even the livestock sector were not available, so in the multivariate model credit to private sector was used as a proxy for investment assuming that in a market oriented economy credit to the private sector would be a good representation of overall investment in the economy. Dairy being a small sector, overall private sector credit and investment in the economy would also contribute to growth in the dairy sector. However, the coefficient of this variable was not significant. Perhaps the coefficient could not capture the effect of overall credit flow on the tiny dairy sector.

The livestock sector contributes about 3% to GDP yet the sector receives much less than one percent of annual government revenue expenditure (Table 3.13). Moreover, the share of expenditure in the livestock sector has been declining over time while its share in the GDP has been increasing. Most of the allocated budget is spent on salaries of staff and for administrative purposes leaving a small share to spend on direct productivity increasing activities such as vaccination, supply of drugs, genetic material and services. In theory, drugs and vaccines are supposed to be provided free or at highly subsidized prices, but in reality budgetary limitations do not allow adequate stock of these materials in government veterinary clinics. The sector has been facing unfavourable budgetary situation to deliver its mandated services and the situation seems to have worsened over time. Although the commercial poultry sector is increasingly accessing private veterinary service, the same can't be expected to happen for smallholder farmers raising one or two animals and a few birds. The problems of smallholders are of a public good character

because of the uncontrolled nature of production organization and the possibilities of externality (e.g. quick spread of disease from farm to farm) so the public sector is expected to continue to play a role for provision of services to smallholders though some cost recovery especially from better organized market oriented producers like dairy has to be introduced to maintain quality of service delivery (see more on this later).

Table 3.13 Public sector budget expenditure and its share in the livestock sector, selected years

	1990-91	1995-96	2000-01	2005-06	2008-09
Revenue expenditure, mil Taka	73100	103000	206620	380700	679180
Of which livestock, mil Taka	495.1	777.2	1004.8	1631.5	1911.7
% of total national budget	0.68	0.75	0.49	0.43	0.28
Total subsidies , mil Taka[a]	-	-	55780	110730	258480
% of total national budget	-	-	27	29	38
Direct subsidies, mil Taka	-	-	6810	17300	83730
% of total national budget	-	-	3.3	4.5	12.3

a. Includes direct subsidies on food grain, other direct subsidies, grants and transfers, credit relief and exemption, loss of public sector enterprises, pension and gratuity etc.
Source: Bangladesh Economic Review 2009, Ministry of Finance, pp.249-51

In 2000-01, total government subsidies accounted for 27% of the budget expenditure, which increased to 38% in 2008-09 (Table 3.13). However, direct subsidies accounted for only 3.3% in 2000-01 which increased to 12.3% in 2008-09. But most of the direct subsidies have gone to the food grain related activities and to cover loss of public enterprises. Direct development expenditure and subsidy in the livestock sector is insignificant and not very regular. Data on the livestock sector's share in the total or direct subsidies could not be gathered but it can be reasonably assumed that it was very insignificant given the small share of the overall budget for the livestock sector.[13]

When any development expenditure has been made, funded activities were not well analyzed and well planned or executed, so achieved little success. For example, in the early 1990s, a good number of exotic cows were directly imported for distribution among interested investors to establish commercial dairy farms for enhancing milk supply. Such

[13] One private dairy processor stated that Milk Vita has received a total of taka One Billion worth of government subsidies and low interest loans since its inception over many years, which bred inefficiency and corruption in its operation, made larger scale dairy farming in the Baghabari milk shed profitable, encouraged other dairy processors to also collect milk from the same area but made other dairy processors less competitive in the market (Chowdhury, 2009). However, while it is true that Milk Vita received loans and subsidies in the past, the claim of One Billion taka has not been substantiated with evidence, and it seems highly exaggerated. Given the tiny share of the livestock sector in the national budget, Milk Vita's subsidy is unlikely to be any significance overall though that should not mean that any inefficiency in its use was justified. Milk Vita played a pioneering role in promoting and developing dairy processing sector in the country by linking rural areas to the city markets at a time when demand for processed dairy products was only emerging. Private sector processors entered the industry to serve a mature market. Milk Vita needs to improve its management and efficiency, especially it should get rid of political and bureaucratic interference in its management and run it like a business guided by its members. But all other actors in the dairy sector should also operate on the basis of efficiency in the open market environment.

farms were given easy credit. But most of these farms collapsed within a short period because the imported animals did not adapt to the tough local climate and succumbed to various diseases. The credit could not be recovered. In 1993, in order to boost dairy production 50 million taka was allocated to distribute among dairy farmers at the rate of 6000 taka per cow for up to 5 cows. Allocation per cow was reduced in the 2nd and 3rd year and in 1996 the scheme was stopped. It was reintroduced in 2002 with allocation per cow reduced to 3000-5000 taka depending on the number of cows being financed. But the scheme was not continued after a year or two. There are conflicting claims about the impact of this scheme though no objective evaluation was done. Some, for example Chowdhury (2009), claim that 1993-1996 period saw significant growth in dairy production due to this scheme, while poor quality of milk production statistics generated in the country discussed earlier cast serious doubt on such claim. Moreover, it was reported during the implementation of the scheme that allocation of the money was politicized so all the funds did not flow to real dairy farmers.

In the 2009-10 budget, there is a proposal to provide incentives to 12,000 farmers for increasing milk and meat production as well to establish farms for sheep and buffaloes. To implement these programmes a total of Tk 7160 million has been allocated combining development and non-development budget, which is 19% higher than the revised budget of 2008-09. However, no guideline or criteria has been prepared yet for disbursement of this fund and it is unclear what the 'development and non-development budget' actually means as the money may in fact be allocated under the existing budget lines in which case, no net increase in allocation may result from this budget.

Credit can play a key role in livestock production by relaxing cash or liquidity constraint to acquire animals and meet operating costs of livestock farms. However, access to credit for livestock activities, especially dairy, has been limited. In recent years, NGOs have disbursed 50-55% of their annual agriculture and rural development loan operations to livestock activities (Table 3.14). Among the NGOs, Grameen Bank and BRAC are major providers of livestock credit. However, most of the livestock loans by the NGOs are for poor and landless households for raising small stock animals and birds, the share of dairy is fairly small for such households though exact figures could not be separated from the total. Krishi Bank is the largest formal sector loan provider to the agriculture sector but in recent years its record of livestock sector credit is dismal. It has disbursed only 7-10% of its loans to the livestock sector in recent years and about half of that loan has been allocated to dairy activities. Cumbersome loan distribution procedure, selection criteria used for screening loan applicants, and high transactions costs of accessing loan do not allow many smallholders to benefit from the livestock credit market.

These pictures about budget, investment, subsidy and credit are obviously very disappointing given the contribution of the livestock sector to GDP and its potential for poverty alleviation through employment and income generation. It seems that the Ministry of Fisheries and Livestock and the Department of Livestock Services have been unable to make a strong case with the Finance Ministry for budgetary allocation and loan fund allocation congruent with its current contribution to the GDP and its potential for even higher contribution. The inadequate capacity of the Ministry and the DLS for technical and economic analysis of the sector's current and future activities to justify larger budgetary and credit allocation is a problem that needs to be addressed if the

sector intends to attract larger resource allocation to play its potential role in the development process.

Table 3.14 Share of Krishi Bank and NGO loan in the livestock sector, 2000-01 to 2007-08

Year	NGO loan disbursement		Krishi Bank loan disbursement		
	Total for agriculture & rural development Mil Taka	% for livestock activities	Total for agriculture, Mil Taka	% for livestock activities	Of which % for dairy activities
2000-01	31923.7	54	na	na	na
2001-02	43192.9	50	na	na	na
2002-03	52770.4	50	16686.7	6.8	3.4
2003-04	53159.4	55	19641.4	9.6	5.4
2004-05	63233.0	50	22796.6	9.6	4.9
2005-06	59518.9	56	30406.8	8.2	4.4
2006-07	91746.7	50	32138.0	7.9	3.9
2007-08	na	na	34775.1	8.2	4.1

Source: Microfinance Institute, Credit Development Forum and Krishi Bank, unpublished data

3.6 Impact of livestock service delivery on growth

In the multivariate model, data limitations did not allow inclusion of any direct measure of manpower or service delivery in the livestock or dairy sector. However, illiteracy rate and R &D expenditure in agriculture were used as proxy variables to represent quality of manpower and technology in the sector but the coefficient of the illiteracy variable was not significant and that of R & D expenditure was negative and significant implying that higher expenditure on R & D in agriculture made negative impact on the dairy sector performance. A possible reason for this unexpected result is that perhaps dairy sector did not benefit from increased R & D expenditure in agriculture in general.

Apart from genetic quality of animals and feeds, the other most important factor that affects productivity of animals is disease incidence and its consequences. Given that animals in the smallholder production systems are low yielding, access to proper veterinary, breeding and extension services are essential for such farms to remain productive to participate in the milk market. The need for these services is critical especially when better quality purchased inputs like concentrate feeds and AI service are used for productivity improvement as investment in better quality inputs need to be properly utilized to derive optimal benefits when risk of losses due to diseases are high. Management of crossbred animals with varying levels of exotic blood requires appropriate management and feeding regimes which are different from local non-descript cattle, so proper extension education need to accompany dissemination of new technologies. This can be illustrated by the fact that access to veterinary and extension

service was a major motivation for smallholder farmers to join Milk Vita cooperatives which provided these services (see above).

The DLS has been the principal provider of veterinary services including AI in the country. The DLS field staff is also supposed to provide extension service as there is no separate livestock extension service in the country. Milk Vita provides limited amount of veterinary and extension services to its members in limited areas, so DLS still remains the principal provider. Although provision of drugs and vaccines are supposed to be free or be provided at subsidized price, due to budget limitations these are inadequately stocked in clinics, so while prescription may be provided free, farmers most of the time require to buy drugs. DLS employs both veterinary and animal husbandry trained staff: in 2003 out of about 1550 Grade I staff, about 74% were veterinarians and 26% were animal husbandry degree holders. But it is primarily designed to provide preventive and curative veterinary services. Extension seems to be a subsidiary function. The rationale for a separate livestock extension directorate or a separate line division within the DLS has been debated for many years without any conclusion.

DLS is severely short of staff to deliver its mandated services. One author stated that with existing infrastructure and staff, the DLS is capable of vaccinating only 10% and provide treatment to 6.5% of the ruminant livestock population in the country. The ratio of animals to a qualified veterinarian is 1: 150,000. Treatment of poultry is considered superficial and is now mostly carried out by NGOs. Especially the DLS has serious shortage of front line staff (veterinary field assistants and technicians) that is the principal contacts with producers in rural areas. In 2003, there were about 4600 staff in this category (grade 3 staff responsible for supporting primary treatment, vaccination, AI, fodder extension, clinical assistance as compounders) (Rahman, 2003). Unlike agricultural extension service, there is no livestock staff employed at the union or village level. The support staff is employed at the upazila vet clinics, so each such staff has to cover about 15 villages or about 2-3 unions. Consequently they can do very little beyond assisting the upazilla vet officers at the upazilla clinics. In the absence of adequate access to proper vet care at reasonable cost, poor farmers often resort to traditional medicine with poor outcomes.

In order to overcome the shortage of frontline veterinary staff in the country, various NGOs trained 'paravets' under different livestock development projects to complement available public sector veterinary staff. [14] Some examples of such training under different projects are summarized in Appendix B. It appears from a review of these training that there is no standard definition of the term 'paravet', they are called differently under different project and the training content, duration and type of people trained varied widely across projects depending on specific needs of the project that provided the training. Although paravets are by nomenclature supposed to be trained in

[14] Among the NGOs, BRAC has the largest contingent of such staff. Up to 2003, under it various projects, BRAC trained 3645 paravets/ rural livestock workers and 29556 poultry vaccinators capable providing primary treatment and vaccination to animals and birds belonging to its project beneficiaries. An additional 56 senior staff were also hired to supervise the activities of the paravets (Rahman, 2003). However, how many of the paravets actually continued the profession after a particular project finished its life remains unknown and unclear (see also Appendix B).

animal health aspects, sometimes they are also provided training on production and management issues in addition to health. For example, a poultry project might have trained people mostly or solely on poultry, a dairy project might have trained mostly or solely on dairy while others might have provided training only on vaccination or on AI and others might have given a more inclusive training on livestock production, management and health. Paravets are not officially recognized as veterinary professionals by the government or by professional veterinarians or their association, and they have not been employed by the DLS. Rather they have been employed by the projects that trained them or by other projects or they have been trained to be selfemployed part or full time to provide service for a fee as a source of income.[15]

The paravets have been found to perform a useful function during the project life whether as project employees or as selfemployed service providers earning income. For example, 'poultry workers' who have been primarily trained as poultry vaccinators under the DLS-BRAC smallholder poultry development project have been found to earn a good supplementary income providing services to the other actors in the project – model breeders, key rearers, mini hatchery owners and chick rearers (Islam and Jabbar, 2005). Practical Action recently reported that in their Dairy Value Cain project in three northern districts, they trained 27 paravets whose monthly income was from Taka 5973 – 9200, calls per day increased from 4/5 to 12/14 kin two years when client base increased from 400/500 to 1200 (Practical Action report to SDVC workshop, unpublished data).

However, it is not clearly known what happened to paravets who were project employees after the project life finished and how many of the selfemployed paravets continued the profession after the project finished. During the project life, usually there was some mandatory supervision by the project and also by arrangement with the DLS about the quality of services provided by these paravets. Sometimes they got materials from the project or the DLS by arrangement. What happened to quality control of the services of selfemployed paravets after the project life was unclear as no one seems to have any obligation to oversee them or supply materials to them. The problem created by this vacuum is that such paravets may go beyond their training and acquired skill to offer services to poor farmers presenting them as versed in all aspects of animal health problems even if they are not, thus put poor farmers at risk of wrong treatment of their animals- which are their key assets for livelihoods. In this venture, they may behave the same way paramedics operate in the area of human health and medicine – they try to practice as full professionals even if they are not, thus put poor people's health in jeopardy. This problem needs to be addressed for proper management of diseases and health of animals as wrong treatments may create drug resistance and other problems for the livestock population.

[15] Paucity of frontline veterinary staff is not a problem unique to Bangladesh as many developing countries have similar situations, and as in Bangladesh, development projects have trained paravets or community animal health workers (CAHW) to fill the gap. But as in Bangladesh there is no uniformity in content, duration and background of trainees, and they are not officially recognized by veterinarians or the government as professionals. They are trained for projects or for self employment.

In order to overcome this problem two actions may be taken. First, an effort may be made to retrain all willing paravets trained in the past to bring them at similar level by offering a standard compensatory course (some may need more compensatory course than others based on what they learned in the past and this may be accommodated based on records). Second, a standard course in terms of content, duration and trainee background may be offered in all future training of paravets irrespective of whether the training is initially done for any project with specific scope. So long as such paravets are allowed to operate as selfemployed service providers it is desirable that they are given a broad minimum standard training irrespective of the immediate needs of any project. NGOs are better placed to undertake both tasks.

4 Summary and implications for the dairy value chain project

4.1 Summary

The objective of this study was to assess the impact of a number of policy and technology factors on growth in the dairy sector and see if such factors are hindering or helping dairy growth. A multivariate model was employed to relate long term dairy sector growth to a number factors representing macro and dairy sector policy, livestock input and output markets and technology. The results of the model were supplemented with additional data and information to assess the impact of various factors on dairy growth.

The results show that long term growth in the dairy sector measured by milk output per capita has been positively and significantly associated with GDP growth rate, domestic consumption level of milk, milk yield per animal, quantity of feed supplied to livestock, number of tractors per hectare (a proxy for mechanization and crop sector growth) and number milking animals. Higher values of these variables were associated with higher growth in milk output per capita as would be normally expected. On the other hand, growth in the dairy sector has been negatively associated with television sets per 1,000 people (a proxy for access to information) and R&D expenditure in agriculture per hectare ($). These may indicate that dairy sector did not benefit from overall increase in research expenditure in agriculture. And dairy also did not benefit from expansion of television network for information dissemination or perhaps television was not a good proxy for access to information. But nearly all the policy related variables – both dairy policy and macro-economic policy- had no significantly association with growth in the dairy sector. These include milk producer's price as a ratio of import price (a proxy for domestic competitiveness), share of formally processed milk in total output, openness of the economy (represented by trade as % of GDP), domestic credit to private sector (as % of GDP), GDP per capita, and illiteracy rate.

Milk producer’s price as a ratio of import price depends on tax, tariff, quota and other trade restrictions, and if applied properly determines the competitiveness of domestic producers with imports. However, analysis of the multivariate model as well as additional data on trends in tax and tariff rates as a well as global and domestic prices at both farm and retail levels show lack of any rational functional linkages between global, urban retail and producer prices of milk and the lack of effectiveness of tax and tariff to establish these linkages to bring synergy between prices at various levels for the benefit of consumers and producers. It appeared that that imperfect dairy market in the country has allowed milk importers and domestic processors to transfer any rise in price or cost due to global price rise or tax/tariff rise to consumers immediately without transferring the benefits of such price rise to producers to provide incentive to increase productivity and production. Also global price fell or tax/tariff fell and cost of import fell as a result, the benefits of such decline has been transferred to consumers very slowly. This imperfect dairy market made tax and tariff policies ineffective for dairy sector growth.

The formal processing sector also did not play any significant role in the long term growth of the dairy sector partly because of its small size and partly because of its lack of interest in providing incentives and services to producers to increase productivity and efficiency. Majority of the producers in the country belong to traditional production and marketing systems while a small proportion of market oriented producers who also adopted improved technologies like crossbred cattle and better feeds in selected milk sheds are linked with urban markets through formal processing enterprises. The transition from semi-subsistence production and traditional marketing to improved production and marketing systems is shaped by many factors of which formal processing enterprises are one element. For a long time Milk Vita has been the only player in market and it played significant role in linking rural milk producers with urban consumers at a time when demand for processed milk has been only emerging. Other processing firms have entered the industry when the dairy market has grown to some extent and achieved a degree of maturity but they have started operations in the same milk sheds which the public sector and Milk Vita created and supported... Moreover, except Milk Vita, other processors do not really operate vertically integrated value chains, rather they operate supply chains with disjointed links with producers. And even Milk Vita's vertically integrated model remains inconsistent, weak and doesn't deliver the quality of service to producers that it should. While contract farming and other forms of vertical integration has been shown to work well in the poultry, fruit and vegetable sectors, in smallholder dairy its operation is more difficult. Yet, in spite of all the criticisms against Operation Flood and NDDP promoted Amul type cooperative in India, it remains a rare success story for smallholder dairy producers in the developing world. Milk Vita has failed to properly adapt the principles of Amul in Bangladesh. Further, while Milk Vita has been suffering from problems of management and inefficiency due to bureaucratic and political interference, private processors have been guided more by short term profit motive rather than sharing investment in infrastructure and services for long term productivity improvement of producers. Expansion outside these milk sheds has been very slow also partly because private processors perhaps considered the possible externality of the benefits of their investment in new areas

There has been some improvement in productivity per animal which contributed to long term growth in the dairy sector. And this has happened due to change in genetic composition of the cattle population brought about by introduction of crossbreeding with exotic semen. However, progress in this regard has been slow because of lack of a consistent breeding policy to choose breeds for improvement, lack of adequate infrastructure for multiplication and dissemination of breeding material, and lack of regulations to control quality of material and services. Natural service has been replaced by artificial insemination but the performance of AI remains rather poor due to proper progeny records and mating policies. The provisional livestock policy which included provisions for breeding policy decided to promote limited array of breeds while expert and farmer opinions indicate that breed choices should be made out of a larger array of breeds based on a number of selection criteria rather than just milk yield.

The other reason for slow growth of the sector is that the livestock sector has been receiving a much smaller share of national budget expenditure in relation to its contribution to GDP. Available budget is adequate in the form of salary and administrative expenses but is highly inadequate for productivity increasing activities

such as vaccination, supply of drugs and genetic material. Data on share of public sector subsidy allocated to the livestock sector could not be discerned but it can be reasonably assumed to be insignificant given its small budget share. Credit is an essential input for removing capital and cash constraint of smallholder producers but access to credit for dairy is very limited. NGOs provide about 50% of rural credit for livestock activities but only a small share for dairy. Krishi Bank provides about 6-9% of its loan for livestock activities and half of that goes for dairy activities. With such poor financial and investment in the dairy sector, growth would normally be expected to be low.

Veterinary health and extension services are essential inputs for productivity improvement especially when better technology and inputs better breeds and feeds are used. However, the manpower for veterinary services are highly inadequate for the mandated services – no more than 10% of the ruminants can be vaccinated and treated with existing infrastructure and professional, staff. Extension service is poorly done if at all. Shortage of frontline veterinary staff is severe and since they are the direct links with producers, both quantity and quality of services are very poor. In order to fill the gap, various NGOs have trained paravets through different livestock development projects. A review of the training programmes offered to these paravets show that they are called differently under different project and the training content, duration and type of people trained varied widely across projects depending on specific needs of the project that provided the training. They have apparently performed a useful function during the life of the project either as project employees or as selfemployed service providers for a fee. But what happened to them after the project life was finished remain unclear.

4.2 Implications for the SDVC project

The project intends to incorporate targeted landless and smallholding households in North and Northwest Bangladesh into a strengthened milk value chain to enable them to achieve more sustainable livelihoods. This is proposed to be done through:

- creation of improved milk collection systems in rural and remote areas
- ensuring improved access to inputs, markets, and services by mobilizing groups of poor farmers, producers, and *char* dwellers
- creation of improved milk transport network
- arranging improved access to quality service at the producer level and
- contributing to improved policy environment

It is assumed that the interaction between the last activity and the other four is not linear rather circular and iterative. A congenial policy environment is a prerequisite for successful implementation of the first four activities but the implementation of these activities may also bring out policy constraints and opportunities for better implementation of the other four activities in the future in many ways and through many pathways or directions.

In order to understand how macro and dairy sector related policies assessed in this study can help or hinder access to inputs and services for milk production and access to milk market through better milk collection and transportation systems, it is necessary first to characterize the current dairy production and marketing systems in the project areas.

Majority of the producers in the project areas belong to what has been described earlier as traditional semi-subsistence production systems with low input technologies and traditional marketing systems with short market chains selling milk in the local market directly to consumers or involving or one or two local intermediaries. Some of the formal milk processing enterprises have established milk collection and chilling centres in a few places in the project areas. So a small proportion of producers – some practicing improved production systems with crossbred animals and related technologies and some practicing low input traditional production systems- are selling milk to processors either directly or though local intermediaries. So producers in the project areas can be considered as belonging to some supply chains but not any value chain proper.

It may be recalled that major elements of any value chain for a commodity include (a) actors along the chain and their functions and interrelations, (b) governance mechanisms for the chain and roles of actors e.g. power relations and principal drivers of the chain functions, (c) impact of upgrading products, services and processes within the chain, and (d) distribution of benefits among actors within the chain. In the traditional or even processor driven supply chains, actors including producers exchange good and services, so there is a flow of good and services. In most cases transactions for inputs may involve a different set of actors and chains than transactions for products. And while different actors perform different functions, and there are informal rules and norms governing these transactions and relationships, there is no integrated system of governance that legally binds all actors giving each specific rights and obligations. In a supply chain each actor tries to maxmize its returns at the expense of the other(s) while in a value chain framework, there are agreed principles for sharing of benefits from improvement in chain functions and performance.

Remunerative market participation by smallholder milk producers, especially in remote and poorly connected areas, is constrained by low volume of output and marketable surplus leading to larger transaction cost pet unit of output marketed, and limited access to larger markets due to poor and difficult transportation. Although traditional milk traders buy and bulk products to supply local and distant markets, their reach and handling capacity is limited due to the perishability of milk and lack of infrastructure to handle and transport large volume. The formal processing sector currently handles a small share of the total output in the project districts and this share will increase only gradually leaving a significant role for the informal supply chains. Although Milk Vita is a vertically integrated enterprise so farmers have a stake in its governance and management and its outcome, private sector processors use traditional milk traders as agents for milk collection rather than reaching producers directly or through creating farmer groups to overcome the problem of small volume of individual households.

Under the above circumstances, the pertinent questions are: how to link thousands of small scale milk producers in rural areas to the urban markets? What will be the role of formal and informal supply chains in making these links? What possibilities are there to upgrade the current formal and informal supply chains into integrated value chains and create new value chains to solve the above problems? What will be the role of public vs private sectors in making these links and institutional changes? And how different policies assessed in this study may help or hinder achievement of the above goals?

Tax and tariff policy: Analysis of the tax and tariff policies showed that there was no functional link between global price, urban retail price and producer price and that dairy market imperfection created by dairy importers and domestic processors made these policies ineffective to benefit producers and consumers. The provisional livestock policy document did not shed much light on this issue. This project can best serve the interest of all concerned, not just its target smallholder beneficiaries, by undertaking extensive dialogue among stakeholders – policy makers, planners, private and public sector processors, private importers, traditional traders and small dairy producers - to highlight this distortion and create awareness among stakeholders that proper application of tax and tariff as tools is essential and in the best interest of all concerned for long term dairy development in the country. Market power of importers and processors may bring short term gains for them but it will be harmful for the dairy sector and the nation. Policy makers should also try to make decisions on the basis of objective analysis of impacts of past policies rather than just yield to pressure of market power. Since smallholders producers are not organised and have no advocacy or lobby power, it is obligatory for public policy makers to keep their interests in mind while making policy. The relative merits of subsidy, tax and tariff at the import end vs direct incentives to producers through appropriate technology, credit and subsidy needs urgent analysis. Unless producers are given incentives (not necessarily undue protection) to make investment for productivity improvement by rational application of tax and tariff policies, the dependence on import will continue to rise and the sector will fall behind further.

Role of formal processing sector: It has been found that the formal processing sector is still fairly small and the enterprises operate in high potential milk sheds in the country leaving producers in the rest of the country delinked form the expanding urban markets. Moreover, other then Milk Vita, all other processors use traditional milk traders as collection agents. If formal processing sector is serve as driver or pull factor for development of the dairy sector, then it is imperative that they should share responsibilities with the public sector for investing in the creation of physical infrastructure and provision of inputs and services (genetics, feeds, veterinary and extension services) for improving productivity, then given an assured market for the product as it is perishable and risky for producers, and pay a remunerative price regularly to producers can continue to invest in operational expenses while improving livelihood. There is hardly any rationality in the argument that public sector should invest for improving productivity and supply, then private investors will invest in chilling and processing facilities or that large scale production is the solution for high transaction costs of collection from smallholders. In fact, there need not be a contradiction between the development of private processing industries and public sector supported programmes targeted to smallholders to develop the dairy sector in the country, rather private, public and NGO sectors should perform complementary roles.

How best to encourage formal sector processors and producers to bring smallholder producers and processors along with them in the development of commercial livestock production is the challenge. Successful schemes or institutional arrangements for inclusion of smallholders in value chains have been observed through variants of contract farming, cooperatives or other forms of collective actions but again with some public

incentive through cost sharing or subsidies to the integrator to work with poorer contractors. Some of these options have been mentioned in the provisional livestock policy document in connection with dairy sector policy, which is a positive step. But how to operationalise them remains unclear in the policy document. Getting the poor involved in the livestock sector almost always requires an asset transfer, but that is not enough. The transfer must be followed up with technical assistance and monitoring of the use of the asset. NGO structures seem well suited to this. However, the social cost and social benefits of different ways of targeting the poor are rarely if ever assessed. Given the above, the SDVC project should study the pros and cons of alternative institutional options, their alternative funding mechanisms, how to share costs between private, public and NGO sectors, and how best to spread the overhead cost of institutions when the number of participants is low in an initial phase. Analysis of these should be followed up by pilot tests of some options involving various stakeholders to see if and how it works. The experiences then can be scaled up.

Operationally one of the most difficult things to do is to provide remunerative price in a situation like Bangladesh where smallholders do not keep records and production and supply vary by month and season so price also is likely to vary. One of the complaints of producers connected to formal processors is that processors do not take full delivery of milk offered in flush season and also do not pay reasonable price. Seasonal variation in supply and farm gate price is common in developed countries as well but there are policies and instruments in place to ensure adequate return to producers. For example, in the UK, the Ministry of Agriculture pays farmers compensation on the basis of milk delivery records equivalent to the difference between farm gate price received and the average cost of production determined by the Ministry for a given area. In Bangladesh cost of production data are not readily available, a significant part of the costs are for non-market inputs and standard local producer price data are also not available except that processors pay relatively fixed prices. If processors want to vary farm gate price by season and month based on supply in the market, there are two ways of implementing this. First, processors may pay fixed price year round but can claim compensation (subsidy) from the government equivalent to the difference between the purchase price and the price prevailing in the informal market, which is determined by market forces. Second, processors may pay variable open market price to producers who may be paid compensation by the government for any difference between open market price and a benchmark cost of production established a priori based on cost survey. Both options have pros and cons and need careful testing, which the SDVC may undertake.

Breeding policy: The limitations of the provisional breeding policies of the past and the one currently operational have been discussed at length. Long term development of the dairy sector will require adoption of a scientifically based breeding policy involving choice of breeds from a larger array composed of both exotic and locally adapted breed than is currently in force based on a number of criteria that experts and farmers have shown as relevant. Appropriate infrastructure and regulations also need to be in place for proper progeny testing and recording for cumulative improvement of the genetic make up of the national dairy herd. Artificial insemination is a technique but what genetic material is disseminated is a matter for the breeding policy to decide. Indiscriminate use of AI

with semen of various breeds may bring short term gain but will hamper long development of the dairy sector. The SDVC may foster dialogue among policy makers, scientists, dairy industry operators and dairy farmers to discuss the need for a more rational breeding policy and its implementation. The SDVC may start this process by trying to harmonise the breeding services of public and various private and NGO sector operators within the project areas.

Public investment and credit: Budgetary allocation to the sector is not commensurate wit its contribution and potential contribution to GDP. The sector also receives very little out of the government's huge subsidy bill. Similar is the case for allocation of agricultural credit by various credit institutions. On both fronts, strong advocacy is required backed by research based evidence that larger allocation to the sector is in the best interest of the nation as continued neglect will only increase dependence on dairy import. It is clear that the DLS and the MOFL have failed to make a strong case for larger allocation of revenue and development budget and credit supply, especially targeted to the poor in the sector. The SDVC may help in this process by assembling and providing hard evidence based on synthesis of past studies and research as well as hard evidence from its project areas.

Improvement of health delivery services: Shortage of both professional and frontline staff is a major problem to be solved for promoting smallholder dairy development. The paravets trained by NGOs through different projects might have performed useful function for specific projects but once the projects are finished, whether they remain active in what form with what outcome are not well known. Moreover, the diversity of course content, training duration and background of trainees imply that the services they are capable of providing and the services they offer if they are active are not standard or of equal quality and effectiveness. Thus a kind of chaotic or anarchic situation may prevail in the field which makes smallholders producers vulnerable to improper treatment of their animals.

In order to overcome this problem two actions may be taken. First, an effort may be made to retrain all willing paravets trained in the past to bring them at similar level by offering a standard compensatory course (some may need more compensatory courses than others based on what they learned in the past and this may be accommodated based on records). Second, a standard course in terms of content, duration and trainee background may be offered in all future training of paravets irrespective of whether the training is initially done for any project with specific scope. So long as such paravets are allowed to operate as selfemployed service providers it is desirable that they are given a broad minimum standard training irrespective of the immediate needs of any project. NGOs are better placed to undertake both tasks and SDVC may start this process for paarvets within the project areas. For the rest of the country, SDVC can undertake a major advocacy programme for standardization paravet training in the future irrespective of the sponsor being public, private or NGO sector.

References

Ahmed, N. (2000) The smallholder poultry model in Bangladesh. In: G Pedersen, A Permin and U M Minga (editors) Possibilities for smallholder poultry projects in Eastern and Southern Africa. Proceedings of a workshop, Morogoro, Tanzania, 20-25 May 2000. Network for Smallholder Poultry Development, Copenhagen. www.poultry.kvl.dk

Alam, J (1995) Livestock Resources in Bangladesh – Present status and future potential. University Press Ltd. Dhaka.

Amin K.M.R. (2000) A Study on Marketing of Milk in Selected Northern Districts of Bangladesh MS Thesis. Submitted to the Department of Cooperation and Marketing, Bangladesh Agricultural University, Mymensingh.

Asaduzzaman M. (2000) Livestock sector, economic development and poverty alleviation in Bangladesh. In: Mandal M.A.S. (ed), *Changing rural economy of Bangladesh*. Bangladesh Economic Association, Dhaka, Bangladesh. pp.1-20.

Barua P. (2006) Analytical Documentation of the Artificial Insemination Program of BRAC, Research and Evaluation Division, BRAC, Dhaka. 20 pp

BBS (2007) Report of the household income and expenditure survey 2005. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Bhuiyan, A K M F H (2008) Characterization, conservation and improvement of Red Chittagong cattle in Bangladesh – Lessons learnt and way forward. Key note paper presented at a National Workshop on Red Chittagong Cattle Project. Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh.

Bhuiyan, A K F H (2009) Breeds and breeding development activity in Bangladesh. Unpublished paper (mimeo).

Chowdhury, Major General Amjad Khan (Retd) (2009) The development of dairy industry in Bangladesh. In : Abul Hashem (ed) *The Guardian* (a national monthly magazine), XIX (2), March 2009 issue. 794/ka South Shahjahanpur, Dhaka 1217

CLP (Char Livelihoods Project) (undated) Paravet Training Guide – Goru motataja karan (Beef fattening). Enterprise Development Unit, CLP.

CLP (Char Livelihoods Project) (undated) Paravet Training Guide – Dugdaboti gavir baybasthapona (Dairy cattle management). Enterprise Development Unit, CLP.

Delgado C., Rosegrant M., Steinfeld H., Ehui S. and Courbois C. (1999) Livestock to 2020: The next food revolution. Food, Agriculture and the Environment Discussion Paper 28. IFPRI (International Food Policy Research Institute), Washington, DC, USA. 72 pp.

Haque S.A.M.A. (2007) Bangladesh: smallholder milk producers' nutrition, income, jobs. Lessons learned case study presented at the FAO/APHCA/CFC Workshop on Improved

Market Access and Smallholder Dairy Farmer Participation for Sustainable Dairy Development.

Haque, Z (undated) Training curricula for Paravet's advanced course. CARE Bangladesh, Dhaka.

Haque, Z and Rahman, B. (undated) Pashu shampad unnayan karmi prashikhan shahayika (Livestock Development Worker training guide). Strengthening Dairy Value Chain project, CARE Bangladesh, Dhaka.

Hossain M. and Bose M.L. (2000) Growth and structural change in Bangladesh agriculture: Implications for strategies and policies for sustainable development. In: Mandal M.A.S. (ed), *Changing rural economy of Bangladesh*. Bangladesh Economic Association, Dhaka, Bangladesh. pp.1-20.

Islam S M F and Jabbar M A. (2005) Smallholder poultry model for poverty alleviation in Bangladesh: a review of evidence on impact. *Livestock Research for Rural Development.* Volume 17, No 10, Article #112. (Retrieved October 10, 2005 from http://www.cipav.org.co/lrrd/lrrd17/10/fakh17112.htm)

Islam, SM F and Jabbar, M A (2009) Consumer preferences and demand for livestock products in urban Bangladesh. Report prepared for ILRI, Nairobi, Kenya. (under review)

Jabbar, M.A. (1989). An assessment of the quality of livestock statistics of Bangladesh. *Bangladesh Journal of Agricultural Economics,* 12 (2): 25-42.

Jabbar M.A. and Ali, S.Z. (1988) The limitations of cross breeding for improvement of cattle in Bangladesh, Oxford Agrarian Studies, 17: 29-56

Jabbar, M A and Green, D A G (1983) The status and potential of livestock within the content of agricultural development policy in Bangladesh. Department of Agricultural Economics, University of Wales, Aberystwyth, UK.

Jabbar**,** M A, Islam, S M F, Delgado, C, Ehui, S, Akanda, M A I, Khan, Mi and Kamruzzaman, M (2005) Policy and scale factors influencing efficiency in dairy and poultry production in Bangladesh. ILRI, Nairobi, Bangabandhu Shaikh Mujibur Rahman Agric University, Bangladesh and SLP.

Jabbar, M A, Raha, S K, Rahman, M H and Talukder, R K (2009) Contractual Arrangements for Milk Production and Marketing by Dairy Producers in Bangladesh. ILRI, Nairobi, Kenya (in press).

Jabbar. M A, Husain, S S, Islam, S M F, Amin, M R, Khandaker, M A M Y, Bhuiyan, A KM F H, Ali, S Z and Faruque, O (2009) Stakeholder perspectives on livestock breeding strategy and choice of breeds. Paper presented at the workshop on "Demand led opportunities for transformation of the livestock sector : role of contract farming and breeding" Bangladesh Agricultural University, Mymensingh, 24 May 2009.

Kaplinsky, R (2000) Globalisation and unequalization: What can be learned from value chain analysis. *Journal of Development Studies* 37 (2): 117-146.
Kaplinsky, R and Morris, M (2001) A handbook of value chain analysis. Institute of Development Studies, Sussex, UK.

Kar, Nibadita (2003) Milk Marketing System in Selected Areas of Mymensingh District MS thesis submitted to the Department of Cooperation and Marketing, Bangladesh Agricultural University, Mymensingh.

Khurana, I. (1997) Vanishing breeds. *Down to Earth*, 6(8): 27-33.

Miah M.A.M. (2002) Production and marketing of livestock and livestock products in selected peri-urban areas of Bangladesh. Ph.D. Thesis submitted to the Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh.

Mitra B.K. and Hossian M.M. (2002) Policies, strategy and achievement of CLDDP in respect of poultry and dairy development in Bangladesh. Paper presented at the Workshop on Policies and Institutions for Poultry and Dairy Development in Bangladesh, Organised by DLS, BSMRAU, BLRI and ILRI, 13-14 October 2002.

MOFL (Ministry of Fisheries and Livestock) (2007) National livestock development policy. Government of the People's Republic of Bangladesh, Dhaka.

Needham, D (1973) Economic Analysis and Industrial Structure, The Gresham Press, Old Working, Surrey, England.

Omore, A, Mulindo, J C, Islam, SM F, Nurah, G, Khan, M I, Staal, S and Dugdill, B T. (2002) Employment generation though small scale dairy marketing and processing: Experiences from Kenya, Bangladesh and Ghana. FAO, Rome, Italy.

Porter, M. (2005) Competitive advantage: Creating and sustaining superior performance. Free Press, New York, and Collier Macmillan, London.

Rahman, M H (2003) Veterinary services and animal production and health. Unpublished working paper for Livestock Sector Review and Future Development Assessment, The Policy and Planning Support Unit, Ministry and Fisheries and Livestock, Dhaka.

Rich, K, Negassa, A and Ross, R B (2008) Concepts, applications and extensions of value chain analysis to livestock products in developing countries: a review and research agenda. *Journal of Development Studies* (under review)

Saleque M.A (2000) Scaling-up: Critical factors in leadership, management, human resource development and institution building in going from pilot project to large scale implementation: The BRAC poultry model in Bangladesh. In: Dolberg F and Petersen P H (editors), Poultry as a tool in poverty eradication of gender equality, Tune workshop, March 22-26, 1999, Tune, Denmark. Pp.15. http://www.husdyr.kvl.dk/htm/php/tune99/5-Saleque.htm

Schmitz, H (2005) Value chain analysis for policy makers and practitioners. International Labour Organization, Geneva, Switzerland.

Shaha G C. (2002) Milk Vita - the National Dairy Co-operative of Bangladesh: A Case Study. Paper presented at the workshop on Policies and Institutions for Poultry and Dairy Development in Bangladesh, Organised by DLS, BSMRAU, BLRI and ILRI, 13-14 October 2002. 16pp.

Shahabuddin, Q. (2008) Modernising agriculture. February 17, The Daily Star, 17th Anniversary Special Issue.

Staal, S, Nin Pratt A and Jabbar, M A (2008) Dairy Development for the Resource Poor. Part 1: A Comparison of Dairy Policies in South Asia and East Africa. FAO Pro-Poor Livestock Policy Initiative, Rome, Italy, and ILRI, Nairobi, Kenya.

Wallace, R (1888) India in 1887. Oliver and Boyd. Edinburgh, UK.

Yunus, M with Karl Weber (2007) Creating a world without poverty – Social business and the future of capitalism. BBS Publishers, New York, USA.

Appendix A: Global and domestic prices of milk, 2006-2009

Appendix A1: Collection prices of milk by selected processors and retail prices of pasteurized and raw milk in Dhaka 2006-2009

Product and year	Monthly maximum price/kg or litre (Taka)										
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May
Collection Price by Aarang											
2006-07	21.9	21.9	21.9	21.9	21.9	21.9	21.9	20.3	20.3	20.3	20.3
2007-08	20.3	20.3	20.3	20.3	26.15	26.15	23.9	23.9	23.9	25.8	25.8
2008-09	25.8	29.15	29.15	29.15	29.15	29.15	32.85	32.85	32.85	29.45	27.45
Collection Price by Milk Vita											
2006-07							20.78	20.29	20.1	19.79	19.83
2007-08	20.57	20.69	21.63	21.67	25.19	26.29	26.01	25.63	24.87	26.75	28.13
2008-09	26.82	28.47	29.72	29.9	30.87	32.14	32.6	32.43	31.86	28.57	27.71
Collection Price by PRAN											
2006-07							19.75	19.75	19.75	19.75	19.75
2007-08	20.91	22.91	22.91	22.91	24.76	24.76	24.76	24.76	24.76	28.1	28.1
2008-09	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	31.15	31.15	31.15
Pasteurized milk – Dhaka Retail											
2006-07	30	30	33	40	34	34	34	32	32	32	35
2007-08	36	38	38	38	40	40	42	42	42	45	45
2008-09	46	46	46	48	48	48	52	52	52	50	50
Normal raw milk – Dhaka Retail											
2006-07							30	30	30	30	30
2007-08	30	35	35	35	35	35	40	40	40	40	40
2008-09	60	60	60	60	60	60	40	40	40	40	30

Source: Unpublished data from processors; Survey in liquid milk markets in Dhaka city

Appendix A2: Retail price in Dhaka and global prices of powder milk, 2006-2009

	Maximum price by month (Taka)											
Product and year	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June
Dhaka retail price per kg												
Dano full cream powder												
2006-07	340	345	345	345	355	360	360	370	370	370	390	420
2007-08	415	415	420	440	480	490	495	505	515	555	555	555
2008-09	555	555	555	560	560	560	560	520	520	525	520	520
Red Cow full cream powder												
2006-07	315	318	318	310	322	332	348	360	360	362	380	415
2007-08	415	405	418	445	500	515	510	510	510	535	540	455
2008-09	540	550	550	560	555	555	555	500	500	500	500	500
Diploma full cream powder												
2006-07	308	310	310	312	338	360	350	365	370	370	380	400
2007-08	415	410	412	460	515	515	510	510	485	510	510	540
2008-09	510	510	510	555	500	500	500	450	450	455	450	450
Global price per m ton												
Oceania												
2006-07	2100	2100	2000	2200	2500	2800	2850	3050	3375	4000	4050	4525
2007-08	4650	4750	4750	5050	4900	4800	4800	4550	4750	4550	4550	4400
2008-09	4400	4350	3475	3000	2650	2225	1950	1850	1950	2075	2200	2050
Europe												
2006-07	2225	2250	2450	2475	2762.5	3025	3125	3375	3850	4600	4800	5150
2007-08	5350	5550	5600	5525	5112.5	4850	4475	4625	4612.5	4550	4550	4550
2008-09	4512	4300	3525	3100	2762	2837	2462	2187	2287	2325	2625	2650

Source: For global price: http://future.aae.wisc.edu/data/weekly_values/by_area/1705?tab=prices
For Dhaka retail prices: Department of Agricultural Marketing;

Appendix B : An inventory of selected paravet training courses offered by different organizations

1. Poultry Workers under the Smallholder Poultry Project

The semi-scavenging smallholder poultry model popularly known as the BRAC-DLS model was developed in the 1990s jointly by BRAC and DLS as a tool for poverty alleviation. Landless and smallholder poor households were the target beneficiaries. The model was extended to nearly 400 thanas in the country though two major projects funded by DANIDA, ADB, IFAD and UNDP with counterpart funds provided by BRAC and the government of Bangladesh. The model was also adapted and replicated in a number of developing countries by IFAD and FAO (Ahmed, 2000; Saleque, 2000; Islam and Jabbar, 2005). The model included a number of actors as follows:

- Model Breeder-Small low cost parent farms with a breeding stock of 54 Fayoumi hens and the requisite number (6) of RIR cocks received either from the project site or directly from government poultry farms. The birds are raised under a semi-scavenging system with balanced rations for producing quality fertile eggs to be used for hatching. The fertile eggs were to be sold to Mini Hatcheries but a substantial amount of the fertile eggs would be sold to the Key Rearers who would hatch them under local broody hens.

- Mini Hatchery-Small low cost hatcheries operated with solar energy and kerosene stove. Black pillows filled with rice husk were heated in the sun or by means of kerosene and the eggs were placed into a cylinder between two pillows for hatching. Each hatchery had a capacity to hatch 1000 chickens per month. The day old chicks were sold to the Chick Rearers but Key Rearers also would purchase day old chicks to be reared by the broody hens.

- Chick Rearer-Small rearing farms, each with a capacity of 200-300 chickens per batch and 4 batches per year. The chickens were reared in low cost houses from day-old to 8 week of age. The chickens were fed with balanced feed. The 8 week-old birds were mainly to be sold to the Key Rearers within the same village development committee.

- Key Rearers-Small farms with only around 5 crossbreed layers for the production of table eggs. The hens were kept under semi-scavenging conditions with 30-70% supplementary feed. Additionally 4 local hens were kept to hatch eggs preferably from Model Breeders and rear chick from Mini Hatcheries.

- Poultry workers-A numbers of poultry workers were trained to vaccinate the birds to control diseases. The vaccine was supplied free by the DLS through the Area Office of BRAC and the Poultry Workers charged a vaccination fee for providing the service.

- Feed Seller-The feed sellers were trained to mix feed or sell pre-mixed feed as supplementary feed to the poultry keepers. They prepared balanced chicken rations from locally available feed materials supplemented by purchased nutrients.

- Egg Collectors-Table eggs were collected from the Key Rearers by Egg Collectors to be supplied to a community sale centre or to the wholesaler at the nearby market.

The 'poultry workers' were trained by the project to provide vaccination services to the participants in the poultry project for a fee. Since income from this service might be small, they were also encouraged to provide services to non-participants so that they could create a market for their skill and continue to earn an income once the project was finished. Poultry activities as outlined in the model were not always continued once the project was over so what happened to the poultry workers is also not known. Since the training was confined to only poultry vaccination, it might serve as a constraint for continuing their service as a business.

2 Paravet training under the Char Livelihood Project

This is a large DFID funded project implemented in the char areas of the river Jamuna targeting about 55000 poorest households to build their assets to raise income. The project is being implemented through a number of NGOs including BRAC. Livestock is being used as a major tool for raising income. Households may already have some animals else credit is given to acquire animals for fattening or for milk production for own consumption to improve nutrition as well as sale for income. Productivity improving technologies are also provided and in order to help farmers manage these animals properly, paravets have been trained to provide extension and veterinary services to farmers. The Enterprise Development Unit of the project has provided the following training courses to paravets. Although the training guides prepared for this purpose stated this to be for paravet training, they contain courses or topics covering production, management as well as disease diagnosis and treatment.

a. Beef fattening

The training guide (CLP, undated) for this does not mention duration and background of target trainees but includes course content on the following topics:

- Objectives of fattening
- Things to consider for fattening
- Selection of animals
- Management of animals
- Management of animal shed
- Management of feeds
    - Urea molasses
    - Cultivation of improved fodder
    - Storage and conservation of feeds
- Determination of weight of animals

- Main diseases of domestic animals
- Deworming
- Prevention and treatment of diseases

b. Dairy cattle management

This guide (CLP, undated) also does not mention duration and background of target trainees but includes course content on the following topics:

- Benefits of rearing cows
- Breeds of cows and their characteristics
- Advantages and disadvantages of local and crossbred cows
- Traits of high yielding cows
- Signs of cows in heat
- Optimal time for breeding service/insemination
- Signs of conception/pregnancy
- Delivery and related problems
- Management of pregnant cows
- Management of feeds for cows
- Cultivation improved fodder
- Management of newly born and growing calf
- Milking, increasing milk yield, storage, transportation and marketing milk
- Management of animal shed
- Main diseases of domestic animals
- Problems of calf and cow in milk
- Prevention and treatment of diseases
- Vaccination and deworming

3 Advanced Poultry Training for Paravet for EDU/CARE project, 2005

This training was provided over 6 days. The trainee background is not known. The objective of this course is to enlighten selected personnel from CARE livelihood project with the principles and processes to improve paravets to improve capability to diagnose the disease through improved laboratory practices. The ultimate goal is to prepare each participant so that he/she can perform the duties of a commercial poultry meat producer or serviceman using local/ commercial poultry variety and work as an embedded paravet in the community.

The course content includes the following topics, which shows that, though the title says the training was for poultry, it covered some aspects of goat and dog management and milk quality sampling procedure, the purpose for which was unclear.

Course outline/content

Topic	Mode of delivery
Commercial Broiler Production (Housing)	Theory
Restraining of Animals / Casting	Theory & Practical
Collection of Faecal sample from poultry, cattle and examination under the microscope	Practical
Commercial Broiler, Brooding, Feeding, watering	Theory
Collection of blood, serum, coecal scrapping, impression smear and post-mortem examination	Practical
Water management	Practical
Separation, collection and analysis of serum for ND using blotting paper technique.	Practical
Layer Management, Brooding, feeding and watering	Theory
Caponization	Theory and Practical
Sexing of day old chicks, Different route of vaccination for day old chicks	Practical
Lighting and caloric management for poultry	Theory
Indigenous duck, its nature and management	Theory
Bio-security	Theory
Disease and pests of poultry	Theory
Management of Goat	Practical
Procedure for vaccination in cattle ; Cool Chain maintenance	Practical
Goat/Dog Castration	Theory
Pullet Production and management	Theory
Moulting and Management of Caponized Bird	Theory
Collection of blood and check for M.G and Salmonella	Practical
Poultry Litter composting	Theory
Haem Agglutination of Ranikkhet Virus	Theory and Practical
Haem Agglutination inhibition & Practical for serum and egg	Theory
Introduction on Bird flu and prevention measures.	Theory/ Practical
Milk quality and Sample test procedure	Theory and Practical

Source: CARE unpublished information

3 Practical Action training courses

The following courses were conducted for its Dairy Value chain project under Markets and Livelihood Programme in 2007 (CARE, unpublished record).

a. One batch of 20 for 10 days conducted by DLS, Dinajpur and Department of Youth Development, Dinajpur. The course title was 'Skill Development Training' and included the following topics including disease, feeds, management of cows:

Classification, symptoms, causes and prevention and treatment of diseases; Nutritional diseases, bacterial diseases; Viral diseases; parasitic diseases, others general diseases; general microbiology; basic anatomy of livestock, functions of different organ and mode of operation; selection of standard types of dairy cows and breeds; Introduction to

livestock feed, classification, methods of feed preparation and presentation; Green grass cultivation for the dairy farm; Straw processing and preservation, silage and hay preparation; care and management of different stage of cattle; record keeping in a farm; ration formulation, use of urea, UMB, UMS etc. Factors of success full insemination; clinical diagnosis and modern technology of diagnosis; demonstration of modern treatment equipments; oestrus cycle;

b. One batch of 21 conducted by Bangladesh Agricultural University, Mymensingh. It had three modules as follows:

Module 1: Advance training for Community Animal health worker on basic treatment - 7 days

It covered both theoretical and practical sessions on basic anatomy of livestock, functions of different organ and mode of operation; Classification, symptoms, causes and prevention and treatment of diseases; Nutritional diseases, bacterial diseases; Viral diseases; parasitic diseases, others general diseases; general microbiology; food poison and antidote, antibiotic, antihelmentic, antiseptic; abortion in cows, placenta retention solution of complex delivery, pregnancy diagnosis; diseases of reproductive organ; vaccine preservation and use; clinical diagnosis and modern technology of diagnosis; demonstration of modern treatment equipments; Free duty in the clinic with the doctors treating livestock; demonstration of basic surgery;

Module 2 ; Training on Dairy Production - 5 days

It covered both theoretical and practical sessions on Methods and technology of producing hygienic milk, preservation and transportation; selection of standard types of dairy cows and breeds; importance of dairy farm, types of farm, consideration during establishing a dairy farm; Regular general management of a dairy farm focus on cattle management; nutritive quality of colostrum and normal milk; milk born diseases; Introduction to livestock feed, classification, methods of feed preparation and presentation; Green grass cultivation for the dairy farm; Straw processing and preservation, silage and hay preparation; castration, casting, disbudding, dehorning, and grooming; factors of milk production; general diseases of dairy farm; quality control of milk and testing of milk; care and management of different stage of cattle; record keeping in a farm; ration formulation, use of urea, UMB, UMS etc.

Module 3: Training on Artificial Insemination 5 days (10 out of 21 trainees attended this)

It covered both theoretical and practical sessions on Reproductive organ of Bull and cow; functioning of the reproductive organ; Oestrus cycle, cause of deviation in oestrous cycle; Factors of success full insemination; time of successful insemination; methods of inseminations; semen collections; qualitative test of semen, use of different inseminating equipments; practicing artificial insemination through rectal palpation; pregnancy diagnosis; typical positioning of calves, solving complex delivery.

These trainees worked in the value chain project implemented in 6 upazilas in 3 districts – Dinajpur, Jaipurhat, Gaibandha covering 134 villages 68 producer groups including 28 milk producer groups.

5 CARE Bangladesh training courses for the Strengthening Dairy Value Chain Project

This is an on-going project funded by the Gates Foundation. The project considers paravets or frontline animal health workers as a key link between farmers and other actors in the proposed value chain, and considers proper health delivery as one of the crucial factors for success of the project. In view of this position, the project has made an inventory of existing paravet practioners in the operational areas in the nine project districts and documented their history of training (duration and content and provider) and service area of each paravet. The inventory found that operational area of a paravet overlap in some villages/unions while in some villages no one is available. Then in consultation with farmer participants in the project listed some of the existing paravets to provide services to specific project villages or groups. In addition, a new training course has been planned to train new paravets, especially to fill gaps where there are inadequate paravets at present.

Apparently two courses have been designed. One called training of 'Livestock Development Worker' and another called 'Advance course for paravets'. A training guide has been prepared for training Livestock Development Workers for 7 days (Haque and Rahman, undated). The detailed outline of the course shows that the content has been designed in line with the guides prepared for the Char Livelihood Project but the content of the current course is more extensive than CLP guides discussed earlier (so the detailed content is not repeated here). Almost everything about livestock production, management and disease diagnosis and control has been included and whether a 7 day period is adequate for such an extensive course is highly questionable.

The second Training Curricula for Paravet's Advanced Course (Haque, undated) is also a one week programme that includes the following subjects:

Theory	Practical
• Goat / Sheep Husbandry • Livestock Nutrition • Beef Fattening • Cattle Reproduction • Improvement of Local Breed • Livestock Health and Diseases	• Introduction to instruments and appliances used for AI • Introduction to available fodder and fodder cultivation • Preparation of silage • Demonstration of genital system of bull & cow • Preparation UMB, UMS and UTS • Visit to a dairy farm and case study

Source: CARE, unpublished information

It is reported that 62 (including 10 women) completed foundation and advanced courses and are engaged in the project areas in the nine districts.

Another course over three days on Poultry Housing and Management has the offered with the following content :

Theory	Ptactical
• Introduction • Poultry Housing • Bio-security and Disinfection • Brooding • Poultry Feeds and Nutrition • Poultry Diseases • Poultry Vaccines and Vaccination	• Introduction to instruments and appliances used in a poultry farm • Feed formulation for broiler and layer bird • Vaccination of poultry

Source: CARE unpublished information

CARE Economic Development Unit also conducted a training course on hygienic milk production, collection/preservation and processing in the past but not much details is available about this course.