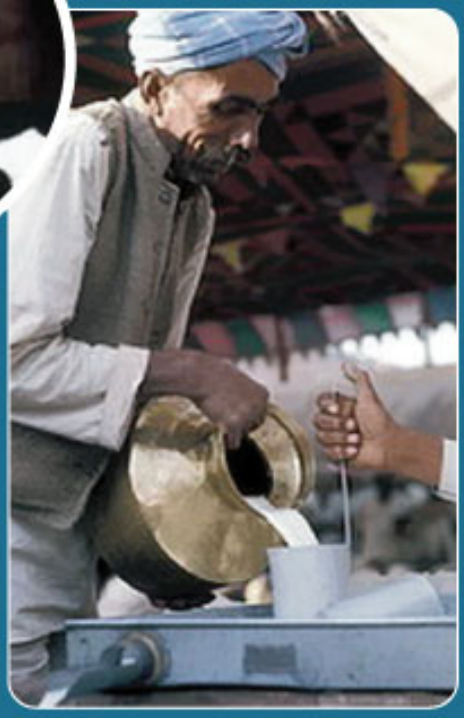
Smallholder dairy development: Lessons learned in Asia



RAP PUBLICATION 2009/02

Smallholder dairy development: Lessons learned in Asia

ANIMAL PRODUCTION AND HEALTH COMMISSION FOR ASIA AND THE PACIFIC

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
REGIONAL OFFICE FOR ASIA AND THE PACIFIC

Bangkok, January 2009

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ISBN 978-92-5-106187-9

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Acknowledgement: The dairy development workshops, country studies and publication of the workshop proceedings were funded by the Common Fund for Commodities, the Animal Production and Health Commission for Asia and the Pacific as well as the FAO regional office in Bangkok.

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Foreword

Demand for dairy products in the Asian region has doubled since 1980 and, after more than half a century of declining real prices for dairy products, there are strong signs of a structural change in the global dairy sector that could make it attractive for investment. This offers livelihood and rural development opportunities for smallholder dairy producers in Asia who currently supply three-quarters of domestic consumption needs in a region projected to be the largest growing market over the next decade.

There are many successful business models through which smallholder milk producers in Asia have gained sustainable access to markets. However, to date, many of the insights on supporting inclusion of smallholder dairy producers are scattered throughout the literature. Building on two smallholder dairy workshops, organized in 2008 by the regional office of the Food and Agriculture Organization of the United Nations (FAO) in Bangkok, of which the first workshop was organized in cooperation with the Common Fund for Commodities (CFC), this publication presents a compilation of experiences and lessons learned from nine countries in the Asian region. It includes generic characterizations and specific models and factors that have influenced smallholder participation in dairy food chains – both good and bad. It also provides the context for regional growth in the sector and some practical guidelines on appropriate/inappropriate support to the sector.

FAO's objective in fostering Asian smallholder dairy development is not only in consideration of livelihood opportunities for small farmers but in recognition that investment in dairy has important spin-offs for rural development and nutrition. It is estimated that one additional off-farm job is created for each 10-20 litres of milk marketed per day. On the consumption side, the nutritional benefits of increasing the productivity of milk animals by just 20 percent could provide a daily glass of milk for every Asian child.

It is hoped that this publication will be useful for dairy stakeholders in the region, up and down the value chain, as they examine opportunities for sector investment and development. The lessons contained herein link decisions from the policy side to those influencing on- and off-farm issues related to enhancing efficiencies and returns from dairy value chains.

FAO, in collaboration with the Animal Production and Health Commission in Asia (APHCA), has a long-standing commitment to smallholder dairy development in the region. This publication is part of a broader regional initiative undertaken in collaboration with the CFC to provide guidance to stakeholders in the region and mobilize resources into a sector that holds vibrant opportunities for poverty alleviation, nutrition enhancement and broader economic development in rural areas.

Amb Ali Mchumo
Managing Director
Common Fund for Commodities

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Assistant Director-General and
FAO Regional Representative for Asia and the Pacific

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Introduction: Dairy development in Asia

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Asia remains one of the most diverse regions in the world in terms of economic growth, changing food consumption preferences and relative availability of resources, both human and environmental. The shape of this diversity is reflected in regional dairy development patterns, marked by diverse growth paths, diverging growth patterns, different production/market systems and varying consumption preferences. These changing diets, demographic shifts and rapid advances in technology have led to the proliferation of different types of dairy products, prompting Asian consumers in both traditional and non-traditional milk-consuming countries to include more milk in their diets. This is evident in the nearly doubling in regional per capita milk consumption figures: from 32 kg per capita in 1981 to 64 kg per capita in 2007 (Table 1).

Table 1: Per capita milk consumption, milk equivalents

	1981	1990	2000	2007e
	Kg/capita			
World	86	80	104	113
Developed	222	180	235	248
Developing	35	40	56	68
Asia	33	39	50	64
China	3	6	11	na
Mongolia	141	144	176	na
SE Asia	6	10	16	32
Thailand	8	14	26	na
Philippines	14	19	22	na
Malaysia	48	41	52	na
Viet Nam	1	1	8	na
South Asia	543	66	84	93
India	50	63	79	na
Pakistan	113	134	180	na
Bangladesh	16	17	18	na
Sri Lanka	24	28	33	na
Nepal	49	50	50	na
US	271	274	287	295
EU	na	363	496	382

Source: FAO estimates

Aggregate consumption gains in regional dairy product consumption over the past decade mirror regional annual income gains of nearly 5 percent. Within a global context, the near doubling of regional milk consumption over the past 25 years, to an estimated 247 million tonnes in 2008, has placed Asia as the strongest growing region for milk and dairy product consumption. In fact, Asian consumers have generated nearly half of the global dairy product demand over the past decade.

Similar to previous trends, the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization of the United Nations (FAO) project that the strongest gains in dairy production and consumption over the coming decade will take place in Asia[1]. Increasing incomes and a continuation in changing consumption patterns are expected to translate into a nearly 120 million tonnes increase in world milk production, up 20 percent to 803 million tonnes by 2017. Over half of these output gains, or 63 million tonnes, will be produced in Asia, particularly China and India, two countries which are expected to account for a respective 16 and 20 percent of the global increase.

This has important implications for many countries, such as those in South Asia where milk is only second to cereals in terms of importance to overall per capita consumption. The importance of milk is evident within long historical traditions of both urban and rural milk consumption, largely influenced by cultural factors, such as those in Pakistan and India. These traditions have encouraged the continued existence of strong informal rural milk marketing systems, thus supporting growing trends in per capita consumption in those countries. By contrast, dairy development in other South Asian countries has lagged, such as in Bangladesh, Nepal and Sri Lanka, partly due to the lack of government support for the sector.

[1] OECD–FAO agricultural outlook, 2008–2017.

Developments in South Asia stand in sharp contrast to much lower consumption levels in Southeast Asia, where average per capita consumption levels, at 32 kg per capita, are one-third the levels in South Asia. While India and Pakistan have the highest per capita consumption levels in Asia at 80 kg and 180 kg, respectively, most of the strongest consumption gains in percentage terms have been due to rapid gains in non-traditional milk-consuming countries, such as China and Viet Nam (Figure 1). Consumption gains have been largest in countries with low per capita consumption estimates. Estimates of per capita consumption range from 2–5 kg per capita in Cambodia and Lao People's Democratic Republic to 11–15 kg per capita in Philippines and Viet Nam and to 40–55 kg per capita in Korea, Malaysia and Thailand.

Nowhere has the change in milk demand been as dramatic as in China, where consumption has increased from 5 kg per capita in 1984 to estimates of over 22 kg by 2007, growing on average of 9 percent per annum. Most of this growth has occurred since 2000 when technical advances allowed integration between dairy markets. An investigation by the China Association of Dairy industry found that in 2003 there were some 381 dairy products sold in different supermarkets in Beijing, much of which was produced in the grasslands of the North China region. Despite lactose intolerance (a historical constraint to fluid milk consumption in some countries in the region), the availability of more processed products, such as cheese and yoghurt, along with technological developments, such as UHT milk processing, have overcome the challenges of long-distance travel. The new technology has allowed more shelf-stable dairy products to be delivered to geographically and culturally diverse consumers.

Government-invested milk promotion, in some cases through school milk programmes, also has been a catalyst in the expansion of demand. This has been particularly true in China where generic milk promotion and encouraged participation of smallholders in milk production have been national and regional policy. In addition, there have been significant incentives for processors who, while regrouping producers, are driving the next stage of China's dairy development (Hu).

Production grows faster than in any other region

This rising regional demand for milk and dairy products (from 76 million tonnes in the early 1980s to an estimated 247 million tonnes in 2008) has translated into opportunities for local producers, the majority of whom maintain between two and five cows and supply more than 80 percent of milk in the region. Aggregate output gains for the region, growing annually by 5 percent over the past decade, have doubled the global average. With approximately 352 million head of cattle and buffalo (Annex Table 1), Asia became by 2005 the largest milk-producing region in the world – surpassing Europe.

This has largely benefited smallholder dairy producers in a region where milk production is an integral part of the small-farm economy in many countries, providing cash, capital assets and nutritional benefits to tens of millions of households. Spread across the largest, most geographically diverse region in the world, aggregate growth in the Asian milk output over the past decade has been exceeded only by that of certain meats and vegetable crops (Figure 2). It also has likely served as a catalyst to overall rural development; FAO estimates that every 10–20 litres of milk marketed in traditional markets has created one non-farm job. Of concern, however, is the much slower growth in grain and fodder production (Figure 2). While many of the production systems in which animals are now located are low input–output systems, characterized by feed produced from local crops, increasingly the emergence of more commercial operations will require access to better quality feed.

Figure 1: Strong income growth prompts increased milk consumption over past decade

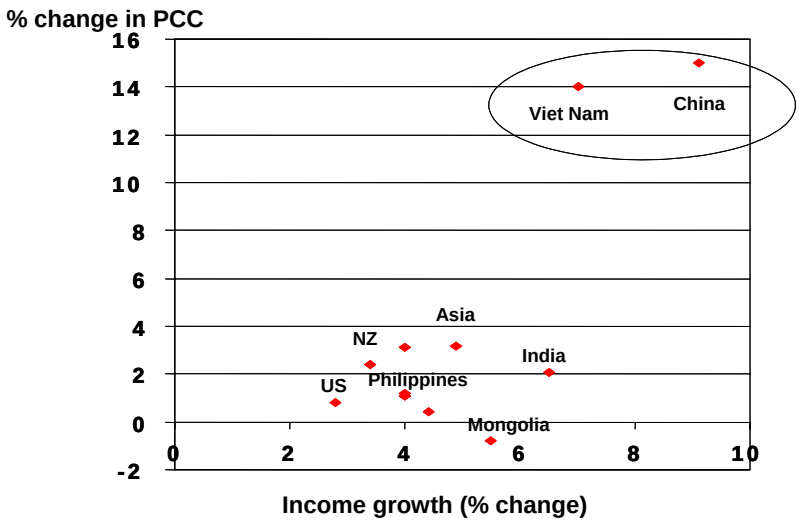
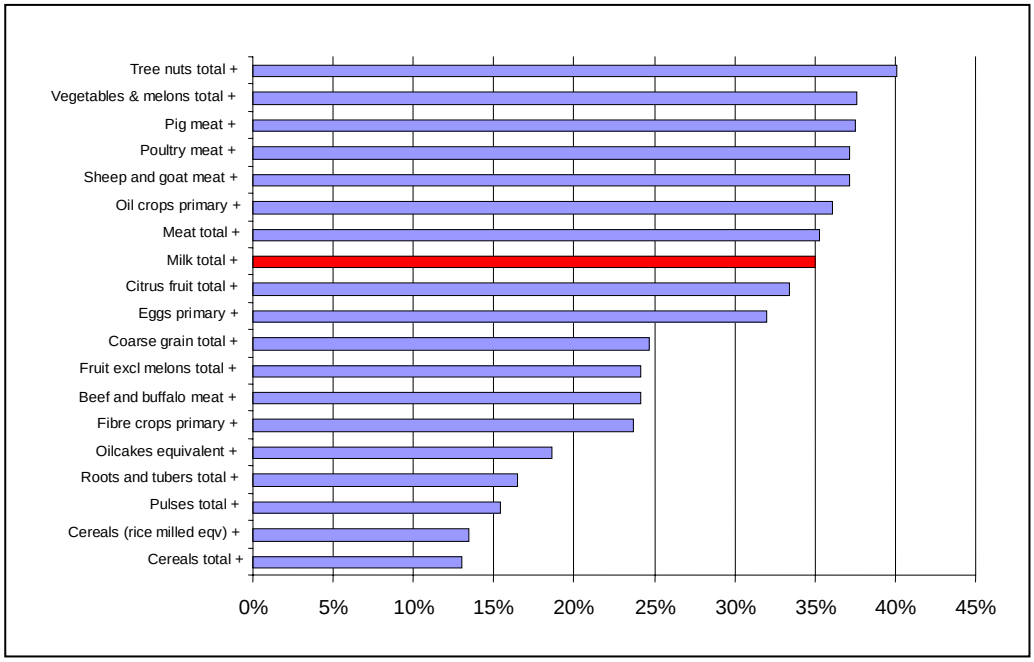


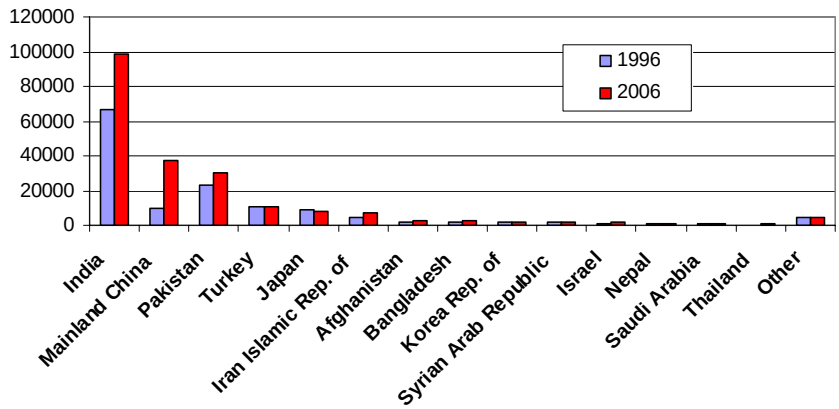
Figure 2: Growth in agricultural production in Asia, 1997–2007



Aggregate regional statistics mask the considerable differences in dairy development among subregions and countries. Nearly 80 percent of the production gains in Asia can be attributed to three countries: India (the world's largest producer), China (the fastest growing market) and Pakistan, with output in India and Pakistan originating from low input–output crop-based systems in which milk from buffalos is important (Figure 3). And yet, the strongest gains over the past decade have been in Southeast Asia. This is also the area where lack of traditional consumption preferences for fresh milk, combined with low tariffs, has led to imported milk products accounting for nearly one-quarter of the subregion's domestic requirements. When calculating dairy imports as a share of processed milk, this proportion in countries such as the Philippines and Viet Nam can jump to over 90 percent. It is clear from the trends that a growing appreciation for fluid milk and products made with locally produced milk is rapidly gaining acceptance.

Asia, as a region, provides feed and forage to more than half of the global cow population of 672 million (Annex Table) and appears to have been marginally successful in increasing output by way of raising production intensity. Over the past 15 years, yields have almost doubled, with productivity gains per animal (calculated as yield per animal) attributing to the nearly two-thirds of overall output gains. Yield gains have been very broad based, with Afghanistan, China, Iran and Viet Nam recording average annual gains that exceed 3 percent.

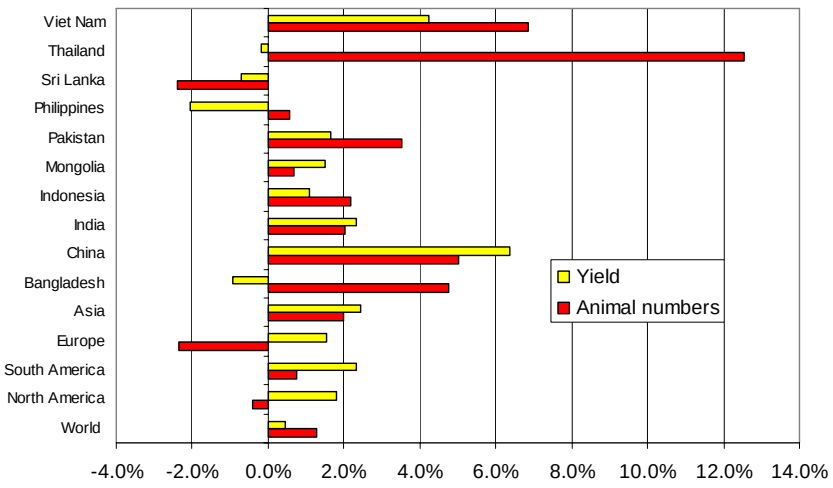
Figure 3 : India, China and Pakistan account for 80 percent of milk production gains over the past decade



However, regional average yields, at less than 1 tonne per animal, remain below the global average and only one-tenth of the developed country average (Table 2).

In China and Viet Nam, double-digit production gains have been the strongest in the world. That growth has been supported by government assistance with the enhancement of cross-bred animal availability, which has resulted in average yield increases of between 4 and 7 percent (Figure 4).

Figure 4: Contribution of yield to milk output (over the past decade)



It is these successes that have prompted yield gains in the region to rise annually, at almost 3 percent – faster than in any other region. In developed countries, the expansion in output has been largely fuelled by enhanced yields per animal, with the exception of Australia and New Zealand where cows are mostly grass fed.

By contrast, productivity per animal in Africa appears to have virtually stagnate. It is clear that favourable economic signals to producers have the potential to quickly increase yields in many parts of Asia where producers poorly feed their animals. Thus, there is ample scope for rapid increases in milk productivity simply by improving the feed quality of local crops.

Table 2 : Average yields (tonnes/animal/yr)

	1992	2007	% change
Africa	.18	.20	13
Asia	.52	.91	74
South America	.90	1.31	46
North America	6.8	9.01	32
Oceania	3.16	3.35	6
World	1.1	1.27	15

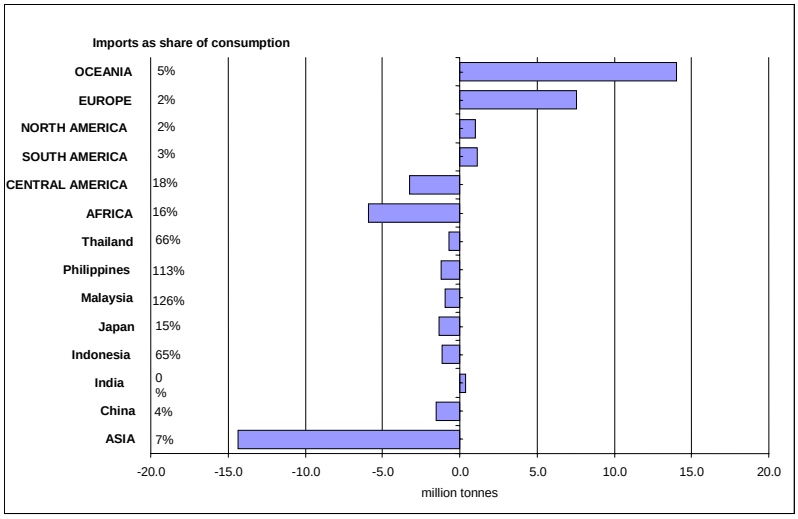
Opportunities for import substitution

Despite the rapid production gains, growing regional demand has also led to a near doubling of imports in Asia over the past 25 years, particularly those of milk powder. Asian imports swelled from 10 million tonnes in the early 1980s to an estimated 19 million tonnes in 2008. Asia currently accounts for approximately half of the global dairy product trade and constitutes an important market for the major dairy exporters, dominated by New Zealand, the European Union (EU), the United States and Australia (Figure 5). However, regional import dependency has remained stable at only 7 percent. This implies that the region as a whole has been relatively successful in supporting local industries to respond to the rising demand for dairy products. But regional averages can mask local realities. For instance, in South Asia, consumer preferences for fresh milk, local product availability and import barriers have limited trade with dairy product imports constituting only 1 percent of domestic consumption. In contrast, imported milk products into Southeast Asia supply nearly one-quarter of domestic requirements; when calculating dairy imports as a share of processed milk, this share jumps to over 90 percent in some countries.

In countries such as Sri Lanka, Philippines and Viet Nam where tariff levels are very low and consumers are familiar with and favour reconstituted milk products, import dependency has reached over 80 percent. And yet in China, a country that has experienced double-digit consumption gains over the past decade, imports constitute only 6 percent of total consumption. However, with imports estimated at nearly 2 million tonnes, China is the largest dairy product importer in the world, followed by Mexico, Russia, Egypt, Indonesia, Malaysia and Philippines.

As global dairy product supplies tightened in late 2006 due to drought in some exporting countries, as the EU intervention stocks drew down and as certain export subsidies discontinued, international dairy product prices rose to record levels. Rising faster and sooner than other agricultural commodities, prices for internationally traded milk powder hit a plateau and started declining in late 2007. While prices declined

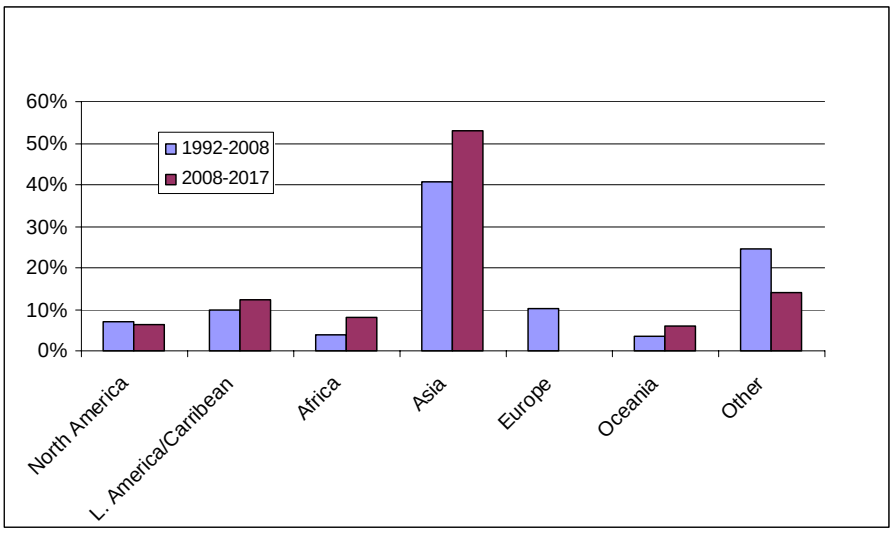
Figure 5: Net trade position in dairy products, 2007



quickly in line with other agricultural commodities through 2008, many of the factors prompting higher prices (increased feed and other input prices and policy reforms) will likely underpin market fundamentals over the medium term.

In various studies, decades-long dairy product policies and support for the sector in OECD countries have depressed international milk-equivalent prices by an estimated 25–35 percent. Though unexpected, the price rises may reflect a market adjusting to a situation that has become less distorted by government interventions. This potential structural[2] change in dairy markets implies a higher level of prices over the next decade. In their recent commodity projections, the FAO and the OECD estimated that prices of skim and whole milk powder will range between US$3 000 and $3 700 per tonne over the next decade – 50–90 percent higher than the previous five years' average. In line with historical trends over the past two decades, production and consumption gains in milk markets over the next decade also are expected to take place in Asia (Figure 6).

Figure 6: Where will dairy production gains be located over the next decade?



This structural change also affords opportunities for producers in developing countries to expand output, particularly in Asia and Africa, which receive nearly 90 percent of milk powder exports from developed countries. The millions of households with milk producing animals across Asia who are some of the poorest in the world – in many cases landless – have a capacity to respond to economic signals, specifically higher prices. In countries with a large import dependency, higher import prices create an opening for import substitution, particularly in countries such as Philippines, Sri Lanka and Viet Nam where imports supply as much as half the formal or processed dairy market demand.

[2] Structural changes in agricultural markets are those in which policy reform or factors outside the commodity sector lead to permanent shifts in the demand and supply curves. Examples could include the introduction of new technologies, concentration in industries and, in the case of dairy, an elimination of policies supporting the export of subsidized dairy products.

The region's challenge: How to ensure local participation in the growing demand for milk products

The opportunity for growth presents Asia dairying stakeholders with the challenge of supporting industry expansion in an increasingly complex and competitive environment, one characterized by longer dairy value chains and mounting pressures on resource availabilities. Dairy farming is still at the preliminary stage in most countries in Asia, with milk supplied by millions of smallholder farmers. But the dairy processing industry is gradually maturing to better meet the requirements of consumers. These diverging trends necessitate a closer look at the diverse structure of dairy industries within the region and their evolution under local conditions.

One of the benefits of supporting dairy development, particularly in Asia where domestic demand is expected to grow faster than in any other region, is that there are fewer economies of scale involved in production than in other livestock systems. Studies have empirically shown that smallholder dairy producers remain competitive in many areas in developing countries (Stahl *et al.*, 2003); nearly 80 percent of overall milk production gains over the past decade were supplied by producers with two to five cows. This is particularly evident where the opportunity cost of labour is low and where value is captured from non-food farm outputs, such as crop residues, manure and the opportunity for capital accumulation in the form of livestock (capita assets). However, as producers scale up to take advantage of the growing demand, smallholder systems become disadvantaged by economies of scale in marketing, input supply and service delivery.

To better shape broader stakeholder engagement and investment into the dairy sector, the opportunities for smallholder dairy producers need to be reviewed within a wide range of influencing factors: economic, institutional, commercial, legal, technological and social. The constraints and opportunities differ both by country and by specific locality, which can affect the development of effective strategies for enhancing smallholder contribution to the growing livestock-product demand.

Useful models need to be identified and analysed. It is particularly important that the enabling factors critical for successfully forging links between smallholder suppliers, processing facilities and traditional markets for fluid milk and other locally acceptable dairy products be identified, weighted and ranked. The selection of acceptable models needs to be based on local conditions, market access, cultural factors and consumption patterns. The possibilities range from enterprise-driven smallholder dairy operations (such as in the Philippines and Viet Nam) to cooperative systems (such as in South Asia) and to strengthened opportunities for subsistence farmers (such as in Bangladesh).

The following chapters present a review of experiences and lessons learned in nine countries (case studies) in Asia. Included is a review of policies that have fostered the growth of the dairy industry in each country and the models that have or have not been conducive to smallholder dairy development. Drawing from these FAO-commissioned case studies and from regional consultations,[3] the final two chapters offer a summary of factors that have influenced the evolution of the sector, the lessons learned on successful and unsuccessful practices in sustaining smallholder participation in the rapidly growing sector and the policy process that fostered this development.

[3] Drawing on regional expertise, the documentation in this publication was generated through a series of activities that included regional workshops. The first workshop (25–29 February 2008) developed a road map for a Strategy and Investment Plan for Smallholder Dairy Development in Asia, while the second (17–20 November 2008) produced a practical guide on dairy development planning and policy formulation. These publications and information on the workshops can be accessed at the APHCA website: http://www.aphca.org/

Annex Table: Asian milk production, yields and numbers of cows

	Milk Production (Averge)				2007		Production gains:	Annual %
	1981-83	1990-92	2000-02	2005-07	Cow Numbers	Yields	1991-2007	2000-07
	(1,000 tonnes)				1 000	ton/animal		
ASIA (EXCL. CIS)	76 614	112 675	177 498	228 133	351 700	0.67	198%	4.8%
Afghanistan	876	862	1 941	2 282	9 218	0.25	161%	2%
Bangladesh	1 199	1 648	2 179	2 315	29 691	0.10	93%	1%
Bhutan	30	32	41	41	166	0.25	37%	0%
China Mainland	3 501	7 333	14 361	36 616	57 830	0.63	946%	18%
India	36 300	55 726	84 143	99 327	105 300	0.97	174%	3%
Indonesia	305	616	780	872	10 267	0.01	186%	1%
Iran Islamic Rep. of	3 056	4 026	5 926	7 677	35 130	2.20	151%	5%
Japan	6 799	8 341	8 394	8 137	1 092	7.45	20%	-1%
Cambodia	16	17	20	23	140	0.17	45%	2%
Korea DPR	63	90	91	96	41	2.20	52%	1%
Korea Rep. of	604	1 747	2 380	2 189	324	6.62	263%	-1%
Laos	3	5	6	6	34	0.20	75%	0%
Malaysia	37	39	39	46	98	0.48	27%	3%
Mongolia	227	296	374	386	1 466	0.27	70%	0%
Myanmar	437	528	634	1 001	2 464	0.45	129%	6%
Nepal	790	929	1 202	1 391	3 673	0.38	76%	3%
Pakistan	9 439	15 494	26 294	31 138	27 990	1.18	230%	4%
Philippines	33	31	11	15	7	1.92	-55%	6%
Sri Lanka	249	265	159	171	462	0.38	-31%	1%
China (Taiwan Pr.)	57	236	380	343	139		504%	-1%
Thailand	29	148	589	713	230	3.00	2362%	3%
Viet Nam	46	60	96	243	177	1.55	427%	15%
Global	363 112	442 510	592 142	662 269	672 305	1.00	82%	2%
Developed	259 080	290 155	335 912	341 629	10 285	9.0	32%	2%
Asia: share	21%	25%	30%	34%	52%			

Bangladesh: Social gains from dairy development

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Dhaka

Background

Bangladesh has a population of 140 million people; more than 80 percent of them, or approximately 15 million households, are located in rural areas. An estimated two-thirds of those households own livestock. Although population growth is slowing, there are still almost 1 000 people per sq km – the highest density of any country in the world (excluding small island-nations and city-states). The dwindling per capita land resource is one of the causes of persisting poverty in the county, according to contemporary human development reports from the United Nations Development Programme (UNDP): More than half the population owns less than 0.5 acres; the bottom 40 percent possesses just 3 percent of the total land area; 48 percent live below the poverty line; and 30 percent consume less than 1 900 calories per day (the minimum desired level is 2 300 calories).

Agriculture generates two-thirds of total employment, contributes a quarter of total export earnings and provides food security to the increasing population. Crop production and animal husbandry are interdependent in the country's mixed-farming system, with livestock performing multiple functions, including the provision of food, nutrition, income, savings, draught power, manure, transport and other social and cultural functions. With livestock, people who are poor and landless can still access common property resources, such as roadsides, open grazing areas and water bodies. Cattle are by far the most important farm animals; smallholders possess the majority of them, and they are directly linked to family income, nutrition and welfare. While animal husbandry is a part of mixed farming, the system of production is not well integrated, and maximum value is not always gained from the inputs and outputs. There is scope for basic improvements that can lead to greater integration and productivity.

In 2006, the livestock sector contributed 3 percent of gross domestic product (GDP), or about 18 percent of agricultural GDP.[4] When the indirect benefits of draught power and manure for fuel and fertilizer are added to the direct economic output of meat, milk and hides, the value added of the livestock subsector almost doubles, to about 6 percent of GDP. Livestock also provide a critical cash reserve and steady cash income for many marginal farmers who grow crops essentially for subsistence or who have little or no land at all. The national herd comprises: 23 million cattle, 1.2 million buffalo, 20 goats and almost 3 million sheep. Milk production was 2.27 million tonnes in 2006, mainly produced by cows yielding, on average, 200–300 litres per 160/180-day lactation.

In the few specialized areas where cross-breeding has taken place, yields range from 1 000 to 3 000 litres over a 210/300-day lactation.[5] Until quite recently, milk was a by-product of cattle, used largely for making traditional sweets and in tea. Per capita milk availability currently ranges from 40 to 50 g per day (14–18 kg per year). The gap between supply and demand is largely met by milk powder imports of about 20 000 tonnes annually, valued at some US$70 million.[6] Imports represent 0.16 million tonnes of liquid milk equivalent annually, feeding some 6–7 percent of total consumption and accounting for an estimated 55 percent of the formal dairy market. Although there is no specific nutritional target in the country for milk consumption, the figure of 250 g per day (90 kg per year) often appears in national plans, implying an annual milk requirement of 12.8 million tonnes – more than five times current production.[7]

[4] Directorate of Livestock Services, Bangladesh, 2006–2007.
[5] Directorate of Livestock Services, Bangladesh, 2006–2007.
[6] Bangladesh Bank, annual report, 2006.
[7] Kbd. Syed Altaf Hossain, Paper presented at the annual (2003) Bangladesh Animal Husbandry Association conference.

The history of the sector

The first dairy plant was set up in 1946 by the National Nutrients Company in the then Indian subcontinent, at Lahirmonhanpur, now in Sirajganj district (northern Bangladesh). Following the partition of India in 1947, the Eastern Milk Products Company took over through an exchange of properties. Milk and dairy products marketing eventually started in 1952 under the brand name Milk Vita in the then East Pakistan. The cooperative accumulated huge losses, as did the only other dairy venture, Asto dairy in Dhaka, which began in the 1960s. By 1970, both dairies had virtually ceased trading.

Acute scarcity of milk following independence from Pakistan in 1971 prompted the Government to commission two dairy studies, with support from FAO and the Danish International Development Agency (DANIDA). The studies' authors recommended establishing a sustainable cooperative dairy development programme based on buying surplus milk from smallholder producers and combining the businesses of Asto and Milk Vita into the Eastern Milk Producers' Cooperative Union Ltd, which became Bangladesh Milk Producers Cooperative Ltd (BMPCUL) in 1980.

The Milk Vita Cooperative Dairy Complex was established in 1973 and operated until 1978 under the auspices of the Ministry of Local Government, Rural Development and Cooperatives, with support from FAO, DANIDA and UNDP. The cooperative model was largely adapted from the successful Anand Pattern Dairy Cooperative in India. Two dairy plants and three milk collection centres were built, and milk collection from smallholders started in 1976. The Government also established a small dairy at Savar in the mid 1970s, close to Dhaka, to provide government employees processed milk from its Central Cattle Breeding Station.

At Milk Vita, the gap between milk supply and demand was originally met by recombining butter oil and the skimmed milk powder (that DANIDA and the European Economic Community provided) into liquid milk. By the end of the 1970s, more and more village cooperatives had been established and annual milk collection from some 36 000 smallholders had rapidly built up to 15 million litres. But by the mid 1980s, Milk Vita had virtually collapsed, with less than 3 million litres of milk collected annually. The problem was attributed to unfair competition from imports flooding in from subsidized over-production in Europe. At that time, whole milk powder was retailing at less than 20 percent of its cost price in Europe and one-third of the cost of milk production in Bangladesh.

By the beginning of the 1990s, import taxes were imposed to counter the adverse impact of the cheaper imports. Also at that time and following the recommendations of the FAO technical assistance team, the Government withdrew from day-to-day management of the dairy cooperative. Professional managers took over, turning Milk Vita into a profitable business.

Recent developments

Fortuitously, the turnaround at Milk Vita coincided with a growing market for processed milk as urbanization accelerated. This encouraged other investors to adopt parts of the Milk Vita smallholder dairy model. The sector now engages many enterprises, as Table 1 indicates. In 1990, processors collected just 1 percent of the total milk production of 1.5 million tonnes (30 000 litres per day); by 2006, this had increased to 7 percent of 2.27 million tonnes (384 000 litres/day).

Other developments since the 1990s:

- **Government-sponsored investment incentives** for a few medium- and large-scale farmers to purchase improved dairy animals; this initiative largely failed because the farmers were not well integrated into the dairy input supply and value chains and were unable to repay their loans.
- **Cheap sweetened condensed milk** is being produced from imported powder milk, sugar and vegetable oil by four large companies: Danish, Starship, Goalini and Kwality. The condensed milk has captured the lion's share of the tea-drinking market, though it is not a dairy product because it contains vegetable oil. The business model of these companies is based on the continued availability of cheap (subsidized) milk powder from developed countries. They have been hugely profitable because they took advantage of low international commodity prices. It will be interesting to see how they adapt their business model to cope with the recent significant increases in prices.

- Foreign investors such as Arla Foods Denmark (Dano brand) and the New Zealand Dairy Board (Anchor brand) have imported milk powder in bulk for repacking.

Table 1: Milk processing capacity, 2007

	Dairy (establishment year)	Average milk collection (litres/day)	Smallholder milk suppliers
1.	Milk Vita (1973)	200 000	150 000
2.	Amomilk (1996)	10 000	5 000
3.	Tulip Dairy(1998)	3 000	2 000
4	Arong–BRAC Dairy (1998)	80 000	70 000
5.	Bikrampur Dairy (1998)	10 000	6 000
6.	Ultra–Shelaidah Dairy (1998)	10 000	4 000
7.	Aftab (1998)	8 000	4 000
8.	Pran (2001)	40 000	30 000
9.	Grameen–CLDDP (1999)	7 000	6 000
10.	Rangpur Dairy (2007)	8 000	7 000
11.	Akij Group (2007)	4 000	500
12.	Grameen Danone (2007)	1 000	From CLDDP
13.	Savar Dairy (1974)	3 000	From own farm
14.	Army	Self-consumption	From own farm
	Total	384 000	284 500

Source: Khan.

Dairy sector policy and strategy

Following the establishment of Milk Vita, two dairy development studies were initiated in the 1980s as a preface to scaling up cooperative dairying elsewhere in the country. The Government and UNDP/FAO sponsored both studies. The first, in 1984, led to the National Cooperative Dairy Development Plan. The Chairman of the Indian National Dairy Development Board (NDDB) orchestrated the second study, in 1987, which led to expanding the earlier plan into a formal strategy for dairy development in Bangladesh. The strategy proposed a regional approach, based on setting up four regional dairy cooperatives to collect milk from smallholder village cooperatives and process and market it safely and affordably to lower-income urban groups. The regional dairy cooperatives would be enveloped into a national dairy federation or a dairy development board. Detailed implementation programmes were prepared but have remained shelved for more than two decades.

Current government policy for agriculture aims to provide an enabling environment and supportive role in moving from a predominantly state function to a more diversified and environmentally sustainable commercial venture. The strategic framework targets non-crop agriculture, such as fishery, poultry and livestock, for accelerated investment.

After an intensive stakeholder consultation process, the Directorate of Livestock Services (DLS) and the Ministry of Fisheries and Livestock (MOFL) drafted the National Livestock Policy in 2005. It was finalized in 2006 under the recently completed Grameen Bank/UNDP/FAO Community Livestock and Dairy Development Project (CLDDP). Although the DLS and the MOFL adopted the policy, it has yet to be approved by the Cabinet, due largely to the succession of interim governments and prevailing civil unrest since it was prepared. Although the policy contains no separate dairy component, the Milk Vita and Grameen–CLDDP dairying models are promoted as “models for early adoption”.

Once approved, the policy will have several more tough challenges:

- implementation of the policy recommendations;
- acceptance of institutional reforms;
- establishment of regulatory frameworks and a legal body;
- enforcement of the laws and regulations;
- quality control assurance;
- collaboration with the private sector for veterinary services and simple diagnostic facilities.

The Government's National Strategy of Accelerated Poverty Reduction (NSAPR, 2005) sets out ways and means for achieving two of the Millennium Development Goals (MDGs): halving poverty and halving under-nutrition by 2015. The strategy document states that while the livestock sector as a whole grew 3 percent during the 1990s, poultry has demonstrated the most impressive growth rate, at around 10 percent per annum since the mid 1970s. Growth in milk production generally has mirrored the general trend in the livestock sector, with low productivity a major limitation to sector development because production remains primarily for subsistence and is highly dispersed. With rapid urbanization and income increases, the demand for livestock products, such as meat, milk and eggs, will continue to rise. The strategy targets local milk production to replace imports, which currently range between 10 and 20 percent of annual consumption. The strategy promotes community-based organizations of production, processing and marketing to overcome the constraints. Smallholder milk producers thus are expected to play a key role in helping to achieve the target and, in so doing, helping Bangladesh to achieve the MDGs relating to poverty and nutrition.

The NSAPR includes a school lunch programme to improve attendance and reduce the incidence of malnutrition as well as generating demand for local produce and catering services through backward and forward links. Community participation is a key driver. Currently, the United States' Department of Agriculture funds a small school milk programme in Bangladesh, for which the US company Land O'Lakes imports milk and then recombines it with its milk powder. Although they enhance the nutrition intake of school-age children, school milk schemes using imported milk powder have limited sustainability and are less beneficial to livelihood development as those using locally produced milk.

Affordable and readily available cattle treatment and other development support provided by Milk Vita and Grameen-CLDDP have encouraged the expansion of milk producers. Still, even though the Government now generally recognizes smallholder milk production in its development strategy, the absence of a comprehensive national dairy policy may limit the growth of the sector. What has been achieved so far primarily relates to the influence of a milk collection system introduced by dairies, which has resulted in a fairer price system for producers. Initially, a government ministry set Milk Vita's prices; but since becoming more independent in the early 1990s, Milk Vita has decided its own prices, in competition with the other dairies as well as imports.

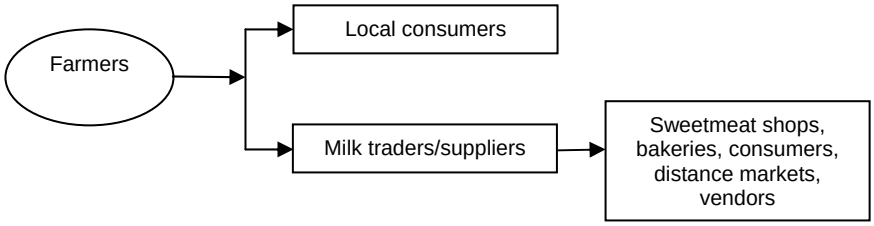
Smallholder milk producers and marketing models

Smallholder milk producers play a key role in dairy markets in Bangladesh. They supply all the domestic milk for the informal traditional market and three quarters of the formal processed market (Annex I provides an illustration of the various smallholder milk producers). Milk Vita and Grameen–CLDDP institutionally promote the empowerment of smallholder dairy farmers, both men and women, in the value chain and business ownership/management process, which encourages their participation. Other processing dairies tend to focus on milk collection only.

Informal traditional markets model

Smallholder milk producers sell milk directly to consumers or milk supplier/middlemen at local markets (Figure 1). The middlemen cater to the demand of sweetmeat shops, bakeries, consumers, more distant markets and vendors. They pay producers up to 50 percent less for their milk than other models, such as those described in the following sections. In many cases, the middlemen provide loans to smallholders with interest rates of up to 20 percent per month.

Figure 1: Traditional milk trader model



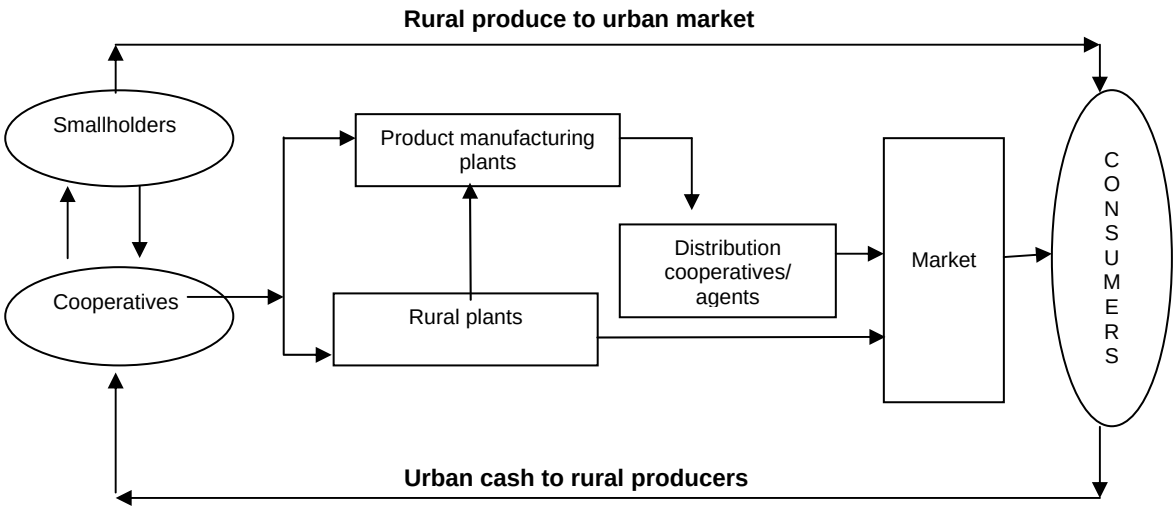
Milk Vita Cooperative model

The Milk Vita Cooperative model was adapted from the world-renowned Anand Model in India. It modestly started in the mid 1970s by providing 4 300 very poor, often landless, households in remote rural areas with a complete package of milk production-enhancing technologies, organizational skills and a milk collection-processing-marketing system. It has since grown into a successful commercial dairy enterprise, collecting from more than 100 000 smallholder members of some 1 200 primary village cooperatives and then processing and distributing the milk to all major cities in the country. In 2006, smallholder milk producers sold 75 million litres of milk surplus. They also earned patronage dividends from Milk Vita's profits. The resulting increase in milking cow numbers and savings generated has helped cushion them against the devastating effects of severe flooding that regularly afflicts the country.

A novel aspect of the Milk Vita operation is its urban distributor cooperatives. These use locally fabricated "milkshaws" – an insulated box mounted on a traditional three-wheeled-cycle rickshaw chassis – to deliver affordable pasteurized milk and dairy products to urban shops and consumers.

The Milk Vita model (Figure 2) created jobs, reduced collection and distribution costs and improved milk quality by cutting delivery times, especially in congested city areas. One off-farm job was created for every 35 litres of milk collected, processed and marketed, and more than half those jobs are in rural areas. Democratically elected milk producer and distributor cooperative members are now in the majority on Milk Vita's board of directors. These achievements encouraged the Government to withdraw from the day-to-day management, enabling the board to hire professional managers, which led to improved performance and created a platform for further expansion to bring more poor people into the dairy value chain. Since the late 1990s, Milk Vita has invested more than $10 million to expand its milk collection, processing and marketing network and now delivers safe and affordable milk and dairy products to some 5 million low-income urban dwellers.

Figure 2: Milk Vita Cooperative model



The benefits of the Milk Vita Cooperative model:

- The model is a holistic, cow-to-consumer model.
- Milk production and productivity increase.
- Household nutrition and incomes increase.
- Communities are empowered through poor farmers' participation in the organized cooperatives and through accountability of the Milk Vita board and management to its milk producer members.
- Quantity of affordable and safely processed milk and dairy products for urban consumers is increased while the quality is enhanced.
- Substantial off-farm employment is generated.

Milk Vita continues to be a flourishing venture and has many recent imitators that have set up similar enterprises to process and market 70 million litres of milk annually. However, these enterprises do not provide cattle development or productivity-enhancement support and technology to milk producers.

Box 1: Milk Vita helps one woman create a dairy cooperative and change her family's prospects

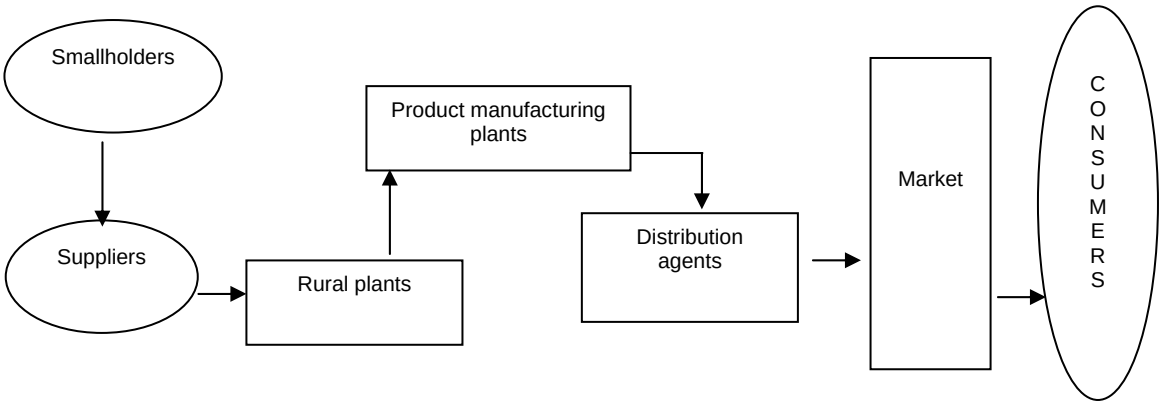
Sandhya Rani Bala lives with her family in the very poor village of Takerhat in Faridpur district, more than 200 km from Dhaka. Born in 1965, she married in 1980. With the help of her husband, she bought her first cow and started to sell her spare milk to Milk Vita to supplement her family's income. Encouraged by the support she received in the form of a fair milk price as well as patronage bonuses and animal husbandry support services, she helped form a village milk cooperative exclusively for women. It now registers more than 200 members. Mrs Bala initially earned 7 000 taka ($100) per month selling her surplus milk. She has sold four cows over the past two decades, for which she earned approximately 200 000 taka ($2 857) in addition to her regular milk sales and bonuses. She also bought an acre of land for 360 000 taka ($5 150) for growing crops and fodder.

In 1995, Mrs Bala was elected to Milk Vita's board of directors, known as the Managing Committee, for two consecutive six-year terms. She says milk and cattle have changed her life and the lives of her family; her two sons were able to seek out higher educations, one now an engineer and the other in his final year studying medicine. Her husband has been very sick over the past four years, and the milk sales have financed part of his expensive treatment. Mrs Bala now owns eight cows, valued at about 400 000 taka ($5 700) and sells 10 000 litres of milk annually, worth about 195 000 taka ($2 800).

Private entrepreneur model

Private dairies, some owned by non-government organizations (NGOs), such as the Bangladesh Rural Advancement Committee (BRAC), usually operate through milk supplier/middlemen (known as *ghoshes* or *dudhwalas)* in place of rural groups or cooperatives (Figure 3). They collect milk for a specific dairy, however, smallholders involved in the system do not receive any value-added benefit – only the basic price for their milk.

Figure 3: Private entrepreneur model

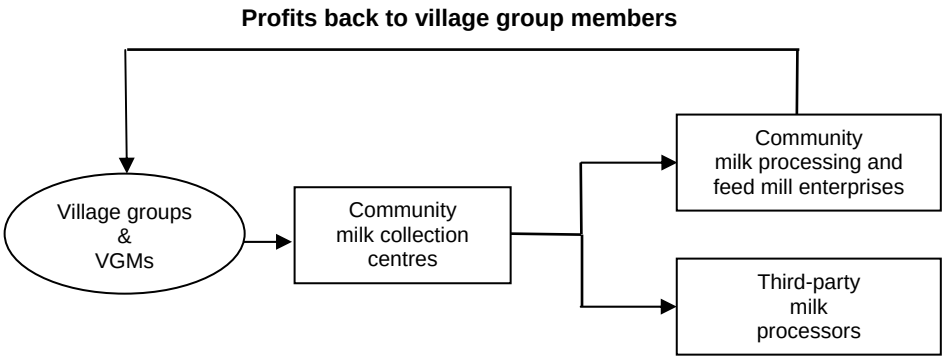


Grameen–CLDDP model

This is a profitable, integrated, community-owned crops-livestock-fish farming system that operates in one of the three poorest areas of the country and includes a dairy chain module. Established in 2000, the model was pioneered under the Grameen Bank/UNDP/FAO CLDDP project. Very poor landless families are organized into groups of five people. These village group members (VGMs) can access commercial loans for raising livestock and other income-generating activities. Some 80 percent of them have opted for dairy cows. The loans include compulsory animal feed and insurance components. VGMs have access, at full cost, to all the inputs needed to produce and market milk. They supply their milk surplus to community-owned milk collection centres for primary processing at community-owned dairy enterprises. The pre-processed milk is then sold to established dairies like Milk Vita, Bikrampur Dairy and Grameen Danone Foods for further processing and marketing. Some processed milk is also marked locally. The VGMs own 70 percent of the community feed mill and dairy enterprises (Grameen owns the other 30 percent) and thus share in the profits. While in some ways it is a social dairying model, it is also commercial in operation.

The feed mill enterprises provide quality dairy rations, compounded from locally available agriculture by-products, for the VGMs who either have insufficient land or no land at all to grow their own feed and fodder. Once the smallholders have four or five cattle, they have enough dung to take a loan for a bio-digester to produce gas for cooking and lighting. The spent slurry from the bio-digester is then used to fertilize and increase the productivity of fish ponds. Every two or three years the ponds are emptied, the slurry dried and used as crop fertilizer. In this way, smallholder dairying has become an important component of an integrated and environmentally sustainable farming system for poor people.

Figure 4: Grameen–CLDDP model



Benefits for the village group members include:[8]

- Household nutrition; before the project, no households consumed milk, but now all 6 000 households with cows consume up to 1 litre of milk daily.
- Household earnings; the average daily earnings from fish and milk increased from $.19 to $1.25, enabling the purchase of other essential foods, schooling, etc.
- Household accumulation of physical assets; an increase of 145 percent for items such as tube wells for safe water, bio-digesters for clean cooking and lighting, sanitary latrines, etc.

So far, these benefits have resulted in moving more than 3 000 smallholder households out of poverty. The model is being scaled up across the country. For example, a Grameen Danone Foods Bogra Dairy started up in 2007 and produces inexpensive bio-yogurt for poor people. In five very poor districts in the Northwest, 10 000 smallholder families are being covered under a 10 billion rupee ($15 million) programme that will operate until 2010 with funds and management from the Palli Karma–Sahayak Foundation.

Box 2: Cows, milk and one family's rise out of destitution

Lily Begum lives with her husband in Jokar Char village in Tangail district. Born in 1957, she married in 1972 at age 15. She had three sons, but the family lived in destitution. They used to own a tiny patch of land (one-fifth of an acre) until the Government appropriated it to build an elevated road in the mid 1990s. The family situation worsened until 1998 when the excavated land (such as the Begum's) was turned into fish farms. A Jokar Char Landless Women's Fish Centre was set up to manage some of the fish ponds, and Mrs Begum became a member. At that time she and her family lived in a kutcha (bamboo) house, with a few pieces of kutcha furniture. Mrs Begum first earned about 4 800 taka, or $70, a year from her fish pond. When the Grameen Bank/UNDP/FAO Community Livestock and Dairy Development Project started, Mrs Begum borrowed 24 000 taka ($378) from the new Grameen Bank Community Credit Scheme to buy a milk cow.

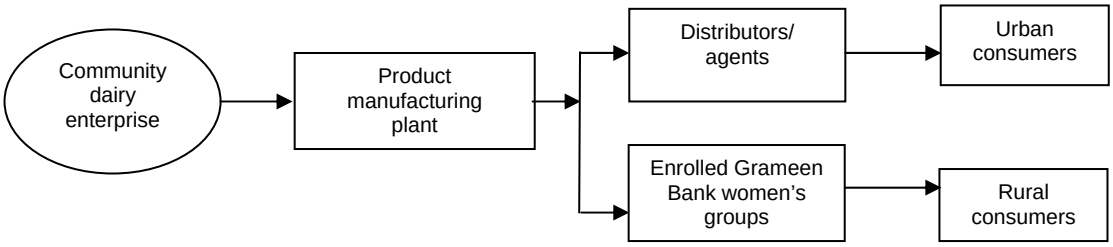
From 2000 to August 2007, she sold 13 500 litres of milk and earned 245 000 taka ($3 550). Through her livestock, she earned a net profit of 162 000 taka ($2 350), equivalent to 27 000 taka ($390) per year. Currently, she has two milk cows and three calves, worth about 100 000 taka ($1 450). With the earnings from the milk and selling animals, she established a rural engineering business for her elder son (the other two sons died), built two tin houses with concrete floors, built a bio-gas plant, purchased other household items (such as a refrigerator, a TV and furniture) and installed a tube well to provide clean water for her family and her neighbours.

Grameen Danone model

Grameen Danone Foods was created in 2006 as an innovative joint social venture between the Grameen Bank and Groupe Danone, a large French multinational dairy corporation renowned for its bio-yogurt. Danone recently established a new division called Danone Communities and gained approval from its shareholders to set up a 50 million Euro ($70 million) mutual fund to channel investment into not-for-profit social ventures in developing countries. Ninety percent of the fund is invested in low-risk securities, the remaining 10 percent in higher-risk social ventures. The first social venture is Grameen Danone Foods, which produces low-cost, fortified yogurt for sale in rural communities. A pilot dairy enterprise was set up in Bogra. The long-term plan is build rural enterprises in ten other disadvantaged areas of Bangladesh. The Bogra enterprise began in February 2007 and currently purchases about 300–400 litres of milk daily from the Grameen–CLDDP Joysagar Dairy enterprise at Nimgatchi, about 50 km away.

[8] Draft terminal report. Grameen Bank/UNDP/FAO Community Livestock and Dairy Development Project (BGD/98/009), 2007.

Figure 5: Grameen Danone model



Lessons learned

The following is a summary of some of the developments and lessons that have shaped smallholder milk production since organized dairying started in the latter half of the twentieth century in Bangladesh:

1. The country has a strong tradition of dairying, dominated by trader/middlemen and traditional indigenous milk products, which are still very important. Nearly all local milk is produced by smallholders and the sector is governed by the informal milk market (93 percent) while the formal market (7 percent) has a small but important and growing market share.

2. Long-term support from the Government and development partners/ projects kick-started the involvement of smallholders into formal dairy value chains; but schemes to promote larger, more intensive dairy farms have been largely unsuccessful due to poor services and market access. Government support is now very limited and has shifted to creating an enabling environment, with development efforts left to NGOs and the private sector.

3. Dairying can play an important role for poor rural families, especially for regular nutrition, income and jobs and in integrating farming systems (crop-fish-livestock) to optimize the use of available resources, including feed/fodder, land, water, etc.

4. Livestock and dairying enhance the capacity of poor rural people to cope with the annual monsoon floods (floods wash crops and fish away – livestock are kept at home and continue to produce food for home consumption and cash sales).

5. Successful models in which smallholders benefit from the complete dairy value chain include the Milk Vita Cooperative and the Grameen–CLDDP models. The Grameen–CLDDP model has been adapted for use in Nepal and inspired the local Grameen Danone Foods social business venture. The models provide assured markets for surplus milk plus the added value of ownership dividends and are reducing exploitation by middlemen money lenders.

6. The success of the Milk Vita model prompted substantial investment by others; currently, 14 dairy companies buy milk from nearly 300 000 smallholders. Private entrepreneur dairy models, however, provide limited value addition for smallholders in terms of livestock development services.

7. The dairy cow insurance scheme and feed mill enterprises play vital roles in the Grameen–CLDDP model, especially because smallholder dairy producers are prone to higher financial risk.

8. Condensed milk is produced from imported commodities, which, until very recently, were cheaper than fresh milk or locally produced condensed milk. Milk Vita is trying to compete with a product produced from fresh milk but has quality problems. BRAC and Milk Vita compete successfully with imported milk powder.

9. Domestic milk prices are no longer controlled. The recent substantial increase in the prices of internationally traded dairy commodities is creating opportunities for import substitution. There is strong interest in investing in the dairy sector; a favourable investment climate and high import tariffs (45 percent) are fostering foreign investment.

10. Modern, appropriate milk-processing technologies are now available at the plant level in about 20 districts (of 64), supported by local production of small-scale equipment.

11. School milk feeding schemes based on imported pre-packed milk are seen as counter-productive to sustainable smallholder dairy development.

12. There is an increasing awareness among governments, NGOs and the private sector about the significant economic and environmental benefits of sustainable and profitable social dairying in rural areas.

Conclusions and prospects

Tens of thousands of very poor rural households have moved out of poverty as a result of the successful introduction of the holistic Milk Vita and Grameen–CLDDP smallholder dairying models. Many families now own up to 20 cows and have intensified and commercialized their milk production. The two models embrace a complete cow-to-consumer package of input and output services, and their ongoing scaling up has helped put the dairy sector in Bangladesh in a unique position to take advantage of the recent huge increases in the cost of imported dairy products, especially milk powder, by substituting imports with domestically produced milk.

The policies proposed in the draft National Livestock Policy (2006) and the National Strategy of Accelerated Poverty Reduction (2005) recognize that milk produced at the community level by smallholder households can play a significant role in improving nutrition, incomes and jobs. It is clear that a more detailed, long-term dairy development strategy is needed to translate those policies into a national dairy programme that clearly focuses on smallholder milk producers.

Such a strategy might include a clear vision/mission statement for enhanced smallholder participation in dairying; it could promote smallholder dairying under the National Livestock Policy as one of the strategies to help Bangladesh achieve its Millennium Development Goals of halving poverty and halving under-nutrition by 2015.

Three overarching strategic objectives that would help expand the dairying sector:

- raising awareness among policy makers and consumers about the nutritional benefits of local milk and dairy products;
- increasing the number of smallholders involved in profitable milk production and dairy value chains through diversification and better integration of their household/farm businesses;
- encouraging processors to set up smallholder milk procurement systems to substitute imports and enhance national food security.

It is important that an inventory be undertaken of appropriate dairy chain models, including their:

- competitiveness
- investment costs
- associated risks.

This could be accompanied by an inventory of strategic public- and private-sector stakeholders and followed by the development of an indicative investment programme with a focused, time-bound national action plan containing realistic and measurable targets, such as raising milk and dairy products consumption from 18 kg to 25 kg by 2015.

Government and dairy stakeholders should jointly develop the strategy, which should clearly identify the areas best addressed by the public sector and those best addressed by the private sector. The strategy would then inform policy-makers and industry stakeholders about opportunities for future investments in smallholder-oriented dairy development.

Box 3: Key definitions

Smallholder milk producer: Person or household, often landless or without assets, engaged in milk production for economic return on surplus milk, usually owning up to three cows.

Smallholder dairy farmer: Milk producers linked to milk processors through cooperatives or associations, or individually by milk traders/middlemen. Initially, they start with one animal but have potential to grow. Many household have moved out of poverty and now have 20 or more milk animals.

Informal market: Markets near to producer locations where producers directly or through traders collecting milk from farmers' homesteads sell milk to consumers or middlemen suppliers of sweetmeat shops, bakeries or against other trading contracts.

Formal market: The guaranteed market for smallholder milk producers in which regular processed milk and milk dairy products supply consumers, including institutional buyers such as hotels, restaurants, airline kitchens, superstores, etc.

Dairy value chain: The stages through which milk and dairy products are marketed from producer to consumer.

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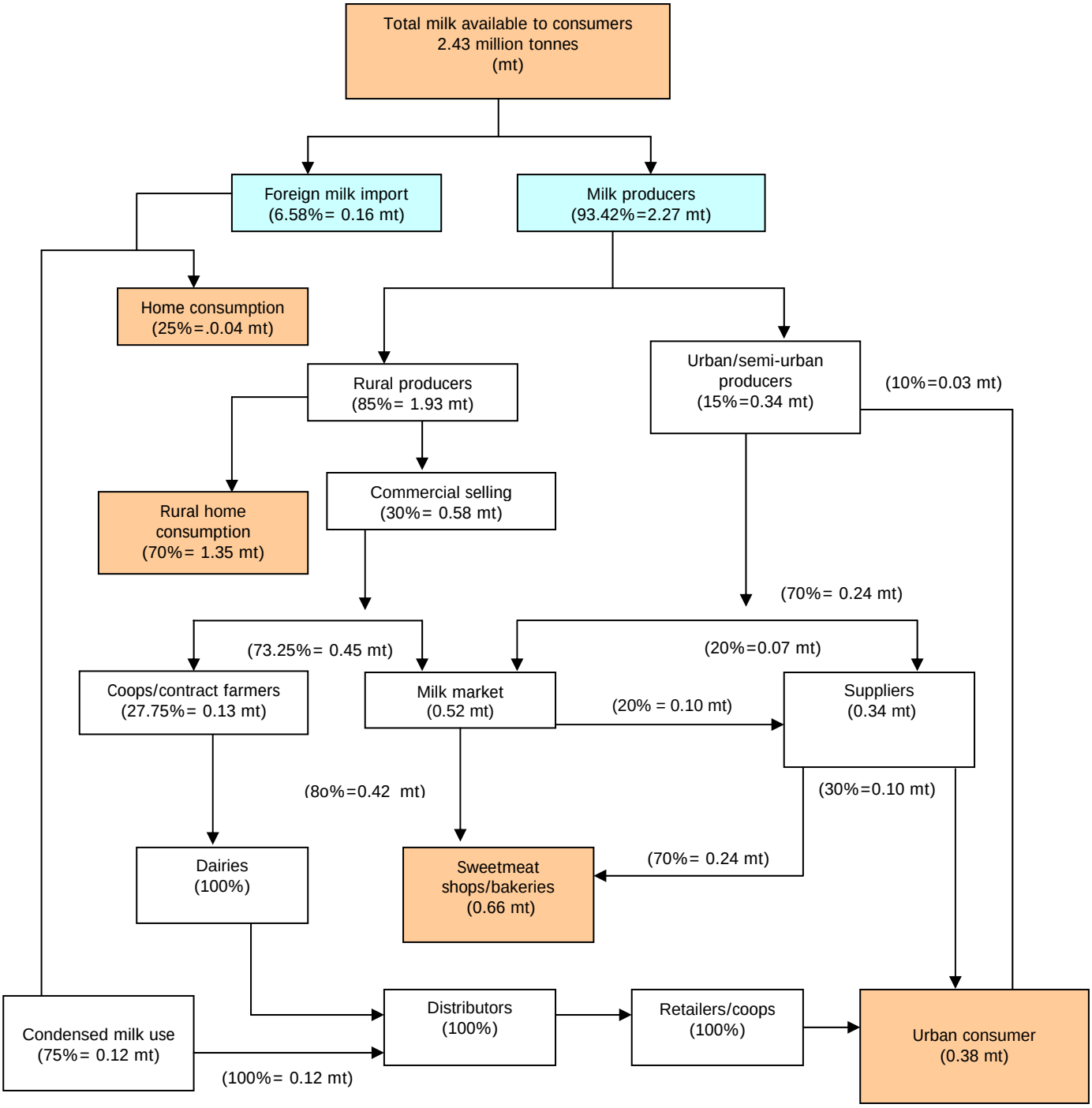
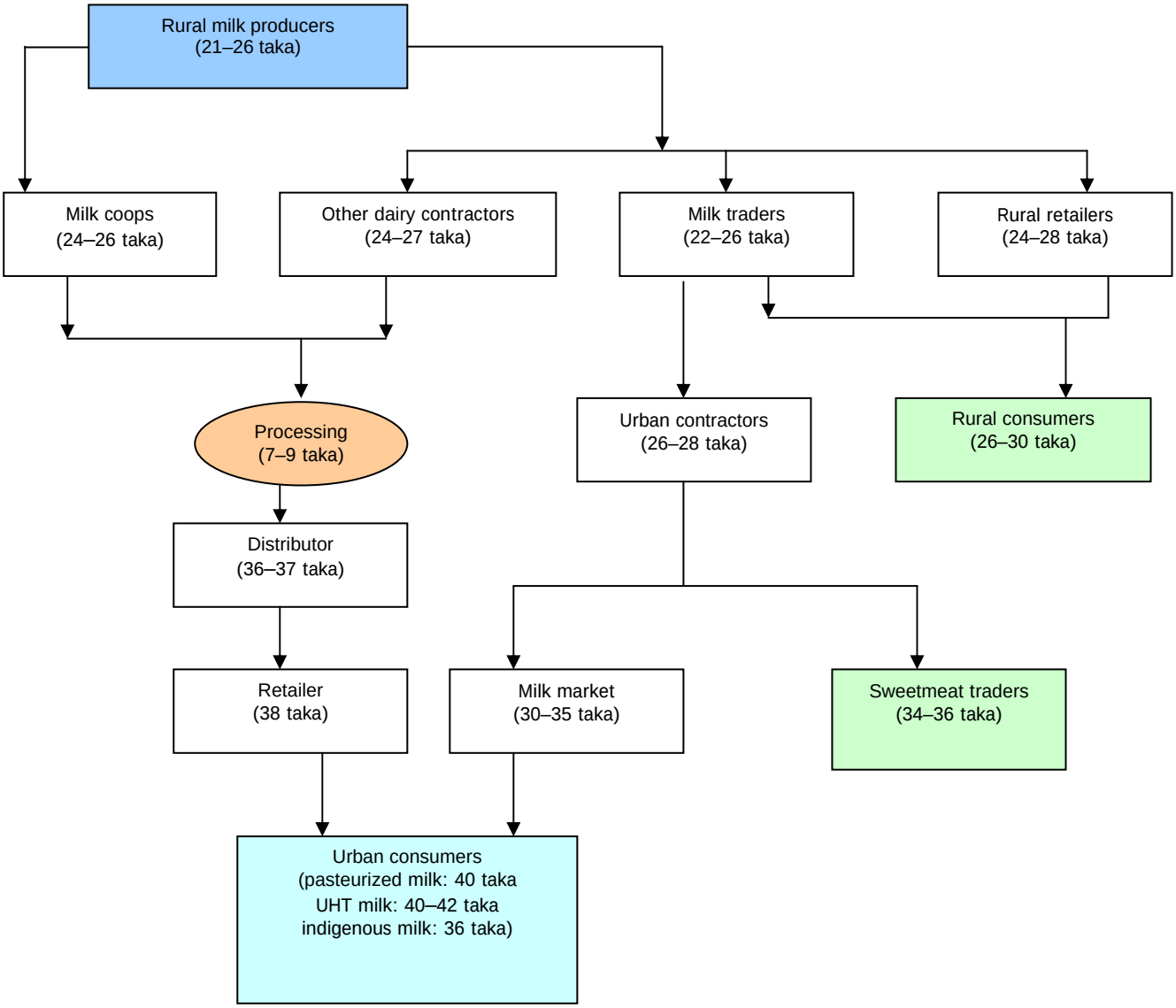
Annex I: Milk flow chart



Milk production information from the Directorate of Livestock Services, processing information from dairy plants and flow data estimated from market operation /tendency.

Annex II: Milk price chart (December 2007)



Conversion: 70 taka = US$1

Cooperatives, other dairies and the market.

China: Dairy product quality as the new industry driver

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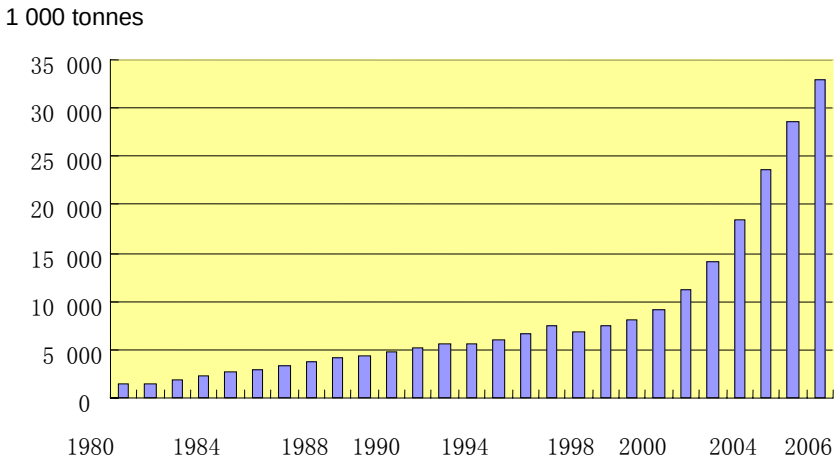
China's population represents one-fifth of the global total, but total dairy product output accounts for only 4 percent of world production. Since the beginning of the twentieth-first century, however, the industry has been rapidly growing. Dairy product production jumped exponentially, from 9.2 million tonnes in 2000 to 33.7 million tonnes in 2006 (Figure 1). This striking development of the dairy industry has allowed the industry to fill the increasing domestic consumption demands and, more importantly, to provide employment and increased income for small farming households.[9]

This case study identifies the factors affecting China's dairy industry, reviews the implications for smallholder dairy farmers and offers suggestions on how to link them to the growth in demand. It is quite possible that some of the lessons learned in China, within the context of the industry's history and the current situation, will be helpful in linking small producers to markets in other Asian developing countries.

Figure 1: Milk output in China, 1980–2006



Source: *Chinese statistical yearbook*

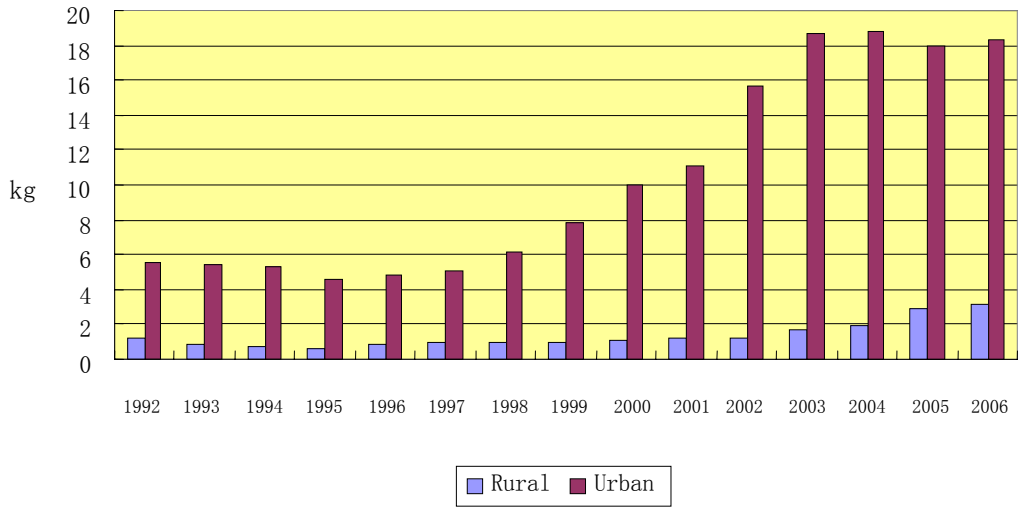
Dairy development in China

The economic reforms that began in the 1970s laid the foundations for a rapid development of the Chinese economy in general as well as the dairy industry. In 1980, total milk output was 1.4 million tonnes; by 2006, it had swelled to 33 million tonnes, with per capita consumption of milk rising from 1 kg to 25 kg over the same period (Figure 2).

There is a major difference in consumption of dairy products between urban and rural residents. The per capita consumption of dairy products among urban residents was nearly 6 kg in 1992, increasing to 18 kg by 2006. Among rural residents, the per capita consumption increased from 1 kg to 3 kg over the same period. The per capita consumption of dairy products of rural residents averaged only 17 percent of that of urban residents by 2006. Rural residents' consumption of dairy products is mainly constrained by low incomes but also by a limited tradition of fresh milk consumption (Hu, Fuller and Readron, 2005).

[9] The income from dairy cow raising is higher than that from crop planting in China.

Figure 2: Per capita consumption of dairy products in rural and urban households



Source: *Chinese statistical yearbook*

From the 1970s to the beginning of the current century, the development of China's dairy industry can be broken down in three phases: i) the urban dairy industry phase, ii) the dairy industry phase in northern China and iii) the multi-modal dairy industry phase.

Urban dairy industry phase

Urban dairy development is also called the "urban suburbs dairy industry", which refers to the dependence on raw milk from suburban dairy farms (or nearby regions, including dairy cattle husbandry by rural households near medium- and large-sized cities) for the manufacture of dairy products consumed by urban residents (Xu Ji *et al*., 1991). Traditionally, apart from minority ethnic nationalities inhabiting western pastoral regions, the Han nationality (representing 95 percent of China's total population) do not a cultural tradition of consuming milk and other dairy products (Chen Zhao, 2001).

Initially, the practice of raising dairy cattle was to meet foreigners' demand for dairy products, with most of the cattle transported from Europe. With most foreigners inhabiting coastal cities, the early urban dairy industry concentrated there. Shanghai was one of the five open coastal cities in 1842. Special-purpose dairy cattle breeds were introduced to Shanghai from Europe before 1870 (Dong Debao *et al*., 2000). In Tianjin, foreign missionaries brought the dairy cattle in the late nineteenth century (Wang Shugui, 2000), while foreign residents from Japan and Russia brought their cattle to Dalian City during the Japan–Russia War (Dalian City Dairy Products Project Office, 2000).

Influenced by the consumption habits of those foreigners, the Chinese urban residents realized the nutritional benefits of dairy products. This was reinforced by the changing food consumption tendencies of Chinese who lived abroad. The number of people drinking milk increased, generating dairy product markets in medium- and large-sized cities (Li Yifang, 1998). Chinese- and foreigner-operated dairy farms as well as rural households in the suburbs of the large cities supplied the raw milk for the urban demand (Dong Debao, 2000; Liu Yuanying, 2000). In 1956, the Government started its private-ownership reforms, and dairy cattle raised by private entrepreneurs were transferred to farms affiliated with the state-owned dairy-processing enterprises or to state farms in the suburbs (Wang Shugui, 2000).

Between 1949 and 1979, the growth rate of the Chinese raw milk supply slowed, increasing at an annual rate of 5 percent and increasing from 210 000 tonnes in 1949 to almost a million tonnes by 1979. The slowed growth was attributed to inadequate marketing systems and an inadequate feed supply. Because the supply of dairy products could not meet consumption requirements, the Government implemented an allocation system to ensure that old people, babies, medical patients and officials of a certain grade level were adequately supplied. There were no similar guarantees in small-sized cities and rural areas (Tuo Guozhu, 2000). It wasn't until the 1980s that rapid growth of the urban dairy industry took off.

Factors underpinning urban dairy development

Multiple factors triggered the rapid development: macro-economic issues, government policies and international assistance. Initially, rising urban incomes supported a growing demand for dairy products. The gap between consumption and production grew, and in cities, especially large cities, the fresh milk supply situation became "very tense" (Xu Ji *et al.*, 1991). To reduce these imbalances, the Government adopted policies to increase the productive capacity of the urban dairy industry. This included allowing private players to raise dairy cattle and contribute to the milk supply, thus breaking the single state-ownership monopoly (Tuo Guozhu, 2000).

To increase the purchase price of raw milk, the Government introduced milk price subsidies, which also stimulated the growth in milk consumption (Liu Yuanying, 2000). In addition, the Government invested a large amount of funds to further develop the industry. For example, the Beijing municipal government allocated US$400 000 annually as a special fund to support dairy cattle development. It provided subsidies for cattle shed renovations and for new equipment on dairy farms (Liu Yuanying, 2000).

In the 1980s, China encountered imbalances in its grain supply, and some cities adopted the policy of exchanging grain for milk. In other words, the Government provided dairy farmers with a certain proportion of feed, based on the number of dairy cattle they owned (Chongqing Municipal Dairy Industry Administration Office, 2000). In addition, the Government adopted support policies that favoured suburban rural households raising dairy cattle (Ouyang Qian, 2000).

International assistance also played an active role in the industry development, thus increasing the milk supply. Approximately 20 medium- and large-sized cities received a total of $156 million from the World Food Programme (WFP) and the European Economic Community (Tuo Guozhu, 2000).

Prior to the 1990s, the major products in large cities, such as Beijing, Shanghai, Tianjin, Dalian, Nanjing, and Kunming, were pasteurized milk and small quantities of milk powder. Due to the limited supply of fresh milk, pasteurized milk provided the only form of liquid milk to urban residents.

Even though China was moving towards a market economy as of the early 1990s, people's lifestyles were still fairly regulated. That situation combined with the limited selection of products and the lack of refrigeration resulted in the habit of drinking milk only in the morning. Dairy processing enterprises have since developed sophisticated distribution systems, providing milk to consumers at any time.

However, since the 1990s, the growth rate of the urban dairy industry supply has declined. In Beijing, for example, dairy product output in 1990 was 77 000 tonnes. By 1999, it was only 129 000 tonnes, with an annual growth rate of 0.46 percent. In many cities, the annual growth rate has averaged less than 1 percent, far below the growth rate of double-digit gains during the 1985–1990 period: 11.8 percent in Beijing, 12 percent in Shanghai and 15 percent in Tianjin.

The falling growth in urban dairy systems is attributed to the following factors:

- rapid development of the national economy, which prompted urban industries, housing construction and commerce to expand outside of city limits, raising land values and thus restricting the construction of dairy farms;
- increasing wage rates in urban suburbs;
- environmental regulations that required original dairy farms, gradually surrounded by new residential houses, to close or move farther from the downtown area;
- decreasing and higher-priced farmland and a scarcity of fodder and feed resources;
- higher production costs, influenced by many of the other four factors, which reduced profitability; for instance, the Bright Dairy and Food Co., one of the largest dairy-processing enterprises in Shanghai, had ten dairy farms in 1985 and only two in the early 2000s, after the others had been shut down and/or consolidated (Jiang Yaming, 2004; Wang Yongkang, 2004).[10]

[10] The author of this case study report visited the Ninth Pastoral Farm of the Shanghai Bright Group to talk with the farm's director, Jiang Yaming, who mentioned the major difficulties in operations; this is the summary of his five points.

The dairy industry phase in northern China (1980–2000)

China's overall raw milk supply has not declined in the context of lower urban or peri-urban availability. Rather, the North China agricultural region gradually became the major source of raw milk to dairy processors in the country. The North China agricultural region refers to the crop cultivation zone north of the Yellow River, especially those located in Inner Mongolia Autonomous Region and Heilongjiang and Hebei provinces.[11] In 1975, the raw milk output of those three areas totalled less than a million tonnes and accounted for only 13 percent of the national total. By 1985, the regional output more than doubled, to 2.4 million tonnes and then rose to 10.7 million tonnes a decade later. In 2006, the total output of the three areas jumped to 18 million tonnes, or more than half of the national output (Table 1).

Table 1: Raw milk output in the North China agricultural region

	1975	1980	1985	1990	1995	2000	2005	2006
Output (100 t)								
Inner Mongolia	645	702	2 590	3 960	5 120	8 300	6 969	8 805
Hebei	216	265	1 000	1 430	3 890	9 620	3 486	4 170
Heilongjiang	130	1 385	1 540	1 027	1 666	1 565	4 442	4 646
Total	991	2 352	5 130	6 417	10 676	19 485	14 897	17 621
National	7 552	13 422	28 940	47 510	67 260	91 890	28 648	33 663
Ratio (%)								
nner Mongolia	8.5	5.2	8.9	8.3	7.6	9.0	24.3	26.2
Hebei	2.9	2.0	3.5	3.0	5.8	10.5	12.2	12.4
Heilongjiang	1.7	10.3	5.3	2.2	2.5	1.7	15.5	13.8
Total	13.1	17.5	17.7	13.5	15.9	21.2	52.0	52.3
National	100	100	100	100	100	100	100	100

Source: *China dairy statistical report,* Department of China Dairy Yearbook

The remarkable and rapid development of the dairy industry in these three areas can be attributed to many reasons favouring competitiveness and production. Compared with dairy husbandry in the suburbs or even in some of the agricultural regions south of the Yellow River, these areas have encouraging conditions for dairy cattle husbandry. Per capita farmland availability in Heilongjiang and Inner Mongolia is 0.6 h and 0.5 h, respectively, exceeding the national average by 0.3 h. It is certainly far larger than the per capita farmland in the suburbs of Beijing, Shanghai and Tianjin (0.2 h, 0.1 h and 0.3 h, respectively). These three areas have fairly abundant labour resources and low wages. For example, the proportion of the population of rural residents engaged off-farm is 18 percent (Hebei), 11 percent (Heilongjiang) and 10 percent (Inner Mongolia), compared with 74 percent in Shanghai, 66 percent in Beijing and 54 percent in Tianjin.[12]

Wage rates also play a decisive role in determining the production cost of raw milk. At $400, the per capita income in the North China agricultural region is lower than in the suburbs and among rural residents in South China. In Beijing, Jiangsu, Shanghai, Tianjin and Zhejiang, it ranges from $627 to $883. As well, air temperature influences a cow's milk production; the average temperature in North China is more than 3°C lower than in South China.

Additional factors supporting dairy development in the North China agricultural region: i) Dairy product consumption in medium- and large-sized cities has exceeded the development pace of urban dairy industries. ii) Local governments have adopted policies to promote industry development. iii) Investment in dairy-processing enterprises has increased. iv) Available credit, foreign investment and access to technology also have increased.

[11] In the North China Pastoral Zone, due to serious desertification of grassland, inconvenient communication access and other reasons, the dairy industry has not developed as expected (John Longworth, 1998).
[12] In Jiangsu and Zhejiang provinces in South China, the share of rural residents working off-farm is 56 percent and 63 percent, respectively.

Growth in dairy consumption prompts a regional shift in dairy production

From 1992 to 2000, the annual average growth rate of the raw milk supply was 3 percent in Beijing, 9 percent in Tianjin and 0.8 percent in Shanghai. However, during the same period, expenditure on dairy products in those three cities grew at an annual average rate of 52 percent, 33 percent and 29 percent, respectively. The gap between supply and demand has created conditions for dairy products from other regions to enter the urban markets.

Local policies support the process

The financing of local governments in China is heavily reliant on local taxation. This dependency has prompted local governments to actively develop and attract outside businesses to local regions through tax policies. In the coastal regions in South China, due to their existing industrial base, local governments have initiated policies on taxation in town and village enterprises (TVEs). At the same time, they have absorbed rural labourers in large quantities so as to increase the income of rural residents (Sonobe, Hu, Otsuka, 2002; Hu, 2003).

In the North China agricultural region, which lacked an industrial base as of the 1980s, the local governments pushed to develop the local dairy industry through policy and capital support. For example, the government of Inner Mongolia listed the dairy product processing industry as the leading sector of the whole autonomous region. From 1980 to 1985, total investment in dairy product processing was $11 million, and the autonomous region initiated the technical transformation and expansion of 25 dairy-processing enterprises (E. Guangyu, 2000). The governments of Shijiazhuang City and Tangshan City in Hebei province perceived the dairy industry as a "pillar" for development in general and made use of preferential policies to support the dairy industry and leading enterprises, encourage rural farmers in dairy cow husbandry and attract outside investment. To encourage more enterprise investment, those city governments reduced by half, over a five-year period, the local portion of the income tax required for production, dairy product processing and feed-processing enterprises. As well, investment initiatives of more than $3.75 million were exempted from land-use taxation, and land rent fees were reduced by half (MOA Dairy Industry Project Office, 2004).

The original dairy-processing enterprises in the North China agricultural region were small in scale with limited processing capacity. For example, in 1978, Heilongjiang province had 34 dairy-processing enterprises, with a daily processing fresh milk capacity of 340 tonnes, or an average daily processing capacity of only 10 tonnes per enterprise (Zhang Xiulan, 2000). In Hebei province, the daily fresh milk-processing capacity (excluding Sanlu Dairy Group) was less than 5 tonnes (Ju Guoquan, 2000).

Dairy product processing expansion in Inner Mongolia

By 1987, the number of dairy-processing enterprises in Inner Mongolia had increased to over 100. However, with limited market access to the high-demand areas in China, more than half of the processing capacity was not used (E. Guangyu, 2000). For instance, the Huhhot Hui Nationality Food Processing Plant (which later became the Yili Industrial Group (Yili Group)) had total fixed assets of only $8 000, consisting of small factories and hand-made workshops. With the change in management came multiple system reforms. In 1993, the Yili Group became an equity enterprise, and in 1996, its stock was sold on the Shanghai Stock Exchange Institute. By going public, Yili leveraged funds urgently needed for expansion; its revenues reached $106 million, generating profit of $8.2 million. That expansion contributed to the daily fresh milk-processing capacity in Inner Mongolia reaching 2 900 tonnes (Yili Group, 1999, 2003).

The China Meng Niu Dairy (later called the Inner Mongolia Meng Niu Dairy or Meng Niu Group) was established in July 1999 as a dairy-processing enterprise with high-level administrators and technicians taken from the Yili Group and with investment funds of only $1.25 million. Adopting a strategy of "establishing the market first and then establishing the factory", the sales of Meng Niu dairy products increased from $5 million in 1999 to $263 million in 2002. Its fresh milk daily processing capacity increased by 1 700 tonnes (Niu Gensheng, 2003).

The successful processing enterprises also included the Wandashan Dairy in Heilongjiang province (Zheng Xinmin, 2003) and Sanlu Dairy Group Co.[13] of Shijiazhuang in Hebei province (Gao Yucheng, 2003). These enterprises absorbed local resources and, with loans,expanded their processing capacity while establishing milking stations. They additionally expanded dairy husbandry to increase the fluid milk supply in the region (Hu, 2005).

Financial support for industry expansion

Large quantities of capital funds have been invested into the dairy-processing enterprises in the North China agricultural region. Having listed on the Chinese exchange in 1996, Yili's stock had acquired $49 million from capital markets as of end 2003 (Yili, 2004). Meng Niu procured a total of $1.706 billion from the Hong Kong stock market (Xie Baokang, Cheng Dong, 2004). The investment has provided enterprises in the region with adequate funds to expand factories, invest in modern equipment and technologies, assist rural households in dairy cattle husbandry in surrounding regions to expand their milk supply and develop sophisticated product-marketing strategies.

Foreign capital entered the North China agricultural region through joint ventures, establishing processing enterprises and making use of the local resource advantages to benefit from the growing demand for dairy products throughout the country. The Shuangcheng Nestlé Co. is a joint venture between the Swiss Nestlé Co. and Shuangcheng Dairy and Food Industry Co., producing milk powder as its major product. Total investment, generating an average daily fresh milk processing capacity of 900 tonnes, has increased from $10 million to $75.8 million. The three international financial institutions of Morgan Stanley, Yinglian Investment and Dinghui Investment injected funds into the enterprise in October 2002 and October 2003. In the first-round capital increment, those three institutions provided a total of $26 million, drawn from companies abroad; in the second round, they invested a total of $35 million (Yu Yongfang, 2005).

New technologies open markets

The dairy industry in the North China agricultural region started to grow in the 1980s. This movement has linked to the growing demand in the South China market where the per capita income was higher, particularly in medium- and large-sized cities. At that time, the major product was milk powder due to restricting transportation conditions and the lack of cold chain facilities. The proportion of national milk powder produced in the region was 58 percent in 1982, rising to 78 percent by 1991. However, it declined to 69 percent by 1997 (Nan Qingxian, Lu Ling, 2000). Dairy product supplies from the North China agricultural region currently dominate national production.

Through the production of processed milk powder, the abundant raw milk resources in the North China agricultural region were tapped, but it had disadvantages. In particular, the use of milk powder was not very convenient and the taste was not perceived as good as liquid milk. More importantly, many urban consumers believed that milk powder was not as nutritious as liquid milk (Guo Benheng, Zheng Xiaoping, 2000). These perceptions restricted further growth of milk powder consumption and created a surplus. By end 1997, 50 000 tonnes of milk powder were in stock, accounting for 15 percent of the total national milk powder output. This resulted in financial difficulties for some small- and medium-scale processing enterprises, in some cases even bankruptcy, which impacted the income of dairy farms and dairy cow-raising households that provided raw milk to those enterprises (Tuo Guozhu, 1999).

At that time, however, the dairy industry in North China identified a new development opportunity: ultra-high temperature (UHT) processing technology. Introduced by foreign enterprises to meet the demand of high-income consumers, UHT technology fed on large quantities of raw milk to eventually produce low-cost milk products. Initially, the products were more expensive and thus of little interest to consumers in medium- and large-sized markets (Hu, 2005). The Yili Group began using UHT processing equipment from the Swedish Tetra Laval Holdings & Finance SA in 1996, going into production a year later. Reward came swift. By second quarter 1998, UHT milk was in strong demand among consumers in medium- and large-sized cities (Sun Xianhong, Zhang Zhiguo, 2006). Meng Niu acquired its UHT technology in 1999; a year later it

[13] This paper was written before the company declared bankruptcy as a result of the 2008 scandals related to milk products containing melamine.

adopted new packaging, developed by the same Swedish company. Although it reduced the cost of the final product, its shelf life also reduced, from the original 6 months to 45 days. The low-cost UHT milk enabled Meng Niu to enhance its competitiveness and expand its market share in medium- and large-sized cities (Sun Xianhong, Zhang Zhiguo, 2006).

According to the China Association of Dairy Product Industry, the output of UHT milk increased from 2 million tonnes in 1999 to 3.8 million tonnes in 2000 and to a remarkable 48 million tonnes in 2004. Its share of liquid milk output increased from one-fifth in 1999 to nearly 60 percent by 2004 (Table 2).

Table 2: The output and proportion of liquid milk variety in China[14]

	1999	2000	2001	2002	2003	2004
Output ('000s)						
Pasteurized milk	5 815	8 291	6 965	10 485	12 549	18 470
UHT	2 045	3 785	7 146	15 397	31 987	47 820
Yoghurt and other	1 640	2 827	4 126	7 520	9 030	14 380
Total	9 500	14 903	18 237	33 402	53 566	80 670
Proportion (%)						
Pasteurized milk	61.2	55.6	38.2	31.4	23.4	22.9
UHT	21.5	25.4	39.2	46.1	59.7	59.3
Yoghurt and other	17.3	19	22.6	22.5	16.9	17.8
Total	100	100	100	100	100	100

Source: China Dairy Industry Association

The rapid expansion of UHT milk in China resulted from several conditions:

- UHT milk allowed fresh milk to be transformed to meet the shortage of urban milk and effectively used the milk resources in North China to meet the demand of the broad mass of consumers in medium- and large-sized cities.
- The problems of liquid milk transportation and long-distance transportation were solved by technology that didn't require a cold chain system.
- UHT milk can be preserved under constant temperature for a fairly long period of time, thus allowing consumers to buy several boxes and thus avoid the inconvenience of purchasing milk daily.
- It eliminated the need for household delivery of fresh milk and overcame the requirements of limited milk consumption to only certain times of the day, especially among higher-income consumers who frequently travelled and had less time flexibility than lower-income consumers.
- It is ideal for retail store stocking, particularly because it doesn't require refrigeration.
- Advertising convinced consumers that UHT milk is more nutritious than pasteurized milk (Hu, 2005).

The UHT technology was instrumental in opening markets to the dairy-processing enterprises in North China and thus to the region's rapid development of dairy cow husbandry (Hu, 2005). Having a good resource base and competitively produced milk allowed the region to dominate in the liquid milk market and become competitive with urban processing enterprises. Yili is now the second-largest and Meng Niu the third-largest dairy-processing enterprises in China, behind the Shanghai Bright Dairy.

Multi-modal dairy industry phase (2000 to the present)

Since 2000 and supported by the sustainable and high-speed development of the dairy sector, the market in China has gradually changed from one of shortage to relative surplus (Tuo Guozhu, 2000). There have been two primary supporting factors: first, local economies and governments adopted accommodating policies, which resulted in dairy-processing enterprises expanding investment that pushed production beyond consumption. According to the China Association of Dairy Industry, by 2002 the capacity of the national dairy-processing industry exceeded the country's processing needs by 30 percent (Fang Yousheng, 2003). Second, heightened competition to capture greater market share led dairy-processing enterprises to reduce prices (Yi Chengjie, 2004). Thus the small enterprises that operated with obsolete equipment and backward

[14] The association has not published any new data since 2004.

technology, were poorly managed and lacked product competitiveness were forced out of business (Tuo Guozhu, 2000). It was at this point that China's dairy industry entered into a multi-modal development phase: dairy industry restructuring became characterized by integration and asset recombination.

The first development in this multi-modal industry phase was **a linking between, or gradual integration of, dairy enterprises in the North China agricultural region and urban dairy enterprises**, leading to a gradual disappearance of enterprise borders. The original urban dairy enterprises started to feel pressure as Meng Niu, Yili, Sanlu, Wandashan, etc. entered into markets of medium- and large-sized cities with their UHT milk and milk powder. Peri-urban dairy enterprises that had certain scale and market share quickly adapted their original strategy of safeguarding suburban resources through sales of pasteurized milk and started to explore foreign, export markets. During this period, the Shanghai Bright Dairy formed its development strategy of "using national resources to explore the national market" (Wang Jiafen, 2002). Here, "resources" refer to the milk supply in Heilongjiang province and Inner Mongolia. By building dairy-processing factories in North China, where the milk source is abundant, the Bright Dairy procured its low-cost raw milk. The "national market" refers to cities beyond Shanghai. In 2002, Bright Dairy's share of total milk sales beyond Shanghai reached more than 60 percent (Wang Jiafen, 2003).

By 2004, Bright Dairy operated 14 dairy-processing factories in 11 provinces and autonomous regions beyond Shanghai. Currently, it has a total daily milk-processing capacity of 6 508 tonnes (including dairy product processing plants in Shanghai). Its major milk source is North China, specifically from processing factories in Inner Mongolia (UHT milk) and Heilongjiang province (milk powder). Obviously, accessing resources enabled Bright Dairy to compete with the Meng Niu and Yili enterprises in North China.

Bright Dairy also has processing factories in Beijing and Tianjin, with major products consisting of pasteurized milk, yogurt and dairy beverages. Its aim is to seize the dairy markets in other cities. And it has processing factories in Jiangsu, Henan, Hubei, Hunan, Guangdong and Shaanxi to make use of local raw milk resources and thus dominate the markets in those cities.

The Beijing Sanyuan Group Foods in Beijing also has established a factory in Inner Mongolia, producing UHT milk, milk powder and yogurt. The company has a factory in Shanghai to produce pasteurized milk, yogurt and dairy beverage that compete with the Bright Dairy. The Nanjing Weigang Dairy Group in Nanjing, Jiangsu province, operates processing factories in Shanghai and in Anhui and Jiangxi provinces to expand its market share in those areas (Table 3).

Table 3: Distribution of factories of China's top eight dairy-processing enterprises

Enterprise	District	No. of processing factories	Daily processing capability (tonnes)	Main products					
				Fresh milk	UHT	Yogurt	Dairy drink	Milk powder	Others
Sanyuan	Beijing	7	1 227	*	*	*	*		*
	Tianjin	1	100	*					
	Inner Mongolia	2	350	*	*		*	*	
	Shanghai	2	130	*		*	*		
Bright Dairy	Beijing	4	360	*		*	*		
	Tianjin	1	300	*		*			
	Heilongjiang	1	1 000		*			*	
	Inner Mongolia	1	350		*				
	Shanghai	4	3 750	*	*	*	*		*
	Jiangsu	2	250	*		*	*		
	Henan	1	140	*	*	*			
	Hubei	1	128	*	*	*		*	
	Hunan	1	80	*		*			
	Guangdong	1	300	*		*	*		
	Shanxi	1	200		*	*			
Meng Niu	Beijing	1	250			*	*		
	Inner Mongolia	2	5 700		*		*		
	Henan	1	800		*				*
Yili	Beijing	1	500			*	*		*
	Hebei	2	360		*		*	*	
	Inner Mongolia	2	5 600		*	*		*	
	Shanghai	1	280			*	*		*
	Heilongjiang	2	240		*			*	
	Shanxi	1	800		*	*			
Wandashan	Tianjin	1	350			*	*		
	Liaoning	1	150		*		*		
	Heilongjiang	1	1 200		*			*	
Weiwei	Jiangsu	1	560	*					*
	Shandong	2	600	*	*	*	*		
	Shanxi	1	180	*		*		*	
Sanlu	Hebei	10	3 660	*	*	*	*	*	*
	Henan	1	460	*	*	*			
Weigang	Shanghai	1	50	*					
	Jiangsu	4	500	*	*	*	*	*	
	Anhui	1	50	*					
	Jiangxi	1	70	*	*	*	*		

Source: *China dairy statistical report,2005*, Department of China Dairy Yearbook

The Yili Group went on to open factories in Beijing and bought a processing enterprise in Shanghai to produce pasteurized milk, yogurt, dairy beverages and ice cream and thus avoid long-distance transportation requirements. The Meng Niu Group has broadened its production to include yogurt and dairy beverages.

The second development in the multi-modal industry phase was the **expanding diversity of dairy products**. Since 2000, choice among dairy products in China has increased very rapidly. In 2003, a variety investigation by the China Association of Dairy Industry found a total of 381 dairy products produced by different manufacturers on the shelves in the Huapu, Jingkelong and 11 other supermarkets in Beijing. They included 45 types of pasteurized milk, 45 UHT milk choices, 111 types of yogurt, 62 different whole milk powders, 8 sugar-added whole milk powder varieties, 16 skimmed milk powder types and 94 different baby formulated milk powders (Li Yifang, 2003). In January 2006, students at the Graduate School of the Chinese Academy of Agricultural Sciences conducted a survey on liquid milk marketing in nine supermarkets in Beijing. They found that, on average, each supermarket offered 167 varieties of liquid milk, consisting of 6 types of pasteurized milk, 32 UHT milk varieties, 93 different types of yogurts and 36 distinct dairy beverages (Table 4).

Table 4: The variety of dairy products sold in nine Beijing supermarkets

Supermarket	Area of shopping	Food area size	Total products varieties	Area of frozen dairy products	Area of fresh dairy products	Varieties of dairy products
	sq m		No.	sq m		No.
Carrefour	16 000	4 500	22 000	155	220	181
Wal-Mart	18 000	5 000	20 000	120	180	272
Lotus	12 600	3 500	18 000	80	150	127
Chengxiangcangchu	2 500	1 200	5 100	35	50	190
Chaoshifa,Shuangan Store	700	550	3 000	25	30	179
Champion	3 000	2 000	4 500	80	120	126
Chaoshifa Shuangyushu Store	3 960	1 800	6 000	30	50	182
Chaoshifa Nongkeyuan Store	1 560	780	4 200	20	30	126
Xidan	4500	1700	4200	50	70	124

Source: Survey data by the author and students, February 2006

The rapid increase of dairy product varieties is in response to strong competition for dairy products by consumers, with each "large-scale dairy product processing company relying on the development of new products to expand their market and increase the added value of dairy products to obtain even higher return" (Du Binhua, 2003).

The third dimension of the multi-modal industry phase was the **concentrating of dairy-processing capacity in large-scale enterprises**. The number of dairy-processing enterprises with a capacity of more than 50 tonnes per day was 698 in 2005 and 717 in 2006, generating total sales of $6.1 billion and $7.7 billion, respectively. The top-ten ranking of these enterprises, according to sales, are Yili, Meng Niu, Sanlu, Bright Dairy, Mead Johnson, Jiaobao, Wandashan, Taizinai and Yahua. The total sales of those ten top enterprises were $6.1 billion in 2005 and $7.7 billion in 2006. Although those ten enterprises represented less than 2 percent of the total number of dairy-processing enterprises in China also in 2005 and 2006, their combined sales exceeded more than half of the total dairy product sales (Table 5).

Table 5: The total sales of the top-ten dairy-processing enterprises (unit: US$ million)

Enterprise name	2005	2006
Yili	1 623.3	2 178.5
Meng Niu	1 443.3	2 166.1
Sanlu	993.9	1 158.0
Bright	920.5	961.7
Meadjohnson	200.0	266.7
Jiabao	254.4	254.4
Shuangcheng Nestlé	360.0	244.7
Wandashan	200.0	206.7
Taizinai	62.7	156.8
Yahua	38.1	145.7
Total	6 096.3	7 739.3
National gross sales	11 491.1	13 885.6
Proportion of national gross sales (of the 10) (%)	53.1	55.7

Source: *China dairy statistical report*, 2006 and 2007

The fourth development is that in order to seize the market, the dairy-processing enterprises had to hugely **invest in marketing and advertising** to improve their products' image among consumers. According to ACNielsen, total advertising expenditure for dairy products in January–October 2003 was $353 million. Of that, Fujian Changfu Milk spent $11.5 million, which accounted for 30 percent of its marketing budget. Wandashan's advertising expenditure was $13.5 million, or 10 percent of its marketing budget. Wahaha spent $30.1 million on advertising, which was 9 percent of its marketing budget; Meng Niu spent $46.75 million, also 9 percent of its marketing budget, only to be surpassed by Yili, which spent $53.4 million (8.7 percent of its marketing budget). Bright Dairy spent only $27.1 million, accounting for 5.5 percent of the marketing budget, while Sanlu limited its marketing expenditure to 2.9 billion yuan ($349 million) (Zhongqiu Advertisement, 2003). By 2004, Meng Niu became the new champion by spending $38.8 million on advertising, followed by Yili, at $26.8 million (Dong Suyu, Nie Yan, 2005).

Finally, **foreign investment** played a very important role in accelerating the development of dairy products in China. There are three ways for foreign capital enterprises to enter the Chinese market: The first method is to directly establish a dairy-processing enterprise in China and produce branded dairy products. As previously noted, Nestlé built up a large-scale milk powder processing enterprise in the 1990s in Shuangcheng City, Heilongjiang province, through a joint venture. Since then, it has continuously expanded its production scale. By 2004, its total investment into milk powder production reached nearly $84 million (China Network, Harbin Channel); its revenues reached $3 billion, ranking the joint venture as fourth among dairy-processing enterprises in China. Among the top-ten dairy-processing enterprises, three are linked to direct foreign investment.

The second method is through joint ventures, such as the Daneng Co., which bought up shares of the Bright Dairy through stock purchases. By end 2005, through numerous purchases, Daneng owned 12 percent of Bright Dairy stock. Meanwhile, Daneng handed over its brands to the Bright Dairy, and both parties agreed to establish a dairy product research centre (Gao Suying, 2005).

The third method is through direct investment. For example, in 2002, Morgan Stanley, Dinghui Investment and Yinglian Investment invested more than $26 million in the Meng Niu Group, buying 32 percent of the company stock. In 2003, these institutions injected an additional $35.2 million into Meng Niu from their foreign mother companies. Currently, the three companies own one-third of Meng Niu Group stock (Hu, 2005).

Dairy production in Chinese farm households

Before the policy reforms that began in the 1970s and opened China to the outside world, there were no individual dairy cow-raising farm households or individual milk sellers in the country. The Government did not allow private dairy cow operations; the state-operated and the commune-owned dairy cow farms were the main source of raw milk (Xu and Yin, 2004). Since the implementation of the household contract responsibility system, the Government reversed its policy restricting individual farm households from raising dairy cows. Within the context of increasing market demands for dairy products and promoted by government policy, more and more farm households have engaged in dairy cow raising and milk production.

Dairy cattle farms in China are pyramid shaped: At the base are small farm households that own 1–5 dairy cows while at the top are the large operations with more than 1 000 dairy cows. According to the Dairy Association of China, there were approximately 1.37 million dairy cattle farms in 2002. Of them, 1.14 million (or approximately 83 percent) owned 1–5 cows. By 2006, the total number of dairy cattle farms and farm households nearly reached 1.6 million, up 15 percent compared with the data for 2002 (Table 6).

Table 6: Number of dairy farms, by number of cows owned in China, in 2002 and 2006

Herd size	No. of farms		No. of cows		Milk output (tonnes)	
	No.	%	No.	%	No.	%
Year 2002						
1–5	1 140 022	83.30	3 042 197	44.79	4 951 102	37.30
5–20	200 083	14.62	1 991 830	29.32	3 665 841	27.62
21–100	25 698	1.88	950 090	13.99	2 115 959	15.94
101–200	1 789	0.13	243 137	3.58	673 210	5.07
201–500	650	0.05	193 814	2.85	603 855	4.55
501–1000	262	0.02	172 991	2.55	605 886	4.56
>1000	112	0.01	198 488	2.92	658 050	4.96
Total	1 368 616	100.0	6 792 547	100.0	13 273 903	100.0
Year 2006						
1–5	1 271 729	81.00	4 034 876	44.10	5 356 552	35.31
5–20	263 715	16.80	2 714 241	29.67	4 135 290	27.26
21–100	30 780	1.96	1 257 814	13.75	2 827 367	18.64
101–200	2 294	0.15	335 503	3.67	713 905	4.71
201–500	950	0.06	336 148	3.67	741 448	4.89
501–1000	336	0.02	235 228	2.57	707 555	4.66
>1000	162	0.01	234 816	2.57	688 867	4.54
Total	1 569 966	100.0	9 148 626	100.0	15 170 984	100.0

Sources: *China dairy statistical yearbook*, 2006 and *China dairy information,* 2007

Obviously the small-scale dairy cow farms dominate the milk production, serving as the main suppliers of raw milk to Chinese consumers and processors. Their numbers expanded considerably since the policy reforms began, but particularly over the past decade and despite the many obstacles involved in shifting from crop growers to dairy husbandry, such as lack of credit,[15] production practices and market access. The factors supporting the inclusion of more than 1 million farm households into smallholder dairy production entail: i) good economic returns; ii) policy/institutional support from central and local governments; iii) involvement and support from private sector milk-processing enterprises.

The economics of dairy production

Most of the farm households shifting from crop growing to dairy husbandry are driven by favourable economic returns (Hu, 2005). Farmer income from growing crops is much lower. Table 7 presents a cost–profit analysis (or calculation of returns) of planting maize or potatoes compared with dairy husbandry. The average milk yield from a dairy cow in a farm household is 4 875 kg per year, which translates into a value of $1 334. The total production cost of the milk is $1 062, leaving a net annual profit of $273 and a cost–profit rate of nearly 27 percent. By comparison, a farmer choosing to grow 1 mu of potatoes realizes annual net profits of $76, while that of a farmer growing 1 mu[16] of maize earns $19 of net profit.

The profit from dairy cow husbandry is greater than from growing potatoes or maize; the net profit from raising one dairy cow is 14 times larger than from growing 1 mu of maize and 3.6 times larger than growing 1mu of potatoes.

In most parts of China, the small-scale dairy farmers also plant maize, which is used to feed dairy cows, thus reducing the need to buy feed. Fermented dairy cow manure can be used as an organic fertilizer for growing the maize, enhancing yields at a low cost as well as reducing environmental pollution.

[15] The price for purchasing a dairy cow is more than 10 000 yuan (US$1 200), but the annual income of a farm household is only 3 000–5 000 yuan.
[16] 1 mu = 0.067 ha

Table 7: Comparison of the costs of dairy cow raising with maize and potato growing

Per mu/per cow	Unit	Dairy cow raising (no.)	Maize growing (mu)	Potato growing (mu)
a. Output of main products	Kg	4 875.9	423.5	1561.8
b. Total output value(c+d)	US$	1 334.2	74.2	179.1
c. Output value of main products	$	1 204.2	71.6	178.9
d. Output value of by-products	$	130.0	2.6	0.2
e. Total cost (f+k)	$	1 061.6	54.9	102.8
f. Production cost (g+h)	$	1 058.3	45.1	91.3
g. Materials and service charge	$	920.9	25.1	57.6
h. Labour cost(i+j)	$	137.3	20.0	33.7
i. Family labour (monetary value)	$	136.8	18.7	29.6
j. Labour-hiring cost	$	0.5	1.2	4.1
k. Land cost(l+m)	$	3.3	9.8	11.5
l. Land rent	$	0.0	0.7	0.4
m. Self-owned land rent	$	3.3	9.1	11.1
n. Net profit(b-e)	$	272.6	19.3	76.3
o. Cost-profit ratio (n/e*100)	%	25.7	35.2	74.2

Source: Compilation of cost-profit ratios of agricultural products of the whole country compiled by the Price Department of the National Development and Reform Commission, 2007.

Policies promoting dairy development

"I have a dream and my dream is that each Chinese person, and especially the children, can afford to buy one *jin* [500 g] of milk to drink every day," Chinese Premier Wen Jiabao said in 2006. In recognition of the relative profitability of dairy operations, the central Government as well as local governments interested in supporting industry development have formulated favourable policies to encourage farm households to buy breeding stock.

Since 2000, the State Council and its relevant departments enacted favourable policies to promote the sector, which led to: i) 10 000 high-yielding cow embryo transfers; ii) development plans in large milk-producing regions; iii) studies on key technologies and integrated demonstration of technologies in the fifth five-year development plan; iv) Circular of the Ministry of Agriculture on the Rapid Development of Animal Husbandry" transmitted by the General Office of the State Council; v) the fifth five-year plan of animal husbandry, feed, national food industry and light industry and the long-range objective plan of 2015; and vi) a programme of dairy industry in the land reclamation and cultivation sectors.

The more important objectives of the Government are focused on increasing farmer incomes through dairy cow husbandry and dairy-processing projects. Under the leadership of the central Government, local governments, especially those of Inner Mongolia, Heilongjiang and other provinces, have supported the dairy sector because of its contribution to farmers' income as well as to overall economic growth.

In supporting these policies, relevant ministries and commissions as well as local governments have invested considerable resources (Table 8). Since 2002, for example, the central Government has issued national debt funds to support 16 dairy-processing projects. In total, these projects received $21 million. Use of national debt funds has mobilized the resources of banks, local governments, enterprises and social forces to assist the sector. The ministries and commissions, under the State Council, have continuously invested in dairy industries, such as with the Ministry of Agriculture's Good Animal and Poultry Varieties Engineering Programme. The central finance department alone invested $6.5 million in animal breeding, or one quarter of the programme's total investments from 1998 to 2001. In 2002, the Ministry of Agriculture invested 126 million yuan ($15 million) to set up 17 original-stock dairy farms, 9 bull stations and 6 embryo-transfer centres. The embryo-transfer activities were initiated in nine cities, provinces and autonomous regions (Beijing, Xinjiang, Heilongjiang, Inner Mongolia, Ningxia, Shaanxi, Shanxi, Hebei and Shandong). A year later, in 2003, the Ministry invested more than $14 million in animal and poultry variety/stock engineering (Hu, 2005).

Table 8: Policies and measures adopted by local governments and dairy-processing enterprises to encourage farm households to raise dairy cows

	Regions	Events	Source of data	Remarks
	Government policy			
1.	Shijianzhuang City and Tangshan City, Hebei	Dairy cow-raising households can obtain loans of up to 10 000 yuan, based on having an identity card, and up to 50 000 yuan on the provision of a certificate of house property. The specialized dairy development fund of the city financial department will pay 50 percent of the discounted interest for farm households that have borrowed money.	*Dairy Industry Talking*, pp.29-30	
2.	Shuozhou City, Shanxi	Construction of dairy cow barns on land contracted by farm households. If the farm households have no land to construct cattle barns, the village or township governments will provide them with land for free. For each dairy cow added, a farm household will receive a loan of 3 000–5 000 yuan, with a discounted interest rate from the government. If a village has more than 200 dairy cows, the government will build a milking station.	*Dairy Industry Talking*, pp.31-32	
3.	Shuangcheng county, Heilongjiang	The farmers are organized in dairy associations, with members eligible for loans to purchase dairy cows.	*Dairy Industry Talking*, p.46	Nestlé is located in Shuangcheng County.
4.	Tianjin	The government supports the construction of dairy cow-raising areas, providing 400 000 yuan for each.	D*airy Industry Talking*, pp.52	
5.	Daxing district, Beijing	The government stipulated a policy in 2002 to support and encourage farmers to raise dairy cows. A farm household can get a bank loan of 5 000 yuan to buy a dairy cow. The government encourages farmers to use high-quality bull semen and embryo transfer technology, through the provision of 150 yuan and 1 500 yuan subsidies for each cow, respectively.	*Yearbook of Chinese Dairy Industry*, 2003, pp.131	
6.	Tumotezuo League, Inner Mongolia	The government helps farm households obtain bank loans to buy dairy cows. In 2000–2002 and with government assistance, farm households received a total of 190 million yuan from banks for the purchase of some 18 000 dairy cows.	*Yearbook of Chinese Dairy Industry*, 2003, pp.136	
7.	Daqing City, Heilongjiang	The government uses 7 million yuan to offer discounted interest loans for farm households to purchase imported dairy cows. The farm households are eligible for loans of 8 500 yuan for purchasing a dairy cow and 400 yuan as discounted interest.	*Yearbook of Chinese Dairy Industry*, 2003, pp.138	
8.	Huairou district, Beijing	From 1984 to 1998, the government encouraged farm households to raise dairy cows through the provision of loans ranging from 20 000 to 40 000 yuan, with a discounted interest rate. The government later renewed this policy.	*Yearbook of Chinese Dairy Industry*, 2004, p.173	
9.	Yanmao Hui autonomous county, Xinjiang	The county government pursues a project of "100 households with 100 dairy cows engineering". The dairy-processing enterprises provide dairy cows and the cows are distributed to farm households and fed by them, with the farm households using the milk yield to pay the enterprises for their dairy cows.	*Yearbook of Chinese Dairy Industry*, 2002, p.185	

10.	Wuhan City, Hubei	Wuhan City government encourages farm households to purchase dairy cows from other regions. The dairy cow farmers can get a subsidy of 8000 yuan to buy a dairy cow from other regions and 4 250 yuan to buy a high-yielding cow from a foreign country.	*Yearbook of Chinese Dairy Industry*, 2005, p.98	
	Enterprise support			
11.	Huhehot and Baotou cities, Inner Mongolia	Cooperative dairy cow farmers are eligible for loans of 6 000 yuan from the Meng Niu Group or 4 500 yuan from the Yili Group to buy a cow. The farm households repay the loan from the earnings of milk sold to the company within a three- to four-year period.	*Dairy Industry Talking*, p.43	The two cities are source areas of raw milk for the Yili and Meng Niu processing companies.
12.	Shijiazhuang City, Hebei	The Sanlu Group helps households to purchase dairy cows through a variety of programmes: 1) "leasing" the dairy cows to farm households according to the value of the cow. The households repay the company by using one-third of earnings from milk sales each month. When the "lease" is paid off within three years, the households own the cow. 2) The company sells dairy cows to farm households at a 30 percent-discounted price. 3) The company agrees to be a loan guarantor for a farm household borrowing half the buying price of a cow from a bank.	*Dairy Industry Talking*, p.76－77	The Sanlu Group is the largest milk powder processor, located in Shijiazhuang City, Hebei.

Source: Collected by the author

Local governments have supplied funding for dairy-processing enterprises to buy equipment from foreign countries, to invest in dairy barns and dairy plants and construct dairy farms. They have provided farm households with loans and allowed farmers to raise mortgage credits on their dairy cows, cattle barns, related facilities or equipment and other fixed assets from the banks. To ensure and stabilize the raw milk supply, dairy-processing enterprises helped farmers to procure loans by providing guarantees.

Dairy enterprises and their supportive role

The rapid increase of raw milk in China is closely related to the strong link between dairy-processing enterprises and dairy producers, in terms of the former's promoting the latter's development. There was a time when the insufficient supply of raw milk constrained dairy development. In response, dairy-processing enterprises helped farm households buy cows and improve their husbandry knowledge, which became both an incentive for farmers to enhance their income and expand the milk supply. Interventions by Sanlu and Jinniu (Box 1) as well as Meng Niu, Yili and others focused on helping farm households to first access cows or a bank loan for buying cows and then offering technical guidance.

Box 1: Linking processors and farmers by leasing animals to households

Beginning as a cooperative of 18 farm households with 30 cattle and 170 sheep, the Sanlu Group Co. has become China's largest milk powder-processing company, with total assets of US$324 million and annual income of $1.158 billion. To help expand the milk supply and help itself grow in the early 1990s, Sanlu sold, at favourable rates, some 2 080 dairy cows from its own farm in Hebei province to households that were willing to raise them. The farmers paid off the price of the cows through their milk sales. Additionally, Sanlu also helped families access bank loans by serving as the guarantor. Through this support, Sanlu developed more than 4 100 dairy cow-raising households in 754 villages of 24 counties of Hebei (author's investigations, 2004).

The Jinniu Group Co., a medium-sized dairy-processing enterprise in Jiangxi province, also offered itself as a guarantor for cow-buying bank loans for families with labourers younger than 40 and willing to raise dairy cows. The company provided those households with technical training and established technical service stations in villages with a large dairy cow population, providing veterinary service in disease control and cow breeding. The company's feed-processing mill also extended concentrated food to those households, and Jinniu set up milk collection stations in villages to make selling milk more convenient. In the six years after beginning operations (in 1992), Jinniu developed 11 specialized dairy cow-raising villages and 436 dairy cow households, feeding some 8 800 cows (Li Yifang, 1998).

Models linking smallholder dairy cow farmers and the market

1. Dispersed raising and the mobile-dispersed milk-collecting model

From the 1980s to the 1990s, dairy-processing enterprises turned to a mobile-dispersed milk-collecting model to purchase raw milk. The consignee of the enterprise went from household to household with a milk-tank truck, buying their milk (with cash) and transporting it to the processing plant. There was no focus on specific households, and the households were free to sell to any enterprise.

The most serious problem of this model was the inability to guarantee the quality of the raw milk because it was aggregated and stored in a container. The farm households did not have appropriate chilling equipment, thus leading to high bacteria counts. Some households violated regulations and mixed water into the milk, resulting in economic losses and a lower quality of milk. The dairy-processing enterprises responded with concentration meters to determine the level of adulteration when colleting the raw milk. However, some households then resorted to other ways of nullifying the test, with the quality of the milk declining even further (Hu, 2005).

2. Linking companies and farm households through milking stations

In the mid 1990s in response to the difficulties with the mobile model, most of the dairy-processing enterprises began setting up collection stations. They built mechanical milking facilities; farmers took their cows to these stations for milking. Under the supervision of management personnel, milk was directly transported through the milking machine to storage tanks, thus maintaining low temperatures and preventing the adulteration of the milk. Typically, the stations were constructed in villages with a large dairy cattle population. Currently, one milking station services about 200 dairy cow households. The farmers take their cows to the station at a fixed time (twice a day). The workers at the station maintain a record of the milk procured and pay the households once a month.

Types of milking station owners:

- **The dairy-processing enterprise milking station**
  To ensure its milk supply, some large dairy-processing enterprises, such as Meng Niu and Yili, have built milking stations near the processing plant or in villages or towns with large dairy cow populations. The company then leases the stations to individuals who must provide the milk back to it.

- **The individual milking station**
  In some cases, private individuals have built a milking station and then sell the collected milk to one or more dairy-processing enterprises.

- **The dairy cooperative milking station**
  Over the past decade and supported by government policies, specialized cooperatives have developed rapidly, including those organized by dairy cow farmers. These cooperatives have constructed stations to collect milk from their members. Funds for the construction came from a government project and/or members of the cooperative (Box 2).

  The construction of milking stations directly benefits dairy cow farmers by reducing labour requirements and ensuring the availability of a stable market and technical training. The dairy-processing enterprises benefit from a stable source of high-quality raw milk and limited opportunities for milk adulteration (Duan, 2007).

Box 2: Government support to milking stations

1. *Beijing Miyun County Ligezhuang Dairy Raising Cooperative obtained 100 000 yuan in government funds to construct a milking station, purchase equipment and technically train its members.*

2. *Shanxi Jinzhong Yuci District Xiuwen Dairy Association sourced 150 000 yuan from the government to purchase sterilized milk tanks and milk-testing and other equipment.*

3. *Lianshan District Dairy Raising Cooperative bought milking machines with 150 000 yuan it obtained from the government.*

4. *Zong Zhai town in Qinghai Huangzhong county used 150 000 yuan of government funds to purchase milk tanks.*

Source: *China dairy industry yearbook*, 2006, p. 61

3. Dairy husbandry areas or dairy zones

In this model, dispersed dairy cow farmers are grouped into a designated area or zone. Dairy-processing enterprises construct the necessary infrastructure, with input from farmers and township government. Some individuals also invest in the construction. Typically, at a minimum, there are dozens of households in a zone, with a combined total of approximately 200–300 cows, though sometimes as many as 500–1 000 cows. The cow sheds/barns and other facilities are uniformly designed and constructed, and the households manage their own cows. They also produce, harvest and process their own fodder. They buy concentrated feed from a specialized processing plant. Although each household feeds its own cows, the milking, disease control and other supportive activities are contracted to administrative and managerial departments within the region.

The government and/or the dairy-processing enterprise provides each zone with technical assistance and supervision; the geographical separation between production and residential areas results in better disease control and limits possible infection between humans and animals. With government support,[17] some large-scale dairy-processing enterprises have invested in these zones. For instance, with about 100 million yuan, Sanlu (based in Shijiazhuang, Hebei province) established more than 200 zones, in cooperation with farm households. The Sanlu-created zones adopted the model of "one separation and four unifications", which means that households own the dairy cattle and the zone management provides "unified milking, unified milk selling and unified services" for households. Similarly, the Yili Group set up 85 zones with 300–500 dairy cows in each and 92 areas with 500–1 000 dairy cows each.[18]

[17] The largest support from the provincial government in dairy cow zones has been the provision of land. In rural areas of China, the use of land is strictly controlled. The provincial government's support includes the use of wastelands that are not suitable for crop cultivation or allows a transfer of a portion of cultivated land for use in dairy cow farming.
[18] In Huhehot City and Hulunben'er grassland of Inner Mongolia and Du'er'bote grassland of Heilongjiang.

Dairy zones enable several advantages: i) households can access stable markets and technical services; ii) the quality of raw milk is improved; iii) sufficient quantities of quality raw milk can be guaranteed for enterprises; and iv) assistance in financial subsidies is available through the government's supporting policies (Box 3).

Box 3: A dairy zone example

Wuqing district in Tianjin municipality first obtained subsidies for the construction of dairy zones in 2002, along with 5 million yuan in financial support from the government to expand and improve the condition of the dairy cattle. Consequently, the district's dairy cow population reached 33 000, a 65 percent increase in one year. Similarly, the governments of Beichen district and Jinghai county, also in Tianjin, appropriated specialized funds for building roads and a bridge that would help promote the development of dairy zones (Li, 2003).

4. Pastoral dairy parks

In pastoral regions/areas, households with large herds have joined together with assistance from dairy-processing enterprises. In 2003, the Yili Group invested more than 13 million yuan to build an integrated dairy cattle pastoral region in Huhehot City. This entailed individual pasture land, an area for raising cattle and a modern milking station. Each household in the pastoral park owns more than 200 dairy cows, for a combined total of more than 6 000 cows in the park. The annual output of fresh milk is estimated at 30 000 tonnes. The Yili Group also constructed six other pastoral parks, each with a cow population between 1 000 and 3 000; the Meng Niu Group set up five large dairy cow pastoral parks.

In the pastoral parks, the milk-processing enterprise invests in its construction (including necessary facilities) and the farm households raise the cows. The enterprise also provides technical assistance to ensure that good genetics of the animals and good husbandry management. Some pastoral parks also produce organic milk (author's investigation).

5. Dairy farm household cooperatives

There were no farmer associations or cooperatives representing smallholders in the dairy sector in China until recently. The dispersed smallholder dairying households lacked the negotiating and bargaining power necessary to benefit from marketing arrangements with dairy-processing enterprises and feed marketing enterprises. After 2000, the Government recognized the potential importance of farmers' cooperatives and established cooperative societies. The Government issued the Law of Farmer Specialized Cooperative Society in 2007, thus providing a legal basis for farmer cooperatives to organize. Some local governments are exploring the possibility or are already helping dairy operators set up dairy industry cooperatives. In Heilongjiang province, for instance, the Anda City government helped establish more than 50 dairy associations and dairy industry cooperatives. Among them, the Taipingzhuang Dairy Association has more than 730 members, with a total of 4 200 dairy cows producing a daily output of more than 30 tonnes of milk.

Challenges for the smallholder dairying households

Smallholder dairying households encounter considerable problems, mainly related to: i) poor remuneration resulting in declining income and ii) difficulties in meeting the quality standards for raw milk.

Declining incomes for dairy producers

According to the Ministry of Agriculture, since early 2007, dairy cow farmers' incomes have decreased gradually: 40 percent of households are not breaking even, and the average earnings from each cow are now 1 500 yuan, lower than in 2006. Some dairy cow farmers have resorted to selling or slaughtering their cows due to the low profitability.[19]

[19] "Loss incurred in 40 percent of the dairy cow raisers in the whole country and the Ministry of Agriculture considers that the milk price forming mechanism is not reasonable", http://www.yndaily.com_2007077.

The reduction in incomes is due to higher production costs and relatively stable milk prices paid by the processors. Price collusion among processors is resulting from an oligopolistic market structure, with the purchasing price of raw milk controlled by only a few dairy-processing enterprises. The dispersed farm households have no bargaining power and are unable to negotiate higher prices; thus, they are obliged to receive the price offered by dairy-processing enterprises.

While the milk price paid remains fairly constant, the price of feed is rising: Over a one-year period, feed corn prices increased by 16 percent and dry alfalfa hay prices increased by more than 20 percent. In comparison, the purchasing price of milk in Heilongjiang, Inner Mongolia and Shanxi increased only by 7 percent, 6 percent and 3 percent, respectively[20] – despite rising prices of milk products in international markets.

Quality control of raw milk

Of considerable concern to the industry and consumers are effective controls on milk quality. The quality of raw milk not only influences the quality of dairy products and the safety of consumers on the one hand, but it limits its use in the production of value-added products. For instance, in the course of fermentation of sour milk and milk drinks, some raw milk cannot be used if the level of antibiotics is too high.

Before the 1980s, most raw milk was supplied by state-owned dairy farms to consumers in urban areas, and the quality could be controlled easily. After the 1990s and the expansion of smallholders, effective supervision became very difficult. Considering that most dairying households had a capacity of less than five head of cattle and owing to the great difference among the households in technical and management skills, sanitary conditions and quality awareness, quality problems in raw milk production have evolved into a major concern.

Current quality problems in raw milk include: i) variable protein levels due to the influence of different feeding regimes; ii) high bacteria count; and iii) high levels of antibiotic substances due to farmers' lack of knowledge. Often when dairy cows are given antibiotic substances, the farmers, due to economic interests or lack of knowledge, do not stop milking them (Hu, 2005).

Prospects

The development of China's dairy industry over the past decade has been an impressive one. Encouraging participation of smallholders in milk production has been a component of national and regional policies to promote regional development and reduce poverty. Large processors also have played a significant role in expanding and keeping smallholders in operation. Through the introduction of centralized milk collection stations, millions of small farmers have entered the sector, particularly in the poor western provinces. This has been supported by enabling policies of central and local governments, especially those that encouraged investments in higher-quality animals and infrastructure.

Although China's dairy sector has enjoyed rapid growth, it has encountered new challenges – the most visible of which was revealed in the melamine scandal in 2008. The dairy industry is experiencing considerable transformation – the quantity-based expansion is being replaced by the need to ensure milk quality. It is difficult for scattered smallholder dairy farmers to produce the quality of milk that processors and markets require. Developing large commercial dairy farms is unlikely to be a viable model in China, particularly in the medium term. Rather, alternative models in which an enterprise provides a milking station and proper management to smallholder dairy farmers, dairy parks and farmer associations are developing and proving to be practical. Many other different organizational models exist in practice. This calls for further evaluation on the performance of different organizational forms for linking smallholder farmers with the processors.

It is clear that the large processors have dominated and will continue to drive the next stage of China's dairy development. Critical to ensuring strong growth in the sector is the development of incentive systems for

[20] *China securities journal,* 26 November 2007; "The dairy cow raisers kill their dairy cows as a result of increase of cost and thus resulting the high price of milk in the whole country."

rewarding good practices to increase milk quality, either market based or institution based. The processors need to take a leadership role in setting up effective premium-based pricing systems to support a sustainable dairy sector. Implementing higher standards means higher costs for producers. It is important to understand the cost of compliance to adhering to these new standards, particularly to small farmers if they choose to participate in the evolving systems. In addition, it is important to look at innovative ways of sharing these costs between the farmers and processors, ensuring that farmers receive a fair price for high-quality milk.

China's dairy development policies, particularly regional policies, are very much biased towards large dairy farms. The Government needs to promote rural economy growth and improve the well-being of the rural population through increased technical support and financial subsidies. The policy objectives should focus on enhanced dairy practices, farm management and better-quality milk. The regional governments tend to focus on their regional economy in the short term, prioritizing a quantitative increase in production. Less attention is paid to improving financial rewards for a quality product through enhanced farming practices (through technical training). This has resulted in demand imbalances, which are characterized by limited supplies of raw milk nationwide and oversupplies in some regions. Limited incentives are in place for farmers to improve their farming and raw milk-quality management. Current policies promoting large dairy farms will need to be re-visited, if one of the policy objectives is to provide effective assistance to smallholder dairy farmers.

It is also clear that the current oligopolistic economic stage of the sector, owing to smallholder inability to negotiate with the large-scale dairy processing enterprises, results in dispersed smallholder dairy farmers not receiving fair prices for their raw milk. Therefore, dispersed households need to organize themselves and strengthen their capacity to negotiate with enterprises, thus ensuring long-term profitability to their investment and economic activities. The Government should formulate a positive policy to encourage and support the smallholder dairy farmers to establish institutional systems, such as cooperative organizations.

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India: Increasing demand challenges the dairy sector

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Over the span of three decades, India has transformed from a country of acute milk shortage to the world's leading milk producer, with production exceeding 100 million tonnes in 2006. This phenomenal success is attributed to a Government initiative known as Operation Flood (1970–1996) and its intense focus on dairy development activities. In that initiative, rural milk shed areas were linked to urban markets through the development of a network of village cooperatives for procuring and marketing milk. And milk production and productivity were enhanced by ensuring the availability of veterinary services, artificial insemination (AI), feed and farmer education. The investment paid off, promoting production gains of 4–5 percent per annum.

However, that growth has slumped to less than 3 percent in recent years, raising cause for concern. The slowdown is attributed to the decline in investment in the dairy sector since the end of the Operation Flood initiative. Central and state government allocation for dairy development has diminished in the past two five-year plans.

Emerging situation

Dairy is currently the top-ranking commodity in India, with the value of output in 2004 at 1.179 billion rupees (US$39 million), which is almost equal to the combined output value of rice and wheat. Despite the importance of the dairy sector in overall GDP, it receives less government budgeting than the agriculture sector. Further, there has been no concentrated investment in the development of value-added or innovative products, nor any serious effort to support and modernize the informal sector.

In light of the increasing demand driven by the growing population, higher incomes and more health consciousness, the slowdown in dairy industry growth is severely worrisome. Based on estimates by the National Dairy Development Board (NDDB), the demand for milk is likely to reach 180 million tonnes by 2022. To supply the market, an average incremental increase of 5 million tonnes per annum over the *next* 15 years is required – a doubling of the average incremental rate achieved over the *past* 15 years. In the absence of sufficient increased production, India will need to rely on the world market for imports. And because of the huge volume required, it will affect global milk prices. Thus, focusing on areas for local dairy development is critical.

Traditionally, the policy environment has favoured the expansion of cooperatives, which ultimately crowded out the private sector. However, liberalization of the sector in recent years has encouraged private investment in dairying. In 2002, the Milk and Milk Products Order (MMPO) ushered in major policy changes friendly to the private sector and a momentum of activity that is likely to increase dramatically in the coming years. Large Indian and multinational corporations, such as Reliance, Pepsi and Coca-Cola, are planning significant investments.

Nowadays, both the private sector and the cooperatives drive the value chains. Because of the many unsuccessful cooperatives in the country, other models of dairy farmer organizations are being explored, such as mutually aided cooperative societies (MACS) and producer companies.

Millions of small and marginal farmers in dairying who own two to three animals and produce an average of 5 litres comprise a critical portion of India's dairy industry. Livestock development in general and dairy development activities in particular are key components of pro-poor development strategies because livestock distribution is much more equitable than land distribution. Thus, changes in the dairying environment have important implications for the smallholder farmers and for poverty reduction.

The following characterizes India's dairy farming and its relevance to inclusive growth:

- Small and marginal farmers own 33 percent of land and about 60 percent of female cattle and buffaloes.
- Some 75 percent of rural households own, on average, two to four animals.
- Dairying is a part of the farming system, not a separate enterprise. Feed is mostly residual from crops, whereas cow dung is important for manure.
- Dairying provides a source of regular income, whereas income from agriculture is seasonal. This regular source of income has a huge impact on minimizing risks to income. There is some indication that areas where dairy is well developed have less incidence of farmer suicide.
- About a third of rural incomes are dependent upon dairying.
- Livestock is a security asset to be sold in times of crisis.

Factors affecting the competitiveness of the dairy sector

To assess the dairy sector's competiveness, a performance analysis looked at five factors: demand conditions, market structure, factor conditions, related supporting industries, and government and the enabling environment.[21]

Demand conditions

Demand for dairy products in India is likely to grow significantly in the coming years, driven by more consumers, higher incomes and greater interest in nutrition. Consumption of processed and packaged dairy products is increasing in urban areas. Because of the increasing competition from the private sector, several national and international brands have entered the market and expanded consumers' expectation of quality – although only among a small proportion of the population. In many parts of the country, people still prefer unpacked and unprocessed milk delivered by a local milkman because of its taste and the perception of freshness. The price elasticity for milk is high, thus demand for milk is very sensitive to price changes.

Table 1: Demand conditions	
Market size and growth	Market growth is due to high per capita consumption, increasing population and health consciousness
Consumption patterns	Consumption of processed and packaged dairy products is increasing in urban areas
Consumption patterns	Unpackaged milk is still preferred because of taste and price
Sophistication of consumers	Consumer awareness on product quality is increasing but in a very small portion of the population
Receptivity to new products	Mostly urban consumers have a very low but increasing interest in new products
Price elasticity	Price elasticity is high
Impact of market opening on demand	Consumers now have a variety of quality products

Market structure

Until 2002, cooperatives traditionally were the dominant players in the formal sector. With liberalization of the dairy industry, private investment has increased quite significantly. However, the organized sector's share in milk procurement is very low because a large proportion of the milk and milk products are sold through the informal channel (Table 3). The informal demand absorbs approximately 41 percent of the milk and milk products produced in the country, accounting for about 75 percent of the marketable surplus of milk. The formal channel, with its packaged milk and dairy products, accounts for only about 25 percent of the marketable surplus, which is about 15 percent of production.

[21] The first four factors were drawn from the diamond model; see Dr Michael E. Porter, 1985. *Competitive advantage creating and sustaining superior performance*. The fifth factor is from an adaptation of a model for agro industry value chains by Carlos Da Silva; see Carlos Da Silva and Hildo M. de Souza Filho. 2007. *Guidelines for rapid appraisals of agrifood chain performance in developing countries*. FAO publication. Rome.

Table 2: Market Structure	
Performance	Still large share of produce; 85% of marketable surplus goes through informal channel
	Quality of milk through informal channel is an issue and to some extent in formal channel as well
Competitive structure	Little competition to cooperatives because private sector was not allowed in the sector until recently
	Entry of supermarkets in retailing of milk is increasing the competitive structure
Governance (value chain type)	Governance of cooperative structures is constaining efficiency and expansion
Role of "lead" or organizing firms	Role of lead agency has been hampered by government interference in cooperatives
Farmer organization	Immense scope for improving management and governance through farmer organizations
Marketing chain capacity and efficiency	Scope for enhancing efficiency of distribution
Distribution channels	Cooperatives have a well-developed distribution channel in urban areas
How market signals are conveyed or distorted	Government and political interference in price setting, limits prices being determined by market forces.

The informal sector consists of the village milk vendors who procure loose milk from farmers and sell it in urban and peri-urban areas directly to consumers, small private processors or hotels. The milk vendors also may sell processed products, such as paneer or separated cream. The quality of the vendors' milk and milk products is not guaranteed. Largely sold in loose form, it is often adulterated with several additives to control spoilage.

Table 3: Flow of milk through different channels			
Share of marketable surplus	**% of production**	**Total production (million tonnes)**	**Use**
	100%	100	
	45%	45	Home consumption
	55%	55	Marketable surplus sold in urban and rural markets (informal and formal)
34.5%	**19%**	**19**	**Sold in urban markets as loose unpackaged milk**
40%	**22%**	**22**	**Sold as processed products through informal markets**
14.5%	8%	8	Sold as packaged milk through formal markets
12.7 %	7 %	7	Sold as packaged milk products through formal markets

Cooperatives are the central players in the formal dairy sector. The cooperatives have a three-tier structure – i) primary societies at the village level, ii) unions at the district level and iii) federations at the state level. Currently, there are 14 federations in India.

The success of the Gujarat Cooperative Milk Marketing Federation (GCMMF), known for its Amul brand and its Amul model of cooperative, is acclaimed. However, there is a perception that cooperative organizations generally have failed in other parts of the country. A less recognized fact is that the cooperatives in other states are organized differently than the GCMMF cooperatives. The GCMMF cooperatives operate as a true representative of farmers and are run by professionally qualified managers. In most other states, the cooperatives are managed by civil servants, function more as government bodies and are weak representatives of farmers.

Of the 14 major state cooperatives in the country, 10 have state government equity, of which 6 have government equity in excess of 51 percent. Twelve of the 14 cooperatives have government officers as

managing directors who are appointed by the state government. It is not uncommon for these officials to change up to three times a year. Because of such governance, cooperatives are mere parastatals and do not work in the true spirit of cooperatives – with elected farmer representatives and professionals who run the organization. This governance structure influences the functioning of the entire chain, from the state federation to the village societies and thus significantly impacts farmers' involvement in the chain.

The primary differences between the GCMMF cooperatives and other state cooperatives are price and services. In Gujarat, the price paid to farmers is based on fat content; there is regular testing of milk each farmer supplies. In most of the other states, there is hardly any testing of milk. In other state cooperatives, the village society president wields a lot of power and typically decides the prices paid to farmers. Reportedly, farmers with some degree of influence receive higher prices while those without receive lower remuneration. Being the lead organizations, the cooperatives also set a benchmark for prices paid by other buyers, such as local vendors and private dairies, who tend to pay 50 paise or 1 rupee ($ .02) more than that paid by the cooperatives. Thus, if the farmgate price paid by the cooperative is low, other players also pay a low price.

For most of the private dairies, agents procure the milk from farmers. Some private dairies have established village societies for milk collection that follow the cooperative model. However, this model requires much larger investment and is not economically feasible, considering that cooperatives receive considerable development support from the government (such as feed subsidies). It is not uncommon for private dairies to make loans to farmers, which is a key reason for the somewhat large share of milk directed to this channel.

Factor conditions

Factor conditions for dairying entail the quality of animals, human resources and technical skills, land availability, capital, credit, infrastructure and other inputs relevant to the value chain, as the following explains.

The quality of animals is critical in determining its milk productivity and hence overall production. Currently, low productivity per animal hinders development of the dairy sector. Despite being the world's largest milk producer, India's productivity per animal is very low, at 987 kg per lactation, compared with the global average of 2 038 kg per lactation.

The low productivity is a result of ineffective cattle and buffalo breeding programmes, limited extension and management on dairy enterprise development, traditional feeding practices that are not based on scientific feeding methods, and limited availability and affordability of quality feed and fodder. In addition, the limited supply of quality animals is exacerbated by policies limiting interstate movement of animals. Indigenous cattle and buffalo make up 45 percent of the country's total milch population, in contrast to the cross-bred cows at 10 percent.

Animal health and breeding services provision, veterinary infrastructure development and vaccinations are the responsibility of the state government. These services have traditionally been provided for free or at a very subsidized rate. In the past few years, there has been increasing awareness that the state pays heavily to offer these services, which are easily available to farmers (Ahuja *et al*.). Consequently, many states have instituted partial or full-cost recovery fees for providing the services.

Table 4: Factor conditions	
Herd	
Herd inventory	Very large number of indigenous animals with low productivity and a small portion of cross-breeds
Breed	Lack of policy focus on strengthening indigenous breeds
Feed	Very poor awareness of quality feed, which hinders productivity
	Farmers not interested in quality feed because of the low price of milk
	Increasing feed costs
Veterinary medicine	Availability is not an issue
Veterinary medicine costs	Duplicate or cheap medicines
Human capacity	
Farmer technical capacity	Knowledge and new techniques are not accessible
Support services technical capacity	Accessibility to good quality veterinary services is an issue in many parts of the country
Organization and managerial capacity	Organizational and managerial capacity of farmer cooperatives is very poor
Entrepreneurial capacity	Entrepreneurial capacity is hindered by a low capacity to take risks
Credit or finance market	
Formal credit mechanisms	Access to formal credit mechanisms is very poor
Informal credit mechanisms	Accessible but at very high interest
External economies	
Transmission of learning	Very poor extension support services, leading to very poor knowledge transfer
Social capital and trust	Strong social capital and trust in the villages, which can sustain dairy farmer organizations if properly managed

In addition to the State Department of Animal Husbandry, Dairying and Fisheries, the milk cooperatives and NGOs (BAIF, JK Trust) provide services in many states. So do trained private sector AI technicians, although for a fee. As well, state livestock development agencies are being set up as autonomous bodies to offer services in animal breeding in the form of procurement, production and distribution of breeding inputs (such as semen and liquid nitrogen), training and promotional activities.

Despite these initiatives, the availability of services remains limited. Currently, AI services cover only 15 percent of the breedable animals. Cattle and buffalo breeding programmes have been initiated but have not had the desired impact because of a lack of coordination between the different state departments. And extension activities in dairy management are woefully lacking. Farmers have not been able to take advantage of the potential of their animals because they lack information on feeding and management practices. Extension, especially for women involved in livestock rearing, would enhance dairy production considerably.

Crop residues are the single largest bulk feed material available to farmers for feeding livestock, specifically ruminants. They include coarse straws, fine straws, leguminous straws, pulses straws and sugarcane tops. Fodder from common property resources is another major source of feed for animals. But lack of efficient management of common property resources is a major constraint in availability of these resources for fodder. The area under cultivated fodder production is limited only to 5 percent of the total cultivable land. In the states of Haryana, Punjab, Gujarat and some parts of Rajasthan, land use for green fodder production is estimated at 10 percent or more. There is a need for restructuring the land use strategy to elevate the overall proportion of cultivable lands for fodder production.

Concentrates used for fodder include coarse grains, such as maize, sorghum, bajra and other millets, and other cereal by-products, such as rice bran/polish and various oil meals, including groundnut cake, mustard cake, coconut cake, soybean meal, cotton seed meal and sesame cake. The escalating price of feed ingredients is a major cause for concern. In many states, cooperatives are involved in producing feed concentrate and selling to farmers at subsidized rates.

Scarcity of fodder resources is likely to be a major constraint in the development of the dairy sector unless adequate measures are undertaken to augment them. Another important issue regarding feed is the lack of regulations to ensure quality. In the absence of a coherent policy, all kinds of substandard feeds are available in the market.

Formal/informal credit: Lack of access to credit to expand the herd is a critical problem for farmers. There is little access to formal credit through the cooperatives. Informal credit is available from private traders and agents of private companies, but the interest rate is very high. And these loans may or may not be linked to dairy activity. When taking a loan from a trader, the farmer is then tied to selling the milk to that trader, often at a low rate. The *Working Group Report on Animal Husbandry* emphasizes the low or non-availability of credit as a primary constraint in livestock sector activity, indicating that: "Public sector lending is abysmally very low. The commercial banks are not favourably disposed to providing credit to livestock farmers and the cooperative credit system is very weak, resulting in excessive dependence of livestock farmers on informal sources [and] usually at exorbitant interest rates. Efforts should be put on correcting these distortions and ensure timely availability of inputs and services, including credit to livestock."

Vaccines/medicines: The Government and the private sector are involved in producing medicines and vaccines. However, quality control is a critical issue. An important policy question is whether the government should be involved in the manufacturing and production of vaccines or should it instead take on a regulatory role to ensure quality and availability at a reasonable price.

Related supporting industries

Strong supporting industries are critical for the development of any industry. In the case of dairying, the National Dairy Research Institute pursues research and education in all aspects of dairying: microbiology, chemistry, technology, engineering, animal genetics and breeding, livestock production and management, animal nutrition, animal physiology, dairy economics and dairy extension education.

Table 5: Related and supporting industries	
Processing capacity	Lack of processing capacity in the country, including primary processing by bulk chilling
Processing capacity	There are government subsidies on bulk chilling and processing infrastructure
Transportation and distribution	Because of low productivity, transportation costs for procurement are high
Dairy farmer services	Availability of health and breeding services could be enhanced; extension is almost non-existent
Specialized finance and credit	Exists on paper but is very difficult to access
Relevant research capacity and use	Good research capacity

Processing capacity: At present, there are 678 registered dairy processing units processing 12–15 percent, or 26.63 tonnes, of the milk produced in the country each year. Of the total units registered under the MMPO, 403 are private dairies processing around 11.83 tonnes per year, whereas 212 cooperative dairies process 10.36 tonnes per year. The remaining 63 government plants process 4.44 tonnes per year. These dairy plants are registered in the different states of India. There is immense scope to increase the processing capacity and direct a greater share of milk and milk products through the formal channel.

Primary processing is another factor in need of critical attention to ensure the quality of milk through the supply chain. In addition to the Clean Milk Programme and other rural development schemes, the Government has provided subsidies for bulk chilling and processing infrastructure to support the dairy industry. But credit remains a problem; specialized credit exists on paper but is difficult to access for dairying. There is significant private sector investment in feed manufacturing and the manufacturing of medicines and vaccines.

Government and the enabling environment

The dairy sector in India has traditionally been highly regulated. The government projects and programmes in place for enhancing dairy development include subsidies for developing infrastructure for milk processing and testing. The Clean Milk Production Programme is a centrally sponsored scheme that is being implemented by the State Department of Animal Husbandry, Dairying and Fisheries with several objectives: i) the creation and strengthening of necessary infrastructure for the production of quality milk and milk products at the farm level up to the points of consumption; ii) improvement of milking techniques; and iii) training to enhance awareness on the importance of hygienic milk production. Several other rural development initiatives support dairying, such as through the District Rural Development Agency and women's self-help groups.

An area of government support that has not been capitalized on so far is the investment in promoting the nutritional aspects of milk, particularly pasteurized milk versus loose milk. Detailed information about policy regulations regarding the dairy sector in India is available online at www.indiandairy.com.

The policy history

Until 1991, the dairying sector was licensed under the Industries Development and Regulation Act (IRDA, 1951). This resulted in preferential treatment given to milk cooperatives that were outside the purview of the legislation. In 1991, the dairy sector was swept up in the move to liberalize the economy. Consequently, the IRDA was replaced by the Milk and Milk Product Order in 1992, which contained the following provisions:

1. The main objective of the MMPO is to maintain and increase the supply of liquid milk of desired quality in the interests of the general public and to regulate the production, processing and distribution of milk and milk products.
2. Any person or dairy plant handling more than 10 000 litres of milk per day or 500 tonnes of milk solid per annum needs to be registered, with the registering authority appointed by the central Government.
3. Every holder of a registration certificate can collect or procure milk only from the milk shed assigned under the registration certificate. The milk shed, is defined as "an area geographically demarcated by the registering authority for the collection of milk or milk product by the holder of a registration certificate".

Amendments were made to MMPO in 2002 to further liberalize the sector and encourage dairy entrepreneurs from the private sector. The milk shed concept was abandoned, allowing for milk supplies to be procured from any area.

Traditionally, the cooperatives have not had much competition from the private sector. In the liberalized environment characterized by open procurement of milk, there is incentive for private players to invest in the sector. Consequently, many agencies, organizations and agents have started buying milk. But a major difference is that they are not backward investing in dairy development activities through the offering of producer services. In the coming years, the lack of involvement in dairy development by the various players is likely to constrain further growth of the industry.

In this environment, dairy farmer organizations and cooperatives will have a strong role to play in supporting dairy development activities. If they were to establish higher prices to farmers, for instance, the private sector and other players would be forced to pay at least that much as well.

Policy and regulatory issues

Agriculture is a state responsibility in India, and the State Department of Animal Husbandry, Dairying and Fisheries, within the Ministry of Agriculture, is responsible for the dairy activities. Consequently, the focus of the activities and budgetary allocation is biased towards agriculture rather than livestock.

Table 6: Enabling environment	
National sector regulation	
Key regulatory actors (ministries)	Department of Animal Husbandry is under the Ministry of Agriculture, hence focus on livestock is underemphasized, particularly in light of the high value of the sector.
Price regulation	Price setting by cooperatives
Food safety	Regulated through the Milk and Milk Products Order
Informal regulations	Very difficult to control quality in traditional channels Huge premium on fat content of milk compared with formal regulations; thus buffalo milk fetches much higher price
Formal sector support	
Domestic sector (national)	Approaches being taken to modernize the sector
Subsidy support	Various subsidies available for milk processing and testing infrastructure
Inward investment promotion	Very little investment on the promotion of health or quality of milk
Provincial/local	
Key regulatory actors (ministries)	State Department of Animal Husbandry, Dairying and Fisheries is the implementing agency at the state level
Informal regulation & transparency	Lack of milk testing equipment and thus transparency, leading to low payments
Formal sector support	Availability of veterinary services; paravets are working with the Department of Animal Husbandry, Dairying and Fisheries
Formal sector support	Availability of services in remote areas through the government
Donor/NGO roles	Donor agencies are very actively involved in livestock sector development

There are several issues related to milk pricing policies that require serious review and reconsideration. Because cooperatives are mostly managed by civil servants, there is some government influence in determining milk prices. But the state cooperatives are supposed to base the price paid to farmers on the fat and solid-not-fat (SNF) content of milk. In the case of the better-managed cooperatives in Gujuart, the system works that way.[22] However, it is less the practice elsewhere. As noted previously, the village society president often wields a lot of power and determines the price randomly, without testing the fat or SNF content.

Also as previously mentioned, the cooperative price becomes the benchmark price for other buyers (vendors and private dairy agents) and when it is low, so are the other prices paid. Thus there is no incentive for farmers to sell to the other buyers; only about 15 percent of the milk is sold this way for the marketing of packaged milk and milk products. Policy efforts should focus on enforcing testing as the basis for milk pricing. This can be achieved by ensuring availability of testing machines at all milk collection centres, educating farmers to sell milk only based on testing and setting up policy norms for all players in the sector to collect milk only when it has been tested.

Another important aspect of milk pricing is the huge premium on the fat content compared to the non-fat solid content. Thus buffalo milk fetches a much higher price than cow milk, which has lower fat content.

Industry SWOT analysis

Within the framework of the competitiveness drivers and issues, the smallholder dairy sector's strengths, weaknesses, opportunities and threats have been assessed. The strengths and weaknesses are factors that are

[22] Gujarat farmers receive the highest share of consumer prices compared to any other state in the country.

directly controllable, while opportunities and threats derive from the external environment. As evident in Table 7, there are a large number of weaknesses in the sector, implying considerable scope for interventions. This SWOT analysis entailed matching each of these elements with an appropriate action.

Table 7: SWOT analysis of performance drivers

Strengths	How to build on them
• Large number of small and marginal farmers involved in dairying • An effective marketing channel helps to meet the demands of the urban consumer • Very large number of animals and huge scope to enhance productivity • Self-sufficiency in medicine production and do not have to rely on exports	• Strengthen economic viability of dairy farms by interventions on the input side as well as ensuring more fair farmer prices • Increase the link between rural production areas and urban markets • Focus on strengthening the indigenous breed to help significantly enhance productivity • Ensure availability of quality medicines by strengthening regulatory framework for quality
Weaknesses	**How to correct them**
• Large share of milk (70–85%) of marketable surplus goes through informal channel where quality is a big concern • Sometimes quality is an issue in the formal channel as well • Very little competition to cooperatives because private sector was not allowed to participate in until recently • Farmers do not share in the benefits of high demand because of poor governance of cooperatives • Milk production is scattered over a large number of farmers producing miniscule quantities • Milk distribution is limited to urban and peri-urban areas • Low milk prices because of lower prices declared by cooperatives, which results in low prices of milk paid by all players • Ad hoc export policies and a ban on exports • Quality of milk and milk products are a barrier to entry to the export market, especially the EU and the USA • Lack of policy focus on strengthening indigenous breeds • Non-existent extension facilities • Farmers' prices are not based on fat measurement, which affects their profitability • Because of low access to credit and risk-taking ability, farmers cannot increase their herd size	• Focus on quality issues even in the informal channel by training traders and by enforcing food quality regulations • Develop infrastructure and training for clean milk production • Support a fair playing field for the private sector • Bring about changes in cooperatives to make them true representatives of farmers instead of functioning as parastatals. • Support to dairying as an enterprise to encourage commercial dairy farming and encourage production and productivity by extension and breed development • Enhance packaged milk distribution in more areas • Strengthen dairy farmer cooperatives to enable farmers to get a higher price for milk • Create rational export policy to enable farmers to take advantage of higher prices • Strictly implement quality regulations and improve infrastructure and training for quality • Strengthen the breed development programmes • Strengthen extension facilities • Create policy regulations to make mandatory testing as a basis for setting milk price • Increase access to credit through dairy farmer organizations and other agencies
Opportunities	**How to pursue them**
• Increased farmer income by exploiting the high demand • Increased consumer sophistication and awareness of quality reception of quality packaged products (though slowly) • Entry of large corporations in retailing, which can lead to more investment • Immense scope to enhance governance of dairy farmer organizations and thus enable dairy farmers to demand higher prices • Potential for exports due to low cost of production • Overall positive growth environment, which is triggering the Government to enhance infrastructure	• Create policies and activities geared towards enhancing dairy farming activity by increasing, production, productivity and ensuring fair farmer price of milk • Establish enabling policy environment to enhance investment • Create policy support to enhance governance of producer companies • Focus on quality issues that are a barrier to exports • Encourage private sector to increase investment in dairying
Threats	**How to avert them**
• Large portion of the population does not care about quality issues in milk • Because of high price sensitivity for dairy products, people are not willing to pay for quality • Significant increase in maize prices can increase feed prices • Large informal markets that extend credit are constraining farmers • Low productivity and scattered production leading to high cost of transportation • Emphasis on milk fat and not on SNF content maintaining relatively lower prices of milk	• Initiate consumer education about the negative health impacts of unpackaged products • Develop packaging in small quantities to meet the needs of the poor • Increase milk prices in accordance with feed prices • Support expansion of dairy farmer organizations • Enhance productivity by breed improvement and extension • Enforce price setting of milk based on fat and SNF content to encourage production of cow milk

Four dairy enterprise models

The following section presents analysis and comparisons of four dairy enterprise models in India. Chosen for the analysis: i) a private dairy operating in Andhra Pradesh, ii) the Orissa State Cooperative as an example of a weak functioning cooperative, iii) the Gujarat Cooperative Milk Marketing Federation as an example of a strong functioning cooperative and iv) a mutually aided cooperative society as an alternative model. Models such as producer companies (emerging as a new generation cooperative) are still in a developing stage.

Table 8: Model features	Private dairy	State cooperative	GCMMF	MACS
Number of farmers involved	150 000	224 000	2 700 000	
Average litres of milk procured per day	700 000	322 000		60 000
Litres of milk processed at dairy plant per day			10 200 000	
Number of primary cooperatives	3 500	3 800	13 141	

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As previously noted, cooperatives have been successful only in some parts of the country. This is largely because the cooperative law falls under the state policy and is formulated differently in different states. In states such as Gujarat, where the model succeeds, the cooperative is headed by elected managers and managed by professionals. In many other states, civil servants manage the cooperative, which results in a lot of government interference in the day-to-day functioning and leads to a lack of democracy and hence no sense of ownership or responsibility at the village level.

Three key differences distinguish the Gujarat (GCMMF) cooperatives from the other states: i) an oversight board elected by farmer members; ii) professionals employed by the cooperatives to manage the cooperatives and iii) the cooperatives have autonomy and freedom in their operating policies from interference by government and politicians (Tushar Shah *et al*.).

To address the governance issues related to cooperative management, the MACS Act was passed in 1995. It de-linked the district level cooperative from the state level, giving autonomy to district and village mutually aided societies. However, only the state of Andhra Pradesh has implemented the legislation.

Changing from the cooperative model to the society model has many associated bureaucratic problems. To overcome the hassles, the concept of producer companies was introduced as a way of transforming cooperatives to work more efficiently as representatives of farmers. However, while promising, it is a relatively new idea that needs more time to develop. Meanwhile, with the liberalization of dairy sector, private sector dairies have emerged as prominent players in the dairy industry.

i) A private dairy

The private dairy selected for the comparative analysis is an ISO 9001-certified dairy headquartered in Andhra Pradesh. The company set up there in 1992 after the MMPO opened the door to private dairies, and it now trades on the Indian stock exchange. Milk collection is about 7 lakh litres per day from 150 000 households in 3 500 villages in 3 states, although the major operations are in Andhra Pradesh. The company serves three main metropolitan areas with fresh milk (Hyderabad, Chennai and Bangalore) and is about to enter Mumbai. It also markets a wide range of products, including milk, curd, butter milk, pedha and paneer as well as new items such as flavoured yoghurt and flavoured milk to cater to the changing tastes of the young generation. The company has several chilling and bulk cooling units across its collection region in Andhra Pradesh to ensure quality of milk through the chain.

The company obtains its milk supply through village agents who have personal relationships with the farmers; it does not get directly involved with farmers. Depending on the social structure of the village, there may be more than one agent per village. The agents collect the milk and deliver to the company. The two parties have negotiated a price, but the company is not involved with what price the agent pays the farmers (although it is slightly above what the cooperatives pay in the state). Agents often provide loans to farmers to maintain their loyalty; typically, the agent competes with agents of other private companies for a farmers'

milk supply. Company employees are previous dairy cooperative employees who have enormous experience in this area. Collection areas depend on milk density and areas in which the district cooperative is less active and access to markets is efficient.

ii) The Orissa State Cooperative

The state cooperative is a dairy cooperative society registered under the Cooperative Society Act (1962). Currently, milk collected from 3 800 village societies and 224 000 farmers within 12 district unions totals about 322 000 litres per day. There has not been much competition with the private sector in this region because of low productivity and little dairy development, although private sector investment in the dairy sector is on the rise.

iii) Gujarat Cooperative Milk Marketing Federation

The Anand Milk Union Limited (Amul) cooperative formed in 1946; but it has become a brand name managed by the Gujarat Cooperative Milk Marketing Federation (GCMMF). The GCMMF consists of 13 district unions, involving 13 141 village dairy cooperative societies and nearly 2.7 million farmer members. With an aggregate milk processing capacity of 10.2 million litres per day, it is Asia's biggest dairy business venture. The marketing network encompasses 3 000 wholesale distributors and over 500 000 retail outlets, giving GCMMF a national reach that very few fast-moving consumer goods companies can boast. GCMMF has been exporting UHT-processed milk, ghee, skimmed and whole milk powder, butter, cheese and indigenous milk products to the China, Hong Kong, Singapore and the USA, among others.

Structure

GCMMF's Amul model of dairy development is a three-tiered structure, with the dairy cooperative societies at the village level federated under a milk union at the district level and a federation of member unions at the state level. Farmer members milk their cows twice daily (morning and evening). GCMMF collects the milk twice a day, makes regular payments to the farmer members and provides them with cattle feed, fodder, animal breeding and veterinarian services.

Anyone who owns a cow or a buffalo and makes a one time payment of 11 rupees (10 rupees for the share certificate and 1 rupee for registration) can become a member of the village cooperative society. The applicant must agree to provide a set minimum quantity of milk, generally between 600 and 700 litres, to the society each year. The farmer members elect a managing committee that then chooses a chairman. The managing committee appoints a secretary to discharge the society's administrative functions.
At the second tier, there is a district level union that processes the milk procured from individual societies. Each of the 13 unions has a board of directors chosen by an electoral college drawn from the chairpersons of its affiliated societies. The union board in turn elects its chairman.

The final tier is constituted by the GCMMF, which is responsible for marketing the milk procured and processed into various value-added products at the union dairies. All the products are sold under the Sagar or Amul umbrella brands. The federation's board consists of the chairpersons of all 13 district unions. They elect the federation chairperson and appoint the managing director, who is accountable to the nearly 2.7 million strong Amul dairy society members.

Elected representatives of the farmer members make policy decisions at all three levels, which are then implemented by professional managers and skilled personnel employed by the farmer members. This structure eliminates all middlemen. By placing the farmer members in command, in essence, of the dairy cooperative involves them in the development process.

This cooperative structure is democratic, and the farmers are in control, from the milking of their animals to the final marketing by the federation. For every rupee that GCMMF earns, roughly 75 paise goes to the farmers. The mandate is clear – production by the masses, for the masses, at its efficient best.

The farmer members democratically govern the entire cooperative structure to ensure that the higher tier organizations are geared to serve the purpose of the lower levels and that the gains at all levels flow

ultimately back to the farmers in a significant measure. The core feature of this structure is farmer involvement in decision-making at all three stages – procurement, processing and marketing of milk and milk products. The value addition at procurement and processing stages can be realized only with effective marketing of products, thus making it an essential feature for success.

Services provided to farmer members

The dairy unions affiliated to GCMMF provide various inputs that contribute to enhancing the productivity and quality standards, such as:

- breed improvement and animal healthcare programmes;
- extension activities;
- supplies of balanced cattle feed on a no profit–no loss basis;
- quality fodder seed distribution at subsidized cost;
- a network of artificial insemination centres aimed at genetic upgrading of the animals using frozen semen of pedigree bulls; these centres are managed by educated unemployed rural youth who provide breeding services to the farmers;
- frozen semen, liquid nitrogen and other consumables;
- 24-hour mobile veterinary services for emergencies.

It is this integrated approach to dairying and addressing farmers' needs at all levels that gives the Amul model its uniqueness. And it is why every third litre of milk from a cow or buffalo in Gujarat is processed in a GCMMF union dairy.

iv) MACS in Andhra Pradesh (AP)

Dairy activities started at the district level in 1971. The originally chosen district union was registered under the Andhra Pradesh Cooperative Societies Act (1964). After the introduction of the MACS Act (1995), the district union opted for registration as a MACS to acquire better functional autonomy for servicing its farmer members. The union is currently collecting 60 000 litres of milk per day from 650 villages, though it likely to increase up to 100 000 litres in the next two to three years.

The MACS have a two-tier operation: at the village and district levels. A village society with elected officers manages operations at the lower level; an elected board of directors managers the district society. The village and district societies each registered separately, and each has the freedom to use its own profits.

The union provides its members with a range of services required for dairy development activity:

- organizing thrift and credit cooperative society to facilitate the financial assistance for buying milch cattle;
- organizing AI services through an NGO;
- making cross-breed or graded animals for farmers to purchase;
- providing inputs such as concentrate feed, fodder seed, fodder slips and mineral mixtures at subsidized rates to members;
- supplying breeding bulls to societies;
- providing veterinary health facility, de-worming and vaccination to the animals of members;
- compensating members in the event of the death of an animal with either a grant or loan;
- providing insurance coverage to members.

Comparative analysis of the four value chains

The following compares performance criteria for the four dairy value chains to determine how they are likely to endure against future competition.

Demand conditions

The GCMMF has a wide range of traditional products as well as several new products catering to the demands of the new generation, such as sugar-free ice cream. It is one of the largest selling brands of dairy products, with a presence in all parts of the country. The private dairy also has a range of modern products catering to the young generation, such as flavoured yoghurt. The Andhra Pradesh MACS largely sells traditional products, such as milk, to urban consumers as well as rural markets through village societies (small packets, 250 ml). The Orissa State Cooperative also largely sells milk and a few traditional products.

Market structure and governance

The competitive structure for the four models varies. Dairy is a regional industry with regional dairies serving the local market, especially in the case of packaged milk. There is more scope for inter-regional trade.

The GCMMF competes with other multinational companies, such as Nestlé and Britannia, with certain products but leads among dairy products in India. The private dairy is a leading brand in the city of Hyderabad. However, the state of Andhra Pradesh has a well-developed dairy industry with several private dairies present in the state and rigorous competition among them. The Andhra Pradesh MACS largely sells packaged milk to the nearby areas and thus encounters less competition in marketing its products. And as mentioned earlier, Orissa finds very little competition to its packaged dairy products because there are hardly any private players in the state.

The supply chain is closely linked to the governance structure of the chain. For instance, the GCMMF network is very strong, with farmer involvement at all levels in the chain. Thus it is difficult for private players to procure milk directly from farmers. It is a similar situation within the Andhra Pradesh MACS. In Orissa, however, the cooperative network is not very strong and the president of the village society wields a lot of power; farmer involvement in decision-making at all levels is virtually non-existent. This has created keen competition from milk vendors in milk procurement in that area. The private dairy in Andhra Pradesh experiences intense competition from several private dairies in milk collection. But most of these companies do not deal directly with farmers. Milk is collected through village agents. There is no involvement of any company in any dairy development activity, and thus the companies compete with each other for milk collection.

The GCMMF collects its milk through village societies, with the cooperative setting the price. But it pays one of the highest prices in the country; milk collection is done in a transparent manner (based on testing fat and SNF content). The MACS society also has similar norms (for testing fat and SNF content) for milk collection. The MACS has the freedom to decide the price paid to farmers for their milk because they have autonomy in setting prices. Societies making profits through the sale of milk products can give higher returns to farmers because they do not have to follow the cooperative price. The prices paid that the Andhra Pradesh MACS declares at the district union are higher than the cooperative prices.

The Orissa State Cooperative collects its milk supply through a village society run by the president who wields a lot of power; its farmers' price is relatively low compared with the GCMMF. In most cases, there is no testing for fat and SNF content on which prices should be based. Average prices are fixed for cow and buffalo milk; however, influential people in community get better prices. In the case of the private dairy, milk purchases are done through the agent, with prices based on competition with agents of other companies and the declared cooperative price. A large number of societies have electronic milk testing machines and more are acquiring them.

Factor conditions

Livestock assets are likely to be better where organizations serving the area are involved in dairy development activities. The GCMMF has been providing good AI services, which has enhanced the quality of buffalo in the area. The Andhra Pradesh MACS have created a good network of services by involving the State Department of Animal Husbandry, Dairying and Fisheries and NGOs working in its area. With

efficient services and involvement in breed development, the quality of herd is likely to improve in the near future.

The GCMMF as well as the Andhra Pradesh MACS provide their farmers with feed, animal medicines and vaccines and breeding services. In the Orissa State Cooperative, feed is made available at a subsidized rate through the village society. The society is also involved in providing health and breeding services; however, the farmers still need to largely rely on the state government to provide health and breeding services, which are somewhat inadequate. There is no facility for loans; however, medicines are available at cost, although supply tends to be a problem. Because the private dairy collects milk through agents, it is not directly involved with the farmers for service provision. The agents sometimes extend loans to farmers, which ensures marketing commitment by producers. These are general loans not specifically used for dairy activities, and the interest rate typically is quite high.

Milk productivity depends on the level of extension support provided to farmers. The GCMMF provides ongoing extension activities, including training sessions and exposure visits for women. The Andhra Pradesh MACS are also involved in extension to some extent. The Orissa State Cooperative offers hardly any extension activity; the private dairy does not involve itself in extension services at all.

Related and supporting industries

The GCMMF has created good processing and primary processing infrastructure. Its plants are ISO certified and meet all the quality requirements. The private dairy processing plant also is ISO certified; however, the primary processing at the village level is not very strong. The Andhra Pradesh MACS have developed adequate processing facilities and plan to expand significantly in the coming years. Milk quality was an issue previously for the Orissa State Cooperative, but the situation has improved in recent years.

Prospects

The GCMMF is the most organized in meeting future growth because of its investing in dairy development activities, such as ensuring the availability of feed and fodder and veterinary services. It is in a position to increase its procurement in the coming years. Also, in terms of development, the GCMMF leads the country in modern products, such as sugar-free ice cream.

The private dairy is not involved in dairy development activity and is only focusing on milk procurement. Faced with increasing competition, it will have to move to newer areas for expansion. Because of low involvement of farmers in the Orissa Cooperative, the private sector will find it easy to move into milk procurement in its area. The lack of variety and quality of its products will make it difficult for Orissa to compete with the private sector.

If the MACS model becomes popular, procurement will be affected. MACS involvement in dairy development activity will help the model grow and expand the milk procurement. It is geared to face competition from the private sector because of close links with farmers at the village level.

Conclusions

Dairy has a lot of potential to improve rural incomes, nutrition and women empowerment, and hence is a very critical area for investment. A well-developed industry will enable millions of farmers to capitalize on the emerging opportunities and make a significant impact on rural incomes. On the flip side, weak efforts towards dairy development also can have a significant but negative impact on the dairy industry. The growth rate has been sluggish over the past few years. With an increase in demand on one hand and sluggish supply on the other, there is a likely shortfall in demand in the coming years.

Major areas of intervention in the dairy sector have been highlighted in this review. Carrying out interventions requires resources and commitment from key actors – government, NGOs, development agencies and the National Dairy Development Board – to partner and work together.

A comprehensive policy addressing the critical issues is required for the robust growth of the sector. The following highlights those issues:

1. The first issue is defining and implementing a policy for dairy development. Though a livestock policy has been established at the national level, its implementation is at the state level because agriculture is a state responsibility in India. But state policies addressing critical needs in dairy development have yet to be clearly defined across the country. Some progressive states have a well-defined policy, but it is lacking in most of the others. But even where a policy is clearly developed, oftentimes implementation is a problem.

2. Lack of clarity between the roles of the State Livestock Development Agency and the State Department of Animal Husbandry, Dairying and Fisheries is an issue for effective policy implementation. For example, the National Cattle and Buffalo Breeding programme has not been well implemented in several states. Further, availability of funds is a major issue in implementing livestock activities. The Livestock Department is within the Department of Agriculture and thus the resources are biased towards agriculture. There is need to emphasize the importance of dairying to smallholder incomes to direct more resources towards dairy development.

Two very significant factors for the growth of the dairy sector are dairy development activities and milk prices paid to farmers. In the liberated policy environment, any player can procure milk in any region. This is a very different situation from the earlier concept of milk sheds, which limited the agency or organization procuring milk to a particular area. Hence, earlier it made sense for agencies and organizations to invest in dairy development activities.

But the freedom for procurement has thwarted the incentive for private companies to invest in dairy development activities. However, private sector investment in procurement is increasing. What is clear is that while the number of buyers is increasing, little is being done to develop the sector. In this situation, farmer-owned organizations (such as cooperatives, producer companies, common interest groups and women's self-help groups) have to be strengthened at the grassroots level and linked to service and input providers.

Dairy farmer organizations can be used as a platform to address issues regarding availability of all inputs, including feed, fodder, breeding, veterinarian services, medicines, vaccines, credit and insurance. As is evident from the examples presented previously, the GCMMF has been the most successful in meeting the input requirements of farmers. However, this model has not been successful in other states because of issues with the basic organization of cooperatives.

Dairy cooperatives in several states function as parastatals and lack the spirit of cooperative organization with farmer involvement in ownership and decision-making. Alternative models of dairy farmer organizations – such as the MACS, producer companies, women's self-help groups – also need to be explored. International agencies and donor groups need to be directed towards creating political will to strengthen dairy cooperatives and to set them up.

A very important aspect of dairy development is the price paid to farmers. Currently in many states, the milk price is set by the cooperatives; this price is used by all other players to set their prices, typically by paying 50 paise or 1 rupee more than the cooperative price in that area. The farmer's price for milk ranges from 9 to 11 rupees for cow milk and 13 to 14 rupees for buffalo milk (a key comparison is a litre of bottled water, which costs 10–12 rupees then why are milk prices so low? The GCMMF pays the highest prices in the country. In the areas where the Andhra Pradesh MACS have set up, their prices are higher than the cooperative prices (MACS have the freedom to declare their own prices). It is evident that where dairy farmer organizations are strong, farmer prices are higher.

Low productivity per animal is another factor hindering development of the dairy sector. Many issues related to low productivity have been discussed – an inadequate cattle and buffalo breeding programme, extension and management on dairy enterprise and feeding practices, and availability of quality feed and fodder. Another important aspect related to low productivity is the lack of quality animals for farmers to purchase. A major hindrance to the availability of quality animals in dairy developing areas is the policy regarding interstate movement of animals.

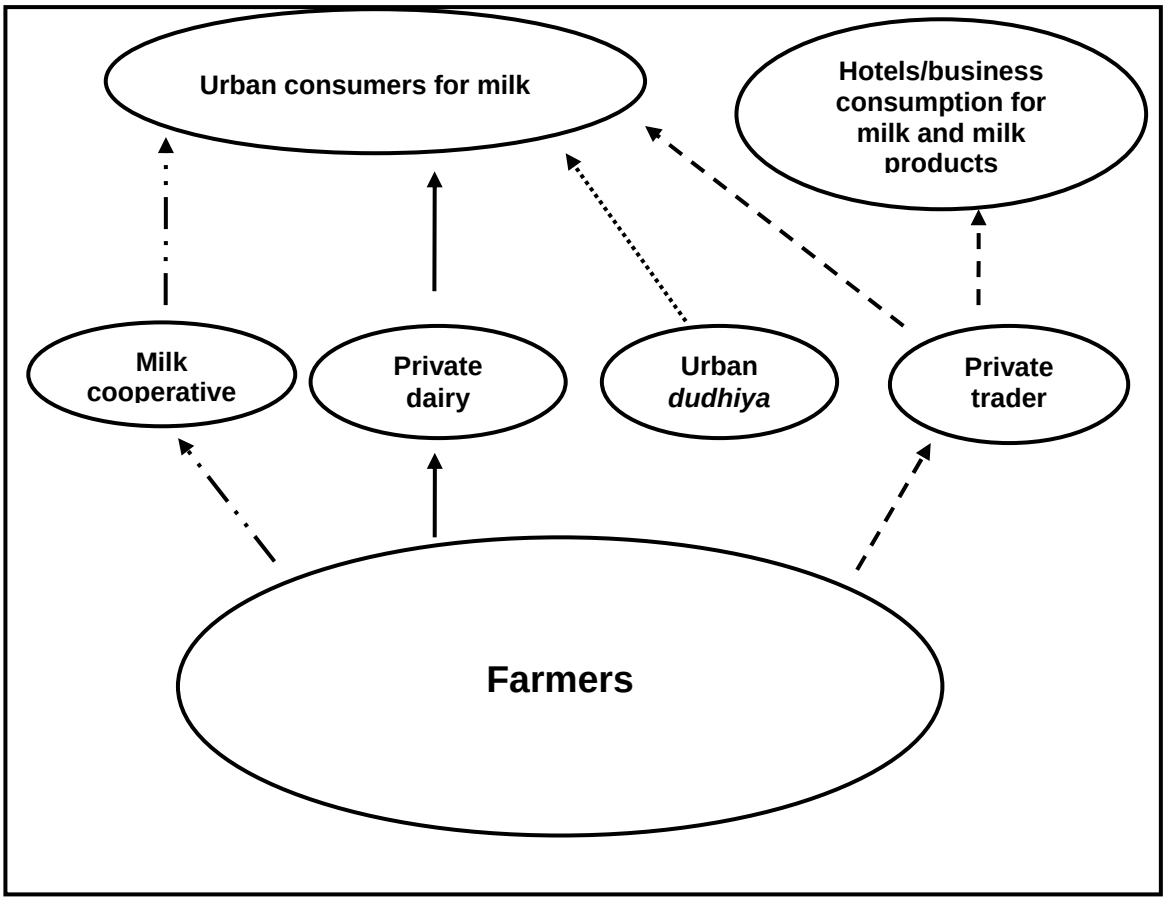
Finally, it is important to discuss the hygienic issues. Milk quality concerns go beyond the farm level and require assurance of safe milk at all stages, including within the informal sector. Through the formal channel, cooperatives, private dairies or any other form of dairy farmer organization, quality can be addressed through training and education on clean milk practices, including the use of bulk coolers. It is also important to develop diagnostic facilities for milk testing, including infrastructure and human resources, that enable constant monitoring for quality. At the processing level, plant certification will help to enhance consumer confidence.

Milk quality in the informal markets is an important issue. As noted, 70–85 percent (based on different estimates) of milk is obtained and sold through the informal channel. In recent years, initiatives have focused on working with and providing training to traders. In Kenya, for instance, licensing has been used to formalize the traditional sector. In India as well, the Capitalisation of Livestock Programme Experiences programme, along with the International Livestock Research Institute, have undertaken some initiatives in this direction.

In the current situation, traders collecting milk at the farm then deliver it and milk products to urban and peri-urban areas. Each trader buys only small amounts of milk. There is scope to organize the traders into groups and create joint facilities where they can test, process and store their milk supplies. These trader facilities could serve as wholesale or bulk suppliers for hotels, *chaiwalas* (tea sellers) and small sweetshops. These initiatives can help to address the quality issues in the informal sector and also create employment opportunities in the non-farm sector.

An argument against working with traders is that formal sector involvement in dairying is increasing and eventually there will be no room for informal players. However, looking at the current reality, it will be several years before this materializes. In the meantime, the informal sector should not be ignored and organizing informal traders should be pursued.

Annex I: Overview of dairy marketing channels in India



Annex II: Income from dairy enterprise

Income from dairy enterprise per month (two-animal farm)

	Economic analysis *(accounting for household labour and cost of green/dry fodder obtained for free from common resources or neighbour fields)*	**Financial analysis** *(Does not account for household labour and free fodder)*
Feed cost	2 000	1 400
Labour cost	750	
Medicine cost	60	60
Total cost	2 810	1 460
Total revenue (4 litre/animal/day @ 9 rupees cow milk or 14 rupees buffalo milk)	2 160–3 360	2 160–3 360
Net income	**-(650)–550**	**700–1 900**

Source: Punjabi

Annex III: Milk price chart

	GCMMF		**Orissa State Coop**		**MACS**		**Private dairy (heritage)**	
	COW	**Buffalo**	**Cow**	**Buffalo**	**Cow**	**Buffalo**	**Cow**	**Buffalo**
Farmer price			9–9.5			260/kg fat		225+ some amount (cooperative pricing)
Agent price			10			Get salary	92–105 + incentive	240+ incentive
Consumer price								

Source: Punjabi

Annex Table 1: Identifying critical issues in the dairy chain

Stage	Priority	Agent	Issues
Policy environment	Developing livestock policy Breed development	Dept. of Animal Husbandry, Dairying and Fisheries	Lack of a coherent livestock development policy Ineffective implementation of policy and projects due to lack of clarity in roles of different agencies Lack of resources Lack of clarity between roles of different departments Lack of regulation for quality of feed and medicines
Services	Disease control/ health/breeding/extension services Support to dairy farmer organizations/women's self-help groups	Dept. of Animal Husbandry, Dairying and Fisheries Cooperatives NGOs Private dairies	Inadequate coverage of veterinarian and breeding services Non-existent extension services Scope to enhance activities of NGOs in these areas Lack of private sector involvement in dairy development services and activities
Inputs	Feed supply Fodder Medicines/vaccine supply	Cooperative Feed companies Medicine companies Medicine store	Quality/cost of feed Ineffective approach for management of common property resources Quality of medicines
	Formal credit for animal purchase	Banks/financial institution Cooperatives Self-help group	Very poor access to formal credit at the farm level
	Informal loans for animal purchase or other dairy needs	Trader Private company agent	Very high rate of interest; farmer has to sell milk at low price to the trader if he/she has borrowed money from the trader
Production	Dairy farming Selling milk cooperatives/traders/private dairy agents	Farmer	Poor management and feeding practices because of lack of information in the absence of extension activities. Low productivity because of poor genetic potential, poor feeding and management practices, poor access to health and breeding services, lack of good-quality animals Availability of milk per household very low Low profitability from dairy enterprise
Marketing/ processing	Collection of milk from farmers through village society, processing and marketing of milk in cities and urban areas	Cooperative society	Lack of coverage of villages Lack of transparency in milk testing and pricing Lack of democracy in village societies Marketing only in peri-urban/urban areas Maintaining quality of milk/infrastructure Milk prices declared by cooperatives kept low and used as a benchmark price by other players
	Purchase milk from farmers and selling milk and processed products to consumers	Trader	No transparency in milk pricing Adulteration and quality of milk and milk products Unhygienic conditions for milk processing
	Purchase of milk from farmers through village agents, processing and selling milk	Private dairy	No transparency in pricing of milk Quality of milk
Retailing	Selling of milk and milk products processed by cooperatives and private dairies	Retailers	

Mongolia: Rebuilding the dairy industry

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Background

With a land area of 1.56 million sq km, Mongolia is more than three times the size of France; its population is only 2.5 million (2006), almost half of whom live in Ulaanbaatar, considered the coldest capital in the world. Broadly speaking, moving from the southern border with China to the northern border with Siberia, the country is separated equally into: i) desert, ii) desert-steppe and iii) steppe regions, each with mountain ranges, some rising to well over 4 000 m. Being so far from the sea, its climate is extreme continental, with temperatures ranging from as low as minus 45°C on the steppe in winter to plus 40°C in the Gobi desert in summer. The summer growing period is very short; the autumn-winter-spring period, when nothing grows, is very long. Less than 1 percent of the land is used for crop cultivation, although some 71 percent is grassland, used for extensive livestock raising, including hay-making and natural pastures.

The livelihoods and well-being of the majority of Mongolia's people still depend largely on livestock in general and on meat and milk in particular. Milk is both a sacred and a staple food. In the short warm summer season, it is produced in great abundance by some 30 million cattle, yaks, camels, horses, goats and sheep that are owned largely by small-scale producers (see the definitions in Box 5). Nomadic herding and traditional dairy product-making are at the core of Mongolian society, providing a significant share of national income and employment. Women have the leading role because they are the ones tending the animals and processing the milk into traditional products for winter food as well as for earning income from selling the surplus for other basic family needs.

Livestock contribute more than one-fifth of GDP and almost half of all employment in what was, until recently, a predominantly nomadic society. Dairying, in particular, provides much-needed nutrition, regular income and employment and is set to play a major role in helping the country become more food secure and, in so doing, supporting the UN Millennium Development Goal seeking to halve poverty and halve under-nutrition by 2015. In Mongolia, the latter goal means reducing the number of under-nourished people living below the poverty line from 800 000 to 400 000.

In the socialist period, Mongolia used to be self-sufficient in milk (Table 1). During the rapid transition to the market-based economy in the 1990s, the dairy industry, like other food industries, collapsed; sales of domestic processed milk fell from more than 65 million litres in 1990 (approximately 20 percent of milk production) to less than 3 million litres by 2002. As a result, overall food insecurity worsened, and many people lost their livelihoods. Imports of milk and dairy products surged to about 50 million litres of a liquid milk equivalent (LME) annually. The dairy industry by 2002 was hampered by obsolete infrastructure and technologies, a chronic shortage of trained people and consumer concern about the quality and safety of domestic milk and dairy products. Consequently, most of the processed milk sold in urban areas was imported, at considerable cost.

Like other countries in the East Asian region, Mongolia is rapidly urbanizing. Domestic products need to be tailored to modern market tastes, particularly to younger Mongolians. Half the population is younger than 20 and have drank only imported milk. Even so, the huge wealth of traditional milk products remains an important part of the culture and for the livelihoods of nomadic herders, especially during the long harsh winters.

Since the move to the market economy in the 1990s, milk prices are no longer centrally set and fluctuate according to supply and demand. Farmgate and consumer prices vary considerably according to season and to how far milk producers are from the market (Annex II-a). A 5 percent tariff on milk powder imports was introduced in 2000, along with a 15 percent value-added tax (VAT). In 2006 the Ministry of Food and Agriculture proposed to increase tariffs to 15 percent on selected food imports, including the ultra-high temperature, or UHT, milk. The proposal is still under consideration. The VAT was reduced in January 2007 from 15 to 10 percent on all imported and domestic goods. Dairy plants with an annual turnover of more than 15 million tögrög (US$13 000) now pay VAT in accordance with the new tax law, which allows payment to be offset against the cost of procuring domestic raw materials such as milk. This is a highly supportive measure, considering 70 percent of costs are for raw milk.

Table 1: Milk production in Mongolia ('000 tonnes)

Year	Total milk production	By species			
		Camel	Mare	Cow	Sheep/goat
1940	242.2	1.6	12.7	186.8	41.1
1950	240.8	2.4	12.1	183.4	42.9
1960	227.7	2.3	12.2	173.5	39.7
1970	220.6	1.2	12.1	177.3	30.0
1980	225.7	1.1	7.3	194.9	22.4
1990	315.7	1.0	26.1	260.2	28.4
1995	369.6	(X)	(X)	(X)	(X)
2000	375.6	(X)	(X)	(X)	(X)
2003	292.4	(X)	(X)	(X)	(X)
2005	425.8	3.7	41.5	259.5	121.1
2006	479.4	3.8	43.3	285.7	146.6
(X) Figures not available					

Source: Mongolia Bureau of Statistics (2006)

At 134 kg of LME per person per year, milk availability is very high by Asian standards; for example, in neighbouring China it is only 10–20 kg, with imports currently increasing at an annual rate of 15 percent. A number of private dairy enterprises emerged during the 1990s, after the political and economic liberalization, including former food and dairy processing *combinats* (state-owned companies) acquired by the incumbent managers. Some failed; others experienced great difficulty in getting milk, a highly nutritious but highly perishable food, to market. Up to a reported one-third of available milk was "lost" in the post-harvest (after milking) food chain because it could not be moved to markets or could not be sold because consumers preferred imports. This encouraged the establishment of two dairy enterprises with business models based on importing subsidized milk powder from developed-country surpluses for recombination.

During the great *zuds*[23] at the turn of the century, more than 30 percent (10–12 million) of the livestock perished, including nearly all the dairy cows, which had been distributed to former state farm workers in the 1990s. Given the importance of dairying to the economy, the Government decided to re-stock and modernize the dairy industry to redress the imbalance between milk supply and demand. It promoted domestic milk production and marketing under its flagging national White (milk) Revolution Programme. Formulated in 1999, the programme never really took off, owing to lack of resources.

Then in 2002 the Government approached the FAO and the Japanese Government for project support to revive the dairy industry,[24] initially in the central a*imags* (provinces) where three-quarters of the urban population lived and the few remaining dairy cows were located. They wanted to link milk producers to the key urban centres of Ulaanbaatar, Darkhan and Erdenet, where about half of the population lived. To reduce post-harvest milk losses, the project would target small milk-producing households and farms (with 10–40 cows) adjoining the urban centres as well as more distant nomadic herders by organizing milk collection, initially for the under-used urban milk processing dairies.

[23] Zuds are any condition when animals cannot feed themselves by grazing – typically when ice or snow covers pastures.
[24] Mongolia-Japan-FAO/UN Special Programme for Food Security project: Increasing the supply of dairy products to urban centres in Mongolia by reducing post-harvest losses and re-stocking.

This case study report is based largely on the achievements and lessons learned during that regional project, which ran from October 2004 to September 2007. The Government mainstreamed the project's three intervention areas (milk-production enhancement, milk-marketing enhancement and dairy training/capacity-building) into a ten-year National Dairy Programme (NDP) for the period 2007–2016. The NDP target is that at least 90 percent of the milk used in the formal market will be produced locally by 2010, up from 2.5 percent in 2003 (Figure 1). The NDP, which replaced the White Revolution Programme, was approved by the Government in October 2006; it is coordinated by the Ministry of Food and Agriculture and implemented using a public–private sector partnership and investment modalities developed through the FAO/Japan project.

The current dairy situation: An overview

Dairy industry survey (2005)

Due to recent lifestyle changes from predominantly nomadic to predominantly sedentary, the country is urbanizing rapidly. A survey of dairying in the central *aimags* conducted in 2005 by the Mongolian Food Processors Association identified many shortcomings in the dairy food chain. Socio-economic data were collected and analysed from 84 small milk producers (nomadic herders and peri-urban households and farms), 14 dairy processors and 1 200 urban consumers. The findings (Box 1) characterize milk production and consumption as: i) a relatively small domestic market for processed milk and dairy products, ii) a huge disparity between rural (at 200 kg per year) and urban (at 58 kg per year) consumption of milk, iii) poor-quality milk and lack of consumer confidence in locally processed milk and dairy products, iv) over-reliance on imports for urban markets and v) a vast natural resource base for milk production from the 6 million or so animals owned by small milk producers that are potentially in milk at any one time.

Box 1: The socio-economic situation of the dairy industry in central *aimags* and urban markets

Selected findings (2005):

1. Annual milk consumption in urban centres is 58 kg LME per person, about one-quarter of the consumption in rural areas, at 200 kg;
2. 70 percent of processed milk consumed in urban areas is imported (approximately 40 kg LME per urban dweller per year), and milk quality is an important driver;
3. Post-harvest "losses" confirmed at one-third of milk production (approximately 40 kg LME per person per year);
4. Nearly all milk is produced by small producers, but quality is poor because of inadequate milk collection and primary treatment infrastructure;
5. A chronic lack of technical expertise and modern technologies and equipment among dairy operators (producers, collectors, processors) – training and capacity-building urgently needed;
6. Iinadequate services for milk producers (health, breeding with artificial insemination, feed/fodder, management);
7. The number of more-intensive* dairy farms doubled to 110 since 2003; owners are inexperienced and lack skills and services;
8. Households selling milk have average incomes three times higher than households not selling milk;
9. Women head 30 percent of the dairy households;
10. No institutional body to represent the dairy industry.

*In the Mongolian livestock context, "intensive" means increased production using local resources – rather than tending towards a high input system.

Source: Baseline Survey-GCSP/MON/001/JPN Dairy Food Security Project by National Food Producers' Association, September 2005

After liberalization, the old state dairy system struggled with obsolete equipment and inexperienced management. Many of the new processors failed because their competitiveness with subsidized imports was constrained by overwhelming difficulties in obtaining: i) quality local milk from widely dispersed small milk producers, ii) modern equipment, iii) modern packaging materials and iv) low interest rates for investment finance and working capital (typically it was high at 18–30 percent). Two large food and beverage companies (one supermarket-based and the other the main producer of vodka) diversified into producing UHT milk and fruit juice. They based their business model on reconstituting imported full-cream milk powder (FCMP) marketed as "fresh" milk. At that time, the cheap milk powder from the West (often subsidized) was readily available at a LME cost of about 200 tögrög ($.17) per litre, roughly the same price as locally produced milk in the summer (Annex II-a).

The 2005 survey found that the informal milk market was still important for the older generation, though product quality was invariably uncertain. Raw milk and traditional products still accounted for approximately half of urban consumption. The informal market was important not only as a supply of milk and dairy products but also as a source of regular income and jobs, especially for female-headed households.

Dairy industry-revival strategy

The revival strategy for the dairy sector has been linked to the current policies for national agricultural development. These focus on improved competitiveness in changing markets by: i) creating favourable business conditions, ii) improving and sustaining productivity leading to iii) improved availability of quality milk and dairy products that are safe, affordable and ecologically clean, and iv) application of new technologies for both extensive pastoral and higher-productivity farming systems.

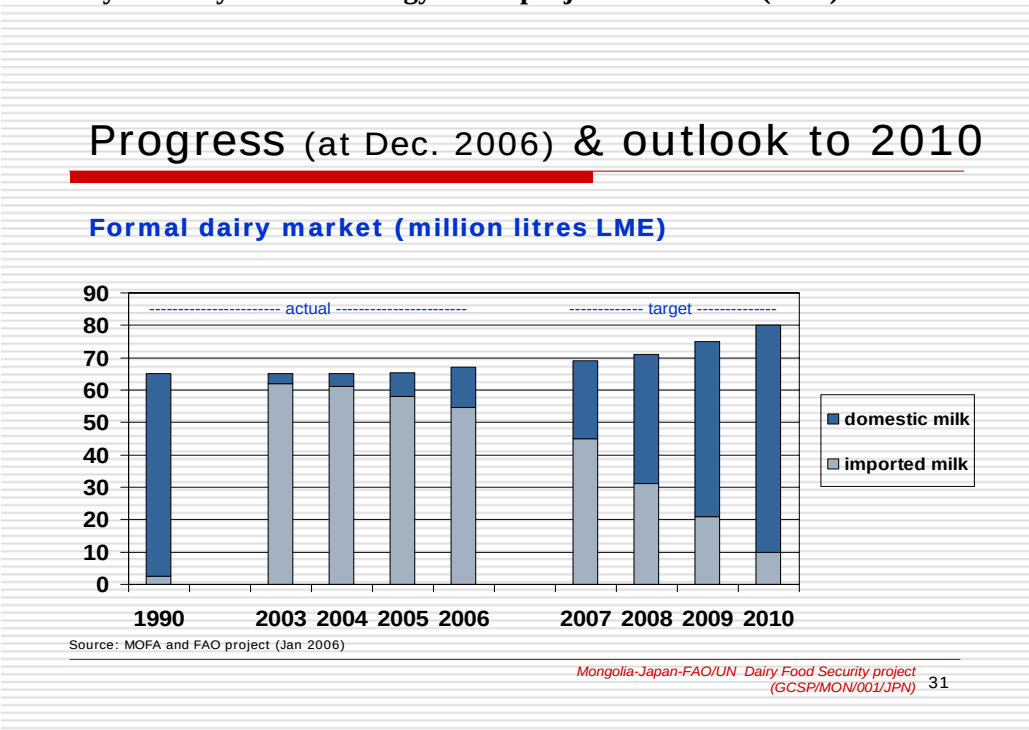
A National Dairy Task Force, representing all public- and private-sector stakeholders, was set up in 2005 to guide the industry's re-building process. The revival strategy was based on an analysis of the dairy industry and approved by the stakeholders at a national workshop. It embraced a sector-wide, cow-to-consumer dairy food chain approach to be implemented under the following thematic programmes: i) milk-production enhancement, ii) milk-marketing enhancement and iii) capacity-building and training.

In line with government policy, the revival strategy is directed initially at the three central *aimags* where: i) the majority of the urban population live, ii) most cattle are found and iii) the main cropping areas are located and thus crop by-products are accessible for feeding. Initial interventions were based on matching modern technologies and know-how to local market needs in order to: i) persuade urban consumers to consume more domestic milk and milk products, ii) reduce post-harvest losses by linking milk producers with consumers through processors; and iii) substitute imported milk and dairy products with quality domestic products.

With public- and private-sector partners, the three thematic programmes have been operationalized through six commercial dairy modules (or investment packages) covering each link in the cow-to-consumer dairy chain. These have been backed up with supporting activities that include: i) a permanent National Dairy Training Centre at the Food Technology College in Ulaanbaatar, which provides practical, vocational and outreach/field training for each of the modules; ii) a pioneering animal genetic improvement scheme; iii) an innovative retailing concept in which processors collaborate to sell their products, including certified raw chilled milk and traditional products at the "one-stop" milk sales centres; iv) the first generic branding and advertising campaign in Mongolia; v) an innovative public–private sector partnership school lunch programme based on local milk, vi) working with the food standards and inspections authorities to train and certify milk traders; and vii) setting up the Dairy Steering Group under the Mongolian Food Processors Association to sustain the activities.

Initial results have been encouraging. By mid 2007, 16 commercial modules/units were in operation, with the National Dairy Programme sharing the investment risks with its partners by contributing up-to-date know-how and limited equipment (approximately $350 000). The partners invested about $1.3 million in equipment and buildings. The quantity of domestic milk entering the formal market in 2006 was 11.7 million litres, up from 2.5 million litres in 2003. This is expected to increase to 18 million litres in 2007. Private investors, including the two companies reconstituting imported FCMP, were expected to invest upwards of $10 million in the modules in 2007 and 2008.

Figure 1: The dairy industry revival strategy's mid-project assessment (2006)



Source: Agricultural development strategy of Mongolia (2006–2015), Government of Mongolia, 2006

Small-scale dairy farmers

Characteristics

"Smallholder" is not a term that can be applied in Mongolia because all grazing land is communal – owned by the State (see the definitions in Box 5). By law, households in city areas are entitled to 0.5 acres of land and those in other areas to 0.7 acres. Since the collapse of the state collective dairy farms, small milk producers have dominated milk production. They comprise two main groups: i) traditional nomadic herder households with mixed herds of up to 200 or more animals and ii) peri-urban households with up to 20 milking cows. A growing group (currently 300-plus) of larger dairy farms, with 20–40 milking cows, have been established between 50 and 100 km from Ulaanbaatar and other urban centres.

Generally speaking, a dairy farm is classified as a small mixed-livestock farm within a 50–100-km radius around a centrally located area, provincial centre or city, which has winter shelters for cattle and the ability to make hay and fodder. According the 2006 livestock census, there were 8 012 dairy cattle kept on 395 dairy farms – an average of 20 animals per farm. Of them, more than 80 percent were located near Ulaanbaatar, the capital city, and in Tov and Selenge *aimags*, the main crop areas of the country. Small dairy farmers usually have their own market outlets and deliver raw milk to: i) milk processing units, ii) food/dairy markets, iii) small food stores or kiosks and institutions (canteens, hospitals, sanatoriums, schools, kindergartens).

Box 2: Jargalkhand, a nomadic herder, successfully transitions into dairying

Jargalkhand, a nomadic herder from Jargalant bag *(village), lives in a remote area of Tov* aimag, *200 km from Ulaanbaatar. A now-single mother with two teenage children, she used to be employed by a state cooperative farm but lost her job after privatization and was given three milk cows, a few goats and sheep as compensation. Since then she has struggled to provide for her family. In 2000 she started to sell milk to a middleman, T. Buuveibaatar, who was then collecting about 2 000 litres of milk daily from 60 households. In 2004, Mr Buuveibaatar worked with the Government's industry-revival project, setting up the model milk-collecting and milk-processing modules. Mr Buuveibaatar now runs a dairy company called Monkhiin Suu (Endless Milk) and collects 8 000–10 000 litres of milk daily in the summer from 280 herding households. Some of the milk he processes for sale in nearby Baganuur city, including for schools; some he sells chilled in Ulaanbaatar.*

Because she now has an assured market for her surplus milk, Mrs Jargalkhand has been able to invest some of her earning from milk in buying more cows. She now has ten milking cows and sold 7 200 litres of milk to Monkhiin Suu in 2006 for a gross income of 1 440 000 tögrög ($1 240). While it is too early to assess the impact of the milk production on her daily life, she likes the regular income that selling milk brings, which she uses for school fees and purchasing other family items, such as flour, rice and sugar, without borrowing money. Mrs Jargalkhand also appreciates having the Dairy Service Centre and veterinarian on call to attend to her livestock – her only assets.

Revival of the dairy industry in Mongolia depends on small producers and on their capacity to increase production of quality milk at prices that enable processors to compete with imports, both as finished products and as milk powder for reconstitution. Small milk producers are reported to be the most profitable type of farmers in Mongolia (World Bank, 2004). In 2007, milk producers linked to formal markets received between 150 and 300 tögrög ($12–$.25) per litre for milk in summer, when 80 percent of the milk supply is produced (depending on the distance from the market; Annex II-a). In winter they are paid between 350 and 500 tögrög ($.29–$.42) per litre. Winter prices were not competitive with subsidized imports from Europe until this year (2007) when the worldwide shortage of FCMP drove liquid milk-equivalent prices up to more than 600 tögrög ($.50) per litre.

The 2006 livestock census reported that 225 400 households (36 percent of the total) owned on average 152 head of livestock; of them, 170 800 households (27 percent) were classified as herding families engaged in livestock raising, owning on average 204 animals. Rural families with less than 50 head of livestock are considered poor households. Herds consist of cattle, horses, camels, sheep and goats. After more than 15 years of market transition, herding families have started to form groups to work together in marketing their produce (such as wool, cashmere, hides and skins, meat and traditional dairy products). The formation of herding groups is largely based on family membership, seasonal pasture location or *bag* (smallest local administrative unit) location.

Traditional dairy food chain model

Traditional dairy products are hugely important. Along with meat, they were, until very recently, the main foods for nomadic families in the long, cold autumn-winter-spring period (October–May). All the milk is used. When the quantity of milk or by-products is too small to process, it is accumulated over a number of days, allowed to sour naturally and then processed.

Though more than 100 regional varieties are produced, traditional products are broadly classified as fat- or protein-based or fermented. Many are unique, such as *airag* (beer fermented from mare's milk), for which the mares are milked every two hours, night and day, during the short summer, and *shimiin arkhii* (vodka distilled from fermented milk). There is also the ubiquitous *suuthe tsai* (salted tea) offered by all households to visitors and restaurants to customers.

Fat-based products: *urum* (cream), *shar tos* (ghee or clarified butter), *tsagaan tos* (white butter from camel and goat milk), *airgiin tos* (cream wafers)

Fermented products: *airag, khoormog* (sour camel milk), *undaa* (fermented drink), *tarag* (yogurt), *tsegee* (sour milk)
Protein-based products: *byaslag* (cheese), *aarts and aaruul* (fermented dried curd), *khuruud, eezgii* (evaporated curd)

These foods are produced out on the steppe in summer and by peri-urban households for both domestic consumption and selling. Traders buy and gather the products and either sell directly or as wholesale to other retailers in the *suu* (milk) markets found in all trading centres and urban areas. Though no studies have been carried out and quality is often highly suspect, it is understood that producing and trading in traditional dairy products is highly profitable. Many of the larger processing dairies now produce and market their own traditional product brands.

Modern dairy-food chain model

The modern dairy-food chain model evolved from the lessons learned during food security analysis and consultations and is inclusive of all milk producers, irrespective of type and size (nomads, peri-urban households, small-scale dairy farms). The model links producers to small- and large-scale processors with a module for each link in the cow-to-consumer dairy-food chain. There are six vertically integrated modules, each capable of being adapted to the local situation and each of which must be profitable. The modules include: i) milk producer organizations (MPOs), ii) dairy service centres, operated on a full cost-recovery basis by private veterinarians, iii) milk-collecting packages, iv) milk-cooling centres, v) milk-processing units and vi) "one-stop" milk sales centres. The modules are supported by many innovative training and marketing features and have been mainstreamed into the National Dairy Programme for the period 2007–2016.

Box 3: A verterinarian survives the economic transition

Dr Chantu used to be a government veterinarian. He was made redundant when the state farming system collapsed in the 1990s during the abrupt change from a state-run to a market-led economy. He set up as a private vet and also leased land at Nomgon soum in Selenge aimag for growing wheat. His income rarely covered his expenses, so, like other farmers and herders in the area, he added milk production to his farm business. He uses crop residues to feed his cows. In 2005 he became a founder-member of the Nomgon Suu Milk Producers' Cooperative, set up with support from the Government's dairy industry-revival project. The project also provided the model milk producer organization (MPO) module along with a model milk-collecting module (3-tonne truck, milk cans, Lactoscan rapid milk analyzer, training). The MPO currently has 18 members who sell around 800 litres of milk and traditional products daily in nearby Darkhan City. The MPO has savings of some 300 000 tögrög, earned from various services provided to members.

In 2006 Dr Chantu was appointed manager of the new, model Dairy Service Centre, set up by the MPO to provide its members with support services. Dr Chantu attended four vocational courses organized by the National Dairy Training Centre (NDTC) on subjects such as dairy cow breeding, establishing MPOs and clean milk production. Today Dr Chantu provides MPO members and other farmers and herders in the area with animal health and diagnostic services and also breeding and other support, including training through the NDTC's outreach programme. Since 2006, he has inseminated more than 300 local cows with Simmental semen provided under the piloted dairy cow genetic-improvement scheme, which has produced some 240 calves. By spreading his risks, Dr Chantu now has a profitable business, driven mainly by earnings from his daily milk sales. He believes that his Simmental-crossed animals perform best under the harsh Mongolian climatic conditions.

The chart in Annex I shows the informal and dairy chains that link small herders and dairy farmers with consumers in large urban areas (populations of more than 25 000), such as Ulaanbaatar, Darkhan, Erdenet and Zuunhaara, and smaller *aimag* centres with populations from 5 000 to 25 000.

Box 4: A product of the revival strategy: Erdenet Khaan Suu Dairy Co. Ltd

Khaan Suu (King Milk) started business at the end of 2006 and currently processes up to 5 tonnes of milk per day. It is the only milk-processing facility in Erdenet City, now the second largest city in Mongolia. The owner, Ganbold Ariunbileg, invested 500 million tögrög ($430 000) processing equipment from China and Russia to make ice cream and yogurt. The company employs 138 staff in its milk collection-processing-marketing operations – one employee for every 15 litres of milk. Eighty percent of the staff are women. The Government's dairy industry-revival project provided Mr Ariunbileg its milk-collecting module and training for key technicians to demonstrate and promote the buying of quality milk from Mongolian milk producers. The company currently buys about 2 tonnes of milk daily from 15 herders, at 200 tögrög per litre. Tos *(sour cream) and* aarts *(curd) are purchased from another 25 herders. Khaan Suu's main products are yogurt and ice cream, which are sold in the cities of Erdenet (20 percent), Darkhan (20 percent) and Ulaanbaatar (60 percent), some 350 km away.*

The natural and flavoured yogurt lines wholesale at 600 tögrög per 500 ml carton (1 200 tögrög per litre) and the ice cream lines at 100 tögrög per 50 ml cone (2 000 tögrög per litre). Salres are currently 50–60 million tögrög per month. The company had planned to double throughput to 4 tonnes daily in 2008 by investing in one of the low-cost model milk-cooling centre modules pioneered by the project. In September 2007, the company began supplying milk juices (made with natural Mongolia berries and fruits) to 10 000 children in Erdenet, through the national school lunch programme. The company also retails it products through a one-stop milk sales centre module in Ulaanbaatar. Due to rising demand, Khaan Suu will launch a range of fresh and flavoured pasteurized milk and milk-juice lines in the Erdenet market in 2008.

Prospects

The transition to the market economy in the early 1990s culminated in today's enterprise-oriented dairy industry, based largely on milk produced by small producers. The strategic lessons and prospects for dairying and small milk producers in Mongolia are listed below. These have been translated into a focused strategy – the National Dairy Programme (NDP), which involves a mix of government and (mainly) private sector investment over the period 2007–2016.

- **Small milk producers**: Re-building the milk collection-processing marketing infrastructure, with a focus on small milk producers, milk quality and training, has driven the dairy-revival process. More effort should now be placed on improving productivity at the farm level.
- **Modern dairying model**: The sector-wide, integrated industry re-building strategy aimed at ensuring that each link (module) in the dairy chain is profitable and is encouraging private-sector investment.
- **Dairy institutions**: Setting up the National Dairy Task Force (later re-named the NDP Working Group) to guide the overall programme and the enterprise-oriented Dairy Steering Group under the Mongolian Food Processors Association enhanced coordination, giving the industry a more powerful voice in promoting local milk by focusing on quality and safety; generic branding, labelling and advertising helped to re-build consumer confidence in local milk.
- **School milk**: Promoting local milk and dairy products through the school lunch programme has the dual impact of improving nutrition and providing a market for local milk producers.
- **Costs and competitiveness**: Milk production costs and farmgate prices are now competitive with imported FCMP, notwithstanding the current 5 percent import tariff. Farmgate prices in summer ($.12–$ 25 per litre) for milk produced under the semi-intensive, peri-urban system are competitive with the most efficient Western countries, provided Western subsidies are discounted. Producer prices are even lower for milk produced by herders and small producers in more remote areas.
- **Traditional dairy products**: These items will continue to be important, high-value-added and profitable products. The potential to export Mongolia's unique mare milk-based and camel milk-based functional foods should be explored under a "green" ecological generic brand/label.

- **Legislation**: Updating domestic and import tax legislation has encouraged domestic milk processing; for example, the VAT paid by milk processors can now be offset against the cost of procuring domestic milk.
- **Future growth prospects**: Due to the already high degree of milk availability and consumption levels, at least by Asian standards, once imports are replaced and urban consumption increased, market growth is expected to stabilize around 2–3 percent per annum, assuming disposable incomes continue to grow. With the recent growth of the mining and tourism sectors' gross national income, while still low by Western standards, has been expanding at about 12 percent annually since 2002 and should be capable of sustaining this modest growth forecast.
- **Exports**: Given its small population and high per capita consumption of milk and dairy products, Mongolia will need to look increasingly to exporting clean, quality, niche dairy products to the rapidly growing markets of milk-deficit countries in the region to continue growing its dairy industry in the longer term. This need is recognized in the NDP. With its huge milking herds and vast grasslands, Mongolia has a clear international comparative advantage for producing and exporting clean milk to ecologically conscious markets; hardly any pesticides or animal drugs and no milk-stimulating hormones are used.
- **Investment**: In the short term, investment is most needed to continue the modernizing and expanding the milk-collecting infrastructure and to further improve the productivity and profitability of dairy cows. In the medium term, investments are required to process surplus milk into niche, value-added, easily transportable products, such as milk powder and processed cheese, for export to milk-deficit markets in the north and north-eastern Asia region.
- **Socio-economic benefits**: The extra regular income for small milk producers, the extra jobs created and the availability of affordable, safe domestic milk and dairy products for urban consumers should help improve livelihoods through better nutrition and reduced poverty. The impact of this on small milk producers and consumers and in helping Mongolia to achieve its Millennium Development Goals of halving poverty and halving under-nutrition by 2015 needs to be assessed.

Conclusions and lessons learned

The 2005 analysis of the Mongolian dairy subsector remains valid. The following is a summary of key lessons learned during the re-building process:

- **Revival strategy**: Adopting a sector-wide, cow-to-consumer strategy, inclusive of small milk producers, to revive the dairy industry that relies on practical demonstration modules to ensure each link in the dairy food chain is profitable.
- **Constraints into opportunities:** Basing the strategy on taking advantage of the key opportunities available to the Mongolian dairy industry: i) high per capita consumption, ii) huge milking herds, iii) vast grasslands, iv) imports to substitute, v) export potential for "clean" milk to nearby milk-deficit markets can overcome the present *constraints*: i) low milch animal productivity and poor-quality milk; ii) lack of market access for milk producers, iii) obsolete infrastructure and equipment, iv) lack of up-to-date technical know-how and skills.
- **Committed partners**: Careful selection of public- and private-sector partners and collaborators has led to cost-sharing and responsible ownership of the model dairy demonstration modules; divesting ownership of the old state dairy in Ulaanbaatar revitalized the company.
- **Policy**: The Government has ensured consistency between its food, agriculture and tax policies by mainstreaming activities into the new ten-year National Dairy Programme (2007–2016).
- **Increasing milch animal productivity**: Having more animals is less vital than each animal's productivity to sustainably increase small milk producers' incomes; priority should be placed on services that provide immediate impact, such as feeding, artificial insemination using appropriate dual-purpose breeds, and animal health, while concurrently introducing genetic improvement.
- **Capacity-building**: Placing priority on establishing a permanent vocational and outreach training facilities – the National Dairy Training Centre – at the Food Technology College in Ulaanbaatar have been prudent.

- **Traditional dairy products**: Of continuing importance, they provide good returns to small-scale milk producers and processors.
- **School lunch (and milk) programme**: Linking small-scale milk producers and processors as well as larger-scale processors to the programme has facilitated the dairy sector's revival process while introducing/re-introducing children and their parents to the nutritional benefits of local milk.
- **Earnings and employment**: Access to milk markets provides nomadic herders and rural households with regular earnings and the dairy food chain provides many rural and urban off-farm jobs, especially for women – up to one job for every 15 litres of milk collected, processed and marketed.
- **Dairy equipment and supplies**: These are only worthwhile if they are appropriate, affordable and available, such as made and maintained locally or imported from nearby counties through local agents.

Box 5: Key definitions

Small-scale milk producer: "Smallholder" is not really a term that can be applied in Mongolia because all land is owned by the State, so the term "small-scale milk producer" is used for this report. A small milk producer is a nomadic herder or peri-urban householder with up to 200 livestock (cows, yaks, camels, horses, sheep and goats). Rural families with less than 50 livestock are considered to be poor. After 10–15 years of market transition, herders have started to form herding groups due to the necessity to work together for the marketing of their agricultural products, such as wool, cashmere, hides and skins, meat and traditional dairy products. Membership of herding groups is usually based on: i) the family unit, ii) seasonal pasture location or iii) the *bag* (smallest administrative unit) location.

Small-scale dairy farmer: Someone who: i) possess 10–40 cows, ii) lives within a 50–100-km radius from the *soum* (district) centre, the *aimag* centre or a city, iii) possesses winter shelters for cattle and iv) can prepare hay and fodder for winter feeding. Small dairy farmers usually have their own market outlets and deliver raw milk to: i) milk processing units, ii) food/dairy markets, iii) small food stores or kiosks and iv) institutions (canteens, hospitals, sanatoriums, schools, kindergartens).

Informal milk market: Direct cash sale of raw milk and traditional dairy products at a food market or home delivery by farmers and herders themselves or by middlemen-milk collectors, who deliver milk to small family shops, stands, local kindergartens, canteens or hospitals, without any registration or license from local authorities.

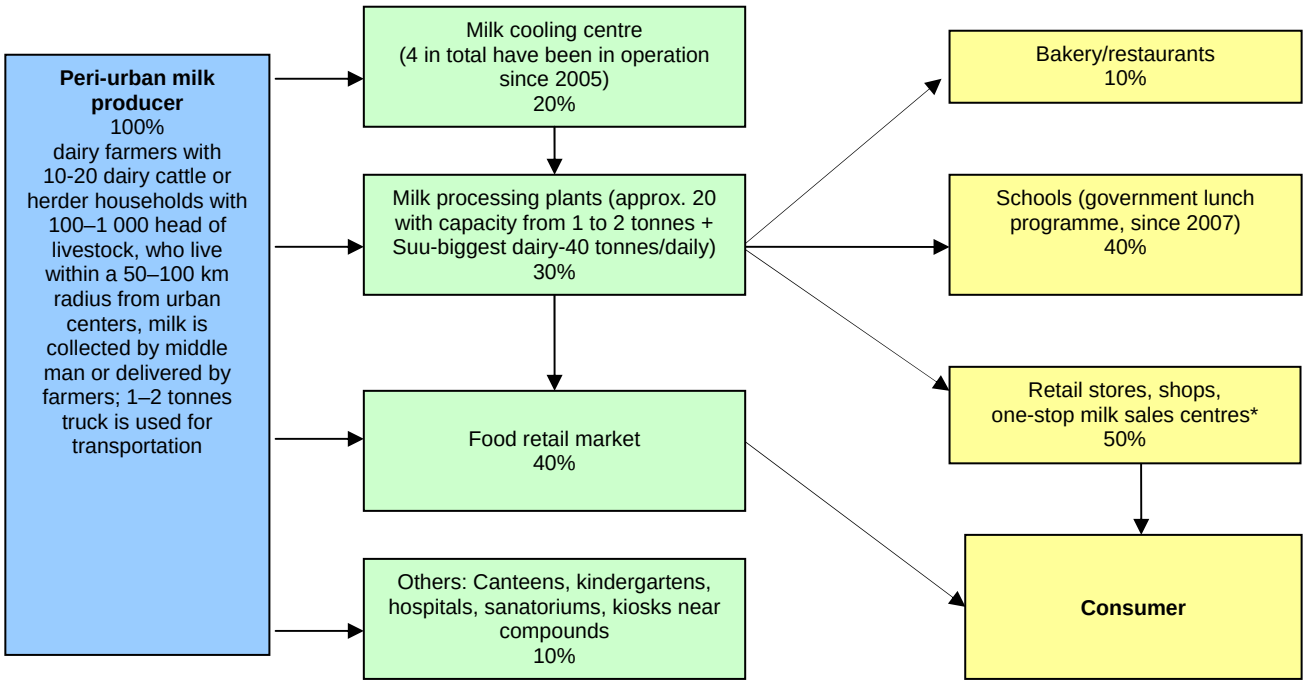
Formal milk market: Industrial use of milk by processing plants and units (milk collection, transportation, reception, processing with various equipment lines, packaging, ready products, distribution networks, returns and others). The quantities of raw milk sold as a raw material, which is processed and sold as a finished product, are registered and included in the official statistical monthly and annual bulletins.

Home retention: Milk that is **s**pilled, spoiled, consumed because the farmers has no access to a market, a traditional dairy product with a long shelf life that is consumed in winter (such as *aaruul*, *aarts*, *eezgii*, *shar*, *tsagaan tos* or is served to visitors is characterized as home retained. **Note:** In the traditional way of milk processing, the definition of *spoilage* cannot be used because the non-treated milk is collected gradually for natural fermentation in a bulk container (skin sack, wooden barrel, plastic drums) for further processing into products such as *aaruul* (dry curd), *aarts* (semi-dried curd), *shimiin arkhii* (milk vodka), *eezgii* (evaporated curd in own whey), *shar*, *tsagaan* and *tos* (melted butter or ghee).

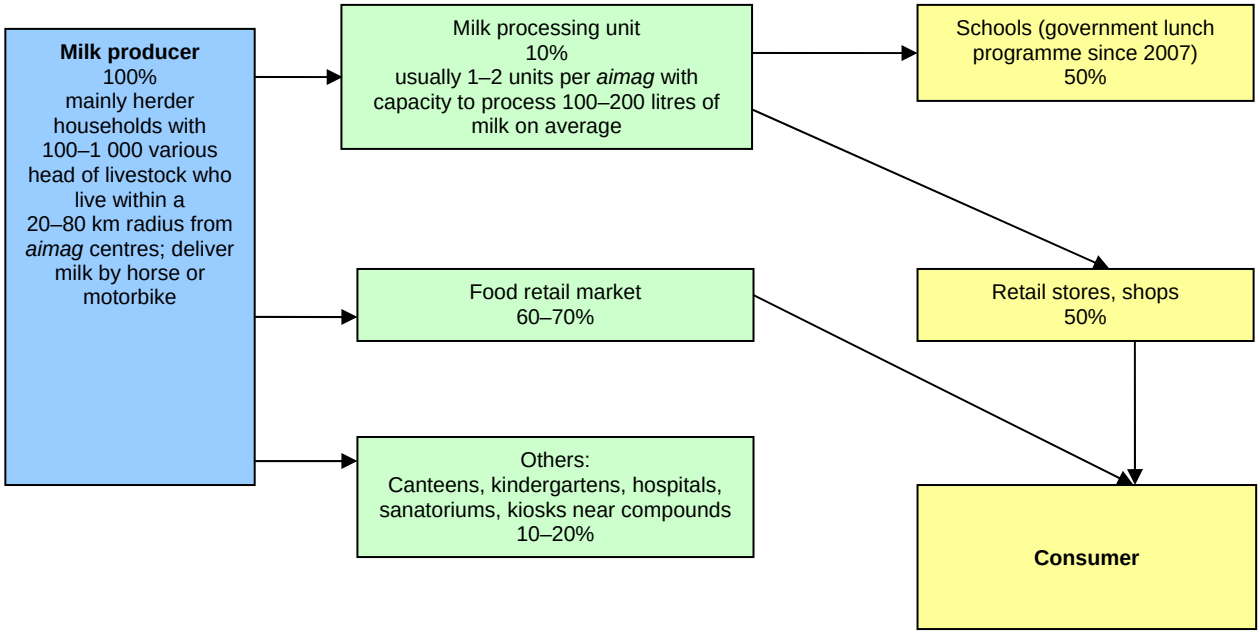
Post-harvest milk "losses": Surplus milk that producers are unable to sell due to no access to market, which is retained and used at home.

Dairy value chain: The stages in the cow-to-consumer food chain (see the milk flow chart in Annex I).

Annex I: Milk flow chart for Ulaanbaatar, Darkhan, Erdenet, Zuunharaa – big urban centres



Milk flow chart at *aimag* provincial centres (residents are considered as urban dwellers)



Annex II-a: Consumer milk price (tögrög) by region and season* (2006–2007)

1. Arvayheer: Ovorkhangai *aimag* centre (central region)

	Jan-Feb	March-April	May-June	July-Aug	Sep-Oct	Nov-Dec
Sheep milk	-	-	700-600	500	-	-
Goat milk	-	-	700-600	500	-	-
Cow milk	-	1000	700-600	500	600	800
Yak milk	-	-	700-600	500	600	-
Mare milk	-	-	1 000-700	600-800	800-900	-

2. Ulaangom: Uvs aimag centre (western region) – 29 600 residents

	Jan-Feb	March-April	May-June	July-Aug	Sep-Oct	Nov-Dec
Goat milk	-	-	400	300	-	-
Cow milk	700	500	350	300	400	500
Mare fermented milk-airag	-	-	-	900-1000	1000	-

3. Dalanzadgad: Omnogobi *aimag* centre (south region) – 32 400 residents

	Jan-Feb	March-April	May-June	July-Aug	Sep-Oct	Nov-Dec
Sheep milk	-	-	-	500-800	-	-
Goat milk	-	-	-	800-1 000	-	-
Cow milk	-	-	700-600	600-700	600-700	600-700
Camel milk	-	-	1 200-1 000	-	1 000-1 200	1 000-1 200
Mare fermented milk-airag	-	-	-	1000-800	800-1 000	-

4. Choibalsan: Dornod *aimag* centre (eastern region) – 53 600 residents

	Jan-Feb	March-April	May-June	July-Aug	Sep-Oct	Nov-Dec
Cow milk	500	500	300	300-400	400-450	500

5. Ulaanbaatar: capital city – 965 300 inhabitants

	Jan-Feb	March-April	May-June	July-Aug	Sep-Oct	Nov-Dec
Cow milk	500-600	500	400-300	300-400	400	500
Fermented mare milk-airag	-	-	-	1 000-800	800-1 000	-

6. Darkhan: second city – 82 400 inhabitants

	Jan-Feb	March-April	May-June	July-Aug	Sep-Oct	Nov-Dec
Cow milk	500-600	500	400-300	200	300-400	450-500
Fermented mare milk-airag	-	-	-	1 000-800	800-1 000	-

* Average retail market price for 1 litre of milk; 100-150 tögrög is added to the farmgate price for informal market sales; milk processors pay 50-100 tögrög less, if they have permanent supplies or own farms.

Source: Provincial Food and Agriculture Agencies, August 2007 (data incomplete).

Annex II-b: Milk prices in Ulaanbaatar's main dairy market (1990–2007)

Year	Farmgate (tögrög/litre)			Consumer (tögrög/litre)			Local milk powder price (tögrög/kg)	Average exchange rate
	Low	High	Ave.	Raw	Past.	UHT*		
1990								
1991								
1992								50 tögrög
1993								200 tögrög
1994								400 tögrög
1995	150	400	250	300	400	-	1 500	400 tögrög
1996	150	400	250	300	400	-	1 500	700 tögrög
1997	150	400	280	300	400	-	1 800	800 tögrög
1998	150	400	280	300	400	-	1 800	800 tögrög
1999	200	400	285	300	400	-	1 800	800 tögrög
2000	200	400	290	300	400	-	2 000	1 000 tögrög
2001	200	400	330	400	500	-	2 000	1 000 tögrög
2002	200	400	350	400	500	-	2 000	1 000 tögrög
2003	200	400	350	400	500	700	2 200	1 160 tögrög
2004	200	400	385	400	500	700	2 500	1 170 tögrög
2005	200	450	390	400	600	800	2 800	1 190 tögrög
2006	200	450	395	500	600	850	3 000	1 160 tögrög
2007	250	450	395	500	650	900	3 500	1 180 tögrög

(US$1= 1,187tögrög)

* First UHT plant with Tetra Pak packaging was started by a New Zealand-Mongolia joint company in January 2003.

Source: Suu Milk Shareholding Co., Monsuu Co. Ltd and GUM Co. Ltd, the main dairy companies operating in Ulaanbaatar; selected available data, August 2007.

Pakistan: A dairy sector at a crossroads

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Overview of the milk economy

Pakistan is the sixth most populous country in the world, with an estimated population of over 160 million,[25] growing at a rate of more than 1.8 percent per annum. Agriculture, being the mainstay of the economy, generates 20.9 percent of the total GDP and employs 43.4 percent of the total workforce.[26]

With an almost 50 percent contribution, livestock is by far the most important subsector in agriculture. In the past ten years, the subsector grew by an average of 5.8 percent.[27] The share of livestock in agriculture growth jumped from 25.3 percent in 1996 to 49.6 percent in 2006.[28] The higher growth in the livestock sector has been mainly attributed to growth not only in the headcount of livestock, which is commercially important, but also in milk production. Within the livestock sector, milk is the largest and single most important commodity. Despite decades of oversight by the Government, Pakistan is the fifth-largest milk producer in the world.[29] According to the 2006 livestock census (Table 1),[30] milk production had increased by 36 percent since 1996.

Table 1: Relative increase in milk production over the past two decades

Type of animal	Gross annual production ** (billion litres)				% change between
	1986	1996	2006	1986 & 1996	1996 & 2006
Cows	7.07	9.36	13.33	32.4	42.4
Buffalo	14.82	18.90	25.04	27.5	32.5
Total	21.89	28.26	38.37	29.1	35.6
*** Calculated using average annual lactation length of 250 for cows and 305 days for buffalo.*					

Source: Economic survey of Pakistan 2007

Production base

Despite being the most lucrative livestock product, milk production is the least commercialized enterprise in the agricultural economy. The majority of the national livestock herd is distributed in small units throughout the country. About 55 million landless or smallholder farmers produce the bulk of the country's milk supply.

Buffalos and cows are the major milk-producing animals. According to a FAO study on milk marketing in Pakistan in 2003, 80 percent of the milk in the country was collectively produced by rural commercial and rural subsistence producers. The peri-urban producers account for 15 percent of the total production, whereas urban producers contribute 5 percent.[31] Annex III shows the distribution of milk as it moves along the various links in the overall supply chain.

According to the 2006 livestock census (Table 2), 51 percent of the 8.4 million reported dairying households owned 1–4 animals, 28 percent of dairying households maintained herd sizes of 5–10 animals; another 14 percent had herds of 11–50 animals). Only 7 percent of the dairying farms in the country could be considered large, with more than 50 animals.

[25] Population Census Organization, 2007
[26] *Economic survey of Pakistan 2007*
[27] *Economic survey of Pakistan 2006*
[28] *Pakistan livestock census 2006*
[29] Husnain and Usmani, 2006
[30] A national livestock census is taken every decade. Thus, the 2006 census is of particular importance.
[31] SSI-NARC, 2003

Table 2: Herd size by household

No. of animals	Ownership by household (%)
1–2	27.32
3–4	23.73
5–6	14.32
7–10	13.68
11–15	6.29
16–20	2.65
21–30	2.58
31–50	2.71
51 or more	6.72
TOTAL	**100**

Source: Pakistan Livestock Census, 2006

Supply and demand

As a food item, milk (both milk and liquid milk equivalents) is second only to cereals in the level of per capita consumption in Pakistan,[32] which nationally is 190 litres.[33] Province-wise, per capita consumption stands at 246 kg in Sindh, 132 kg in Punjab, 86 kg in North-West Frontier (NWFP) and 108 kg in Baluchistan.

Due to rising inflation and high poverty levels, the majority of Pakistani consumers are price conscious. Therefore, demand for raw milk is large compared to processed milk. Hence, raw milk is the primary dairy product marketed in the country. More than 90 percent of the marketed milk is collected and sold unprocessed through the informal market by a multi-tiered layer of marketing agents.

The supply of milk to meet domestic demand has usually lagged. To fill the gap, powdered milk is imported every year. From July 2006 to November 2007, dairy products[34] worth 2 320 million rupees (US$38.6 million)[35] were imported. The Statistics Division lists the products as “milk and milk food for infants”.

Milk markets and chains

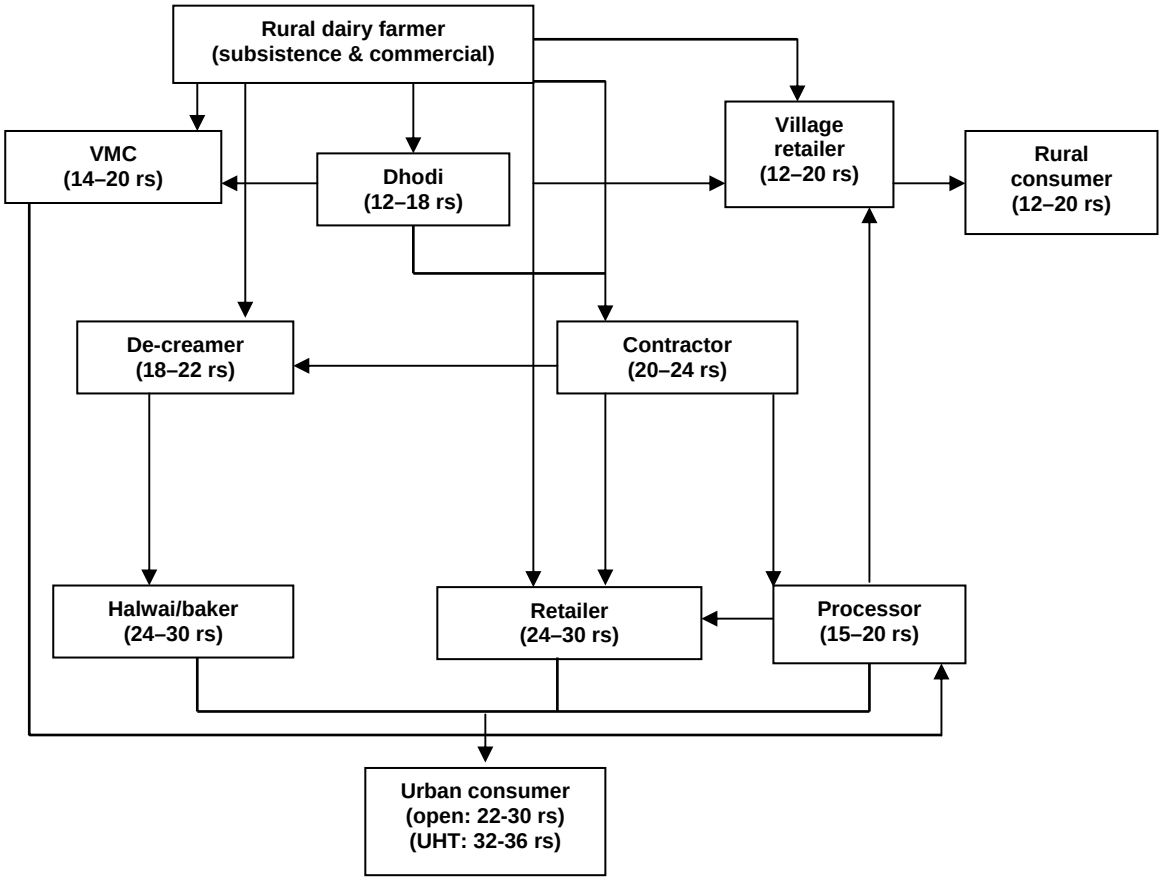
Milk markets in Pakistan can be classified into three categories: rural, urban and international. Similarly, the three marketing chains in Pakistan are rural, urban and processed marketing chains, as the following explains.

Rural marketing chain

A significant proportion of the milk produced in rural areas is consumed at source within the hamlet or village, either through farmstead consumption or in some cases, direct sales by the farmer to the neighbourhood. The remaining 30–40 percent is marketed through an intricate marketing chain, consisting of multiple layers of intermediaries. Figure 1 elaborates the rural milk marketing chain and the price of milk at each node in the chain.

[32] SSI-NARC, 2003
[33] Pakistan dairy development company, 2006
[34] Milk, cream and milk food for infants
[35] Statistics Division, 2007

Figure 1: Rural marketing chain (estimated procurement prices at rupees per litre)



Source: Market information, 2007

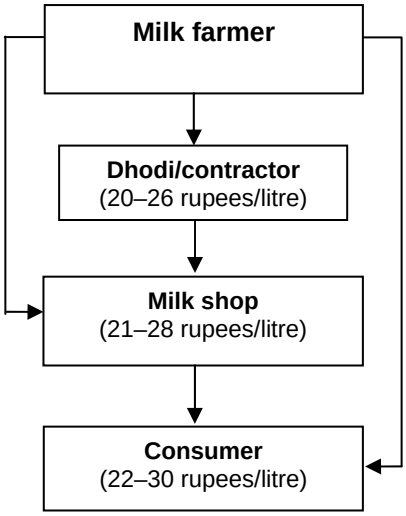
Urban marketing chain

Urban consumers in Pakistan consume an estimated 9–12 million litres of milk every year. To satisfy some of this demand, milk is produced in urban and peri-urban areas of the country, accounting for 5 percent and 15 percent of the total milk production, respectively. Because this quantity is not sufficient to meet the entire urban demand, the deficit is met by rural producers.

Peri-urban dairy farms are located on the outskirts of major cities. These are usually owned by market-oriented farmers and can be classified into two general groups, distinguished by herd size. Most operate on relatively small scale, owning 10–50 dairy animals. The larger farmers usually own up to 500 dairy cows. This latter category of farm is either owned and operated by a progressive farmer individually or is part of the peri-urban cattle colonies.

As depicted in Figure 2, the urban milk marketing chain, the producer has relatively more control over the supply because the consumer is easily accessible and is also willing to pay a high price for milk. Hence, in many instances, farmers in the urban milk marketing chain integrate production and marketing functions in their operations. Instead of relying on a middleman, they sell the milk directly.

Figure 2: Peri-urban marketing chain (estimated procurement prices at rupees per litre)

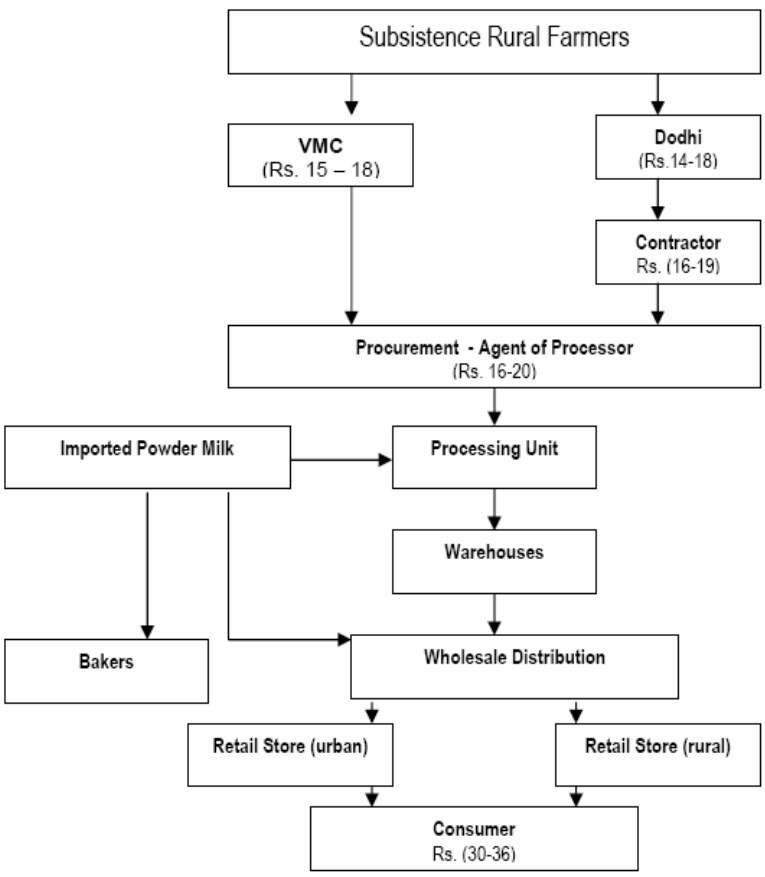


Source: FAO. 2006. Analysis of milk marketing chain, Pakistan

Processed marketing chain

Most of the milk in the country is marketed in raw form. According to industry estimates, only 3–5 percent of the milk is marketed through formal channels as processed milk. Currently, there are more than 20 dairy processing plants operating in the country. The major product produced by them is UHT or pasteurized milk. Other products include powdered milk, butter, cream and lassi. Figure 3 depicts the marketing chain for UHT milk.

Figure 3: Marketing chain of UHT milk (estimated procurement prices at rupees per litre)



Source: FAO. 2006. *Analysis of milk marketing chain*, Pakistan

Constraints

Milk production and marketing in Pakistan is exclusively dominated by the informal private sector, consisting of various agents, each performing a specialized role at the relative link in the supply chain. These consist of producers, collectors, middlemen, processors, traders and consumers.

As previously noted, only 3–5 percent of the country's total milk production is marketed through formal channels. The remaining 97 percent is produced and marketed in raw form by informal agents in the marketing chain. The following is an overview of the informal and formal channels as a way of imparting a description of the opportunities and problems associated with dairying enterprise in Pakistan.

Informal production and marketing channels

Subsistence farmers constitute the majority of dairy farmers in the country and are responsible for 70 percent[36] of the milk produced. They own one to five milk-producing animals. The following characteristics typically define the informal production and marketing channels.

Productivity

Due to lack of proper management practices and poor breeding, animal production tends to be very low. This results in low farm profitability and reduced national productivity. For instance, in comparison with, say, Germany, there are three times as many dairy animals in Pakistan but the milk yield is only one-fifth.[37]

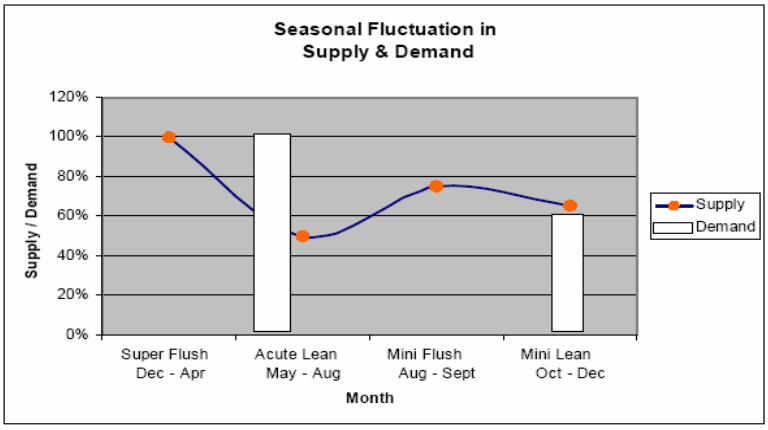
Seasonality

Production and consumption of milk in Pakistan are affected by seasonal fluctuations (Figure 4) that are at relative odds with each other. Milk production is associated with the availability of green fodder and is at its maximum between January and April, hitting a low from May to August. Alternatively, milk consumption is low during the winters and is at its peak during the summer due to heightened preference among consumers for products such as lassi, yogurt and ice cream.

Unorganized farmers

Smallholder dairy farmers in Pakistan are unorganized and mostly carry out production and marketing in isolation from each other. The highly fragmented production base particularly hampers farm profitability. Where it occurs, collective marketing enables individual farmers to reach more markets and results in increased revenue.

Figure 4: Seasonal fluctuation in supply and demand



Source: Umm E. Zia, 2006. *Analysis of milk marketing chain*

[36] R.H. Raja, 2003
[37] IFCN, 2003

Financial services

For smallholders, milk sales are a way of regular cash flow, and the livestock owned by them constitutes an invaluable asset.[38] But in the absence of financial services, such as insurance and credit, they do not have a financial recourse in times of emergency, such as livestock disease or mortality. Similarly, smallholders do not have ready access to credit that enables them to improve their enterprise, such as the addition of improved marketing infrastructure.

Market exploitation

Smallholders have to rely on middlemen to market their produce. Drawing on their monopolistic role, middlemen can exploit farmers by paying low prices, executing binding sales contracts and not passing on gains when prices are seasonally high in response to lower supply.

On the other hand, in their capacity, middlemen also fill the gap of essential support services, such as provision of credit and veterinary care.

Infrastructure

To ensure product quality, proper transportation of milk also requires a cold chain. But agents in the marketing chain in Pakistan rarely have access to cold storage facilities; consequently a major portion of their milk is lost. According to an Asian Development Bank report an estimated 15–20 percent of the total milk production in some areas is lost due to the unavailability of cold storage.

The primary reason behind the unavailability of cold chain facilities is the operating expense. For instance, the purchase cost of a 1 000-litre capacity cooling tank is approximately 300 000 rupees ($5 000), a sum well beyond the reach of a small farmer. Also, cooling tanks are affected by the absence of electricity in rural areas. Where the Government supplies electric power, it is expensive because dairy farmers do not get subsidies similar to the ones given to agricultural farmers on equipment (such as tube wells).

Input–output price

By regulating the price of milk, the Government plays a significant role in milk marketing.[39] Because the law generally gives broad authority to the local government in setting foodstuff prices, the specific law followed can be different from one locality to another within a province (see Box 1 for a description of the two common laws used in regulating milk prices).

Under the law, the Provincial Food Department can declare various commodities, including milk, to be foodstuff. A District Price Review Committee regularly reviews milk prices; it can set different prices for different localities in the district. The committee consists of representatives from the livestock department, dairy farmers, milk retailers and consumers.

When the committee re-sets a price, a notice is circulated among various government agencies and other stakeholders, such as the provincial secretary, the district and town Nazims (mayors), district and session judges, the chief of police, the Information Department, the Food Department, the Agriculture Department, the rationing controller and the official gazette.

Interestingly, in some instances, the local government has used the wrong law while re-setting a price. For example, in the district of Narowal, the Punjab Essential Articles (Control) Act, 1973 is cited even though milk is not listed in its commodity schedule. The price set by districts studied for this case study report varied between 16 and 30 rupees per litre.

[38] The average price of a buffalo is about 50 000 rupees (US$833.33) and of a cow is 35 000 rupees ($583.33)

[39] The two most common laws in this regard are the Balochistan/N.W.F.P/ Punjab/ Sindh Foodstuff (Control) Act, 1958 and the Price Control and Prevention of Profiteering and Hoarding Act, 1977.

Box 1: Legislation affecting the dairy sector

- **The Balochistan/NWFP/Punjab/Sindh Foodstuff (Control) Act, 1958**
  Preamble: Whereas it is expedient in the public interest to provide for the continuance of powers to control the supply, distribution and movement of and trade and commerce in foodstuffs in Balochistan/NWFP/Punjab/Sindh.
  Application: Section 3 – The Government so far as it appears to be necessary or expedient for maintaining supplies of any foodstuffs or for securing its equitable distribution and availability or prohibiting storage, movement, transport, supply, distribution, disposal, acquisition, use or consumption thereof and trade and commerce therein….may provide…
  (b) for controlling the prices at which any foodstuffs may be bought or sold.
  Penalties: **(i)** imprisonment for a term that may extend to three years
  (ii) or fine
  (iii) or both (imprisonment and fine)

- **The Price Control and Prevention of Profiteering and Hoarding Act, 1977**
  Preamble: Whereas, it is expedient to provide for price control and prevention of profiteering and hoarding.
  Application: Section 3 – The Federal Government, so far as it appears to it to be necessary or expedient for securing equitable distribution of an essential commodity and its availability at fair price may, by notified order, provide for regulating the prices, production, movement, transport, supply, distribution, disposal, and sale of the essential commodity and for the price to be charged or paid for it at any stage of transaction therein…
  - for controlling the price, at which any essential commodity may be bought or sold in any area.

  Delegation of powers: The Federal Government may, by notified order, direct that any power conferred on it by or under this Act shall, in relation to such matters and subject to such conditions, if any, as may be specified in the direction, be exercisable also by:
  - such officer or authority subordinate to the Federal Government, or
  - such Provincial Government or such officer or authority subordinate to a Provincial Government, as may be specified in the direction.

  Schedule: A schedule of "essential commodities" listed by the Act includes:
  - milk
  - powdered milk and
  - milk food for infants

  Penalties: **(i)** punishable with imprisonment for a term, which may extend to three years and
  (ii) with fine, which may extend to one lakh rupees.
  Provided that, if a person convicted for an offence punishable under this subsection is again convicted for such offence, the term of imprisonment awarded shall not be less than one year.

Source: Food laws manual, 2006

In contrast, prices of inputs used by farmers for dairy production are not regulated. On the contrary, the prices of some essential inputs have increased by 100–200 percent in the past five to six years (Table 3).

The imbalance between gains in production and output costs has an inverse affect on farm productivity because farmers are barely able to recover their production cost. With growing inflation, this price imbalance recently prompted many well-established large farmers to shut down operations; it also has discouraged new investment in dairy production.

Table 3: Comparison of prices for milk and basic inputs for a dairy farm

Input	Price (rupees) 2000	Price (rupees) 2007	Increase
Milch animal	20 000	60 000	200%
Cotton seed cake	270	560	107.4%
Wheat bran	170	380	123.5%
Maize cake	370	680	83.78%
Fresh milk	20	32	60%

Formal production and marketing channels

Formal marketing is carried out by corporations, which only control 3–5 percent of the county's milk supply. In the past two to three years, the private sector has shown a keen interest in the dairy industry, leading to large-scale investment in refurbishing old plants and, in some instances, setting up new processing units.

Currently, there are more than 25 dairy processing plants, producing UHT milk (predominantly), butter, cream and lassi. Sind and Punjab are the major milk-producing provinces. However, with the exception of Engro Foods, all dairy processors are located in Punjab.[40]

Supply constraints

Dairy processing units collect milk from smallholders situated in the far-flung rural areas of Punjab.[41] This has led to a saturation of supply in the province. The competition has resulted in price wars in collection zones and the establishment of additional processing units by some of the major corporations, such as Nestlé.

Moreover, factors such as lack of cold chains, a fragmented farm base and distance to dairy farmers affect the processing operations. Consequently, none of the processing units is operating at optimal capacity. Hence, many processors have been eying options to reduce or eliminate their reliance on individual smallholders for their supply. Two of the favoured options being considered are i) vertical integration of activities by piloting corporate farming, an idea new to the national dairy practices; and ii) providing additional support services to medium- and large-sized farmers in return for selling bulk quantities of fresh milk to the processors.

Government support

The Government and international donors have been very supportive of the processing industry. This is evident in the 2006–2007 budget in which the Government announced numerous subsidies and tax breaks for the dairy-processing industry, including exemption of sales tax on packaged milk and the subsidized import of processing and other equipment.

Other examples of government and donor championing are the mega projects initiated to improve dairy development; however, almost all of them were designed to immediately benefit medium- to large-scale farmers with minimal practical interventions for smallholders. These include projects such as the Pakistan Dairy Development Company and the Livestock and Dairy Development Board.

Expected future developments

Despite the extensive government support in the form of loans,[42] subsidies, tax breaks and project assistance, many fear the renewed interest in corporate dairy may be short lived. This apprehension is based on several

[40] Collection operations in Sind are problematic due to socio-economic constraints, such as security and road conditions. This has even led Engro to also shift its operations to Punjab by setting up an additional processing unit in the province.
[41] To ensure profitability, the processing industry is forced to purchase milk at low prices from far-flung areas. In these areas, farmers do not have access to the urban fresh milk retail market, which tends to be more profitable for the farmstead.
[42] Most local investors have borrowed heavily from state-run banks to set up dairy processing. This also was the practice during the 1970s and led to the failure of most dairy processors, leading to massive defaults and closures.

underlying factors: i) scarcity of supply and increasing prices of input for smallholders, ii) inability of processors to collect milk required due to transport and cold chain problems, iii) reliance of processors on limited and undiversified products,[43] iv) lack of sustainable farmer-development policies and v) the history of dairy processing in Pakistan (in the 1970s and with the help of the Asian Development Bank, as many as 22 processing units were initiated but failed in a few years due to similar problems).

Smallholder dairy farmers

Currently, the dairy sector has received unprecedented investment from the Government and international donors. However, apart from a few exceptions, most of the programmes are geared towards the development of medium- and large-scale dairy farmers. The following two case studies assess the impact of recent support programmes on smallholder dairy farmers.

Case study 1 – Milk packaging project

The project titled Milk Packaging Project in Central and Southern Districts of the Northwest Frontier Province (NWFP) is an innovative initiative of NWFP's Livestock and Dairy Development Department. It is a four-year effort (2005–2009) with an investment of 13.367 million rupees ($222 783) and adopts a bottom-up approach to develop the province's dairy industry through cooperation between the public and private sectors.

The project was designed to create groups of smallholders, with the ultimate objective of sustainably reducing poverty in remote areas of central and southern districts through increased livestock productivity via the provision or establishment of milk-marketing channels. Project activities include technical and management support services in the form of breed improvement, animal health, feed enhancement, management training for women, training of village extension workers and farmers, establishment of milk collection and processing units, and developing marketing links.

Within the project, dairy farmer groups have been formed in selected villages with the purpose of promoting organized milk production and marketing (see Box 2 for terms of membership). Upon formation of a farmer association in a targeted village, a small milk-collection centre equipped with a cooling tank is set up.

The project was initiated with three partially operational associations collecting an average of 550 litres of milk per day. These initial associations received four cooling tanks and two power generators, which they operate and manage.

However, in a period of just two years, intensified farmer interest in the area led to an expansion of the project and resulted in the number of associations increasing to 36, with a total representation of 873 members and daily collection of 7 275 litres. The number of cooling tanks received has increased to 12.

Box 2: Terms of membership in farmer associations

- *Every farmer must sell at least 2 litres of milk per day to the milk collection centre.*
- *The membership fee for each member is 100 rupees per year.*
- *A compulsory 50 paisas per litre of profit must go into the association's savings fund.*
- *The purchase price of milk by the association will be based on mutual recommendation of the farmer association and the Livestock Department.*

The project is to provide support services, including veterinary care, breed improvement, training of member farmers on livestock management and introduction of improved fodder variety and feed supplements.

[43] Experience shows that large-scale dairy processing, not a very cost-effective enterprise, is only profitable if the company has investments in other lucrative yet low-cost products, such as Nestlé, whose biggest source of cash flow in Pakistan is its bottled mineral water.

The project also has resulted in exponentially increased incomes for farmers because they can market their produce outside the village for 30–32 rupees per litre, in contrast to the village price of 26–28 rupees per litre.

Based on this tremendous success, the provincial government is planning to build a milk-processing plant near these localities. Additionally, there are plans to expand project activities to neighbouring districts.

Lessons learned: A critical lesson is that organizing local farmers around a profitable initiative is a possible goal to achieve within the current context of the Pakistani dairy industry. However, such an initiative requires comprehensive measures instead of a limited focus on production. These measures range from encouraging farmers to form groups by providing support in the areas of technology transfer, market links and enterprise management.

Case study 2 – UNDP Community Empowerment Through Livestock Development and Credit project

The UNDP-initiated project, Community Empowerment Through Livestock Development and Credit (CELDAC), is a three-year, $6.1 million intervention aimed at smallholders, in partnership with two major private dairy processing corporations, Nestlé and Engro. UNDP is bearing 82 percent of the project cost, with the private partners providing the remainder in the form of cash and kind.

The project objective is to promote women's role in livestock development by creating a cadre of community livestock health workers. The University of Veterinary Animal Science, a leading public sector institute, provides technical support in training the master trainers and 3 600 women livestock health workers. The project area is limited to the milk-collection zones of each of the two private companies involved.

Although it is a heavily funded effort, the project is rather limited in scope. Moreover, it tends to be biased in favour of the large corporations: animal productivity will be enhanced in the milk sheds accessed by the two corporate partners, thereby increasing the supply available only to them. Hence, they will enjoy the major long-term economic benefits through a minimal investment in an otherwise social sector initiative.

Lessons learned: It is possible to develop the dairy sector through successful public–private partnerships (in this case, a partnership between the project, corporations and a public university). Women in dairying households are responsible for most activities related to animal management, including feed, shelter and some veterinary care. However, developing their capacity is often overlooked. The CELDAC project has trained a cadre of women extension livestock workers despite the stereotypical belief that women cannot be formally trained due to the social barriers imposed on them.

In addition to training women livestock extension workers, the other major component in the project design was the provision of credit for enterprise development through links with financial institutions. However, the project thus far has had difficulties in finding a partner in the finance industry for such support. This implies that new and innovative ways to tap into credit facilities need to be identified, particularly those that link the timing for repayment of loans with the biological cycle of the specific animal species, in this case dairy cows and buffalo.

The project is relatively new, limiting the lessons until it is further along in implementation. A large criticism so far has been the negligible contribution provided by the corporate partners, despite the long-term economic benefits headed their way.

National dairy strategy: Issues and opportunities

Smallholder dairying in Pakistan has inherent weaknesses and is confronted with various threats. However, the sector can build on its strengths and use opportunities to satisfy the increasing demand. Based on the current situation and an analysis of smallholder dairy producers in Pakistan, the following national and regional strategic initiatives for public and private stakeholders are recommended.

At the national level, the following issues will need a concerted response from both the Government and the private sector to enable the participation of smallholder dairy farmers in dairy markets and to help them competitively supply expanding consumer markets.

Issue 1: Lack of proper livestock management practices and inaccessibility to support services leads to low animal productivity.

To enhance productivity, the following measures are recommended:

- strengthen extension services to reach and educate the maximum number of farmers;
- launch mass-scale awareness campaigns on management and production issues;
- improve farmers' access to financial services;
- initiate sustainable long-term breed improvement programmes.

Issue 2: In the absence of an integrated cold chain, adulteration is rampant and access to markets is hampered.

To improve the provision of quality milk as well as enhanced market access for small holders, the following measures are recommended:

- provide equipment and facilities related to a cold chain at subsidized rates;
- provide credit to improve access to infrastructure, such as cold chains;
- adjust utility fees to dairy farmers to equal with what other farmers are charged; currently, most peri-urban and commercial farms are charged the industrial or residential rate for electricity and water consumption. This is in stark contrast to the main agricultural sector in which farm use of electricity and water is determined on the basis of subsidized agricultural rates. This can be a discouraging factor for many farmers to upgrade their farms, and policies governing the supply of public utilities to the dairy sector must be revised;
- promote local manufacturing of storage and processing equipment;
- encourage the establishment of integrated cold chains instead of piecemeal approaches in which the focus is only on cooling tanks.

Issue 3: Smallholder dairy farmers need to coordinate their marketing activities.

To further organize smallholder farmers into groups that can reap maximum market benefits, the following measures are recommended:

- create a policy environment conducive to the formation of milk producer organizations (MPOs); laws governing MPOs should be drafted with an approach that encourages their formation. This includes tax incentives for collective marketing and a subsidized provision of inputs, such as veterinary services, feed and electricity.
- ensure MPOs can access financial services, such as credit;
- link various groups to organizations like the Small and Medium Enterprise Development Authority to provide guidance in designing an MPO; there are no practical examples currently;
- provide management training to MPOs in various areas, including production, marketing, value addition, and financial and business management techniques;
- guide MPOs in forming market links by ensuring a sound marketing infrastructure;
- encourage middlemen to integrate their operations with MPOs; there can be many modalities for this. For instance, in milk-deficit areas, middlemen can have exclusive contracts with MPOs. In other instances, MPO members can play the role of middlemen by linking producers to markets in return for fees and trade concessions.

Issue 4: The local government is authorized to fix the price of milk on the pretext that it is an essential commodity. However, the prices of inputs are not regulated in the same manner and keep increasing with the growing inflation.

To ensure parity between input and output prices towards profitable dairying, the following measures are recommended:

- review of laws governing price control and their implementation in regards to milk;
- explore alternative measures, such as setting a control price and incentives for increased production to meet demand;
- provide a level playing field by applying similar pricing regulations to both packaged and non-packaged milk.

Issue 5: Data on the dairy sector is often outdated and/or unreliable. Improved market information is a must to facilitate effective planning and investment by all stakeholders.

- To improve information-based planning and decision-making, the following measures are recommended:
- conduct the national livestock census more often and/or devise reliable ways of providing updated interim information;
- conduct detailed analytical studies to guide improved decision-making at macro and micro levels; for example, assess the production of milk in various systems, the proportion of milk hauled by various intermediaries and the actual urban and rural forecasted demand for raw and processed milk; also needed are reliable economic and technical feasibility studies on dairy farming and marketing;
- develop a central repository of information on the dairy sector;
- consider the innovative use of modern information technology, such as mobile phones, to improve access to market information.

Issue 6: Despite proximity to milk-deficit regions, including Central Asia and the Middle East, Pakistani producers do not export their products.

To promote exports of Pakistani dairy products, the following measures are recommended:

- promote exports within the region because the quality standards are at par with those in the international markets;
- enhance animal and enterprise productivity to satisfy the domestic and international demand;
- make cold chains an integral part of the dairy sector (to improve milk quality);
- introduce economical small-scale processing.

Issue 7: Currently, most equipment for storage and processing is imported from Western countries. This leads to greater need for in-country expertise for operations and maintenance.

To promote production independence, the following measures are recommended:

- facilitate technology transfer options within the region, especially between countries where operational standards as well as pricing and affordability are comparable;
- where livestock imports are required to improve the domestic seed stock, import animals from countries with similar climate and ecology.

Issue 8: Learning the lessons

Often, lessons learned from countries with different socio-economic environments are presented for replication in Pakistan, resulting in unanticipated outcomes. For example, an international corporation recently mobilized medium- to large-scale farmers to buy high-yielding cattle from Australia. Due to the heat and climate stress, many of the animals perished, which resulted in a loss of over 100 000 rupees ($1 666) per animal. Because the initiative was not insured, the farmers had to bear the loss directly. Similarly, an international donor promoted the use of automated milking without considering the almost impossible break-even numbers on equipment costs because cheap labour is readily available for such operations.

To succeed in applying models or measures that were successful in other countries, it is more than recommended – it is crucial – to embrace those that worked in countries with a similar socio-politico-economic profile.

Box 3: Key definitions

Marketing: All the activities that are involved in moving products from producers to consumers. This includes product-exchange activities, physical activities and auxiliary activities. The functions of marketing can be further divided into buying and selling as exchange activities; storage, transport, processing and standardizing as physical activities; and financing, risk-bearing and market intelligence as auxiliary activities.

Marketing chain: The flow of commodities from producers to consumers that brings in economic agents who perform complementary functions with the aim of satisfying both producers and consumers.

Marketing node: Any point in the marketing chain where an exchange and/or transformation of a dairy product takes place. A marketing chain may link both formal and informal market agents.

Marketing agents: Individuals, groups of individuals or organizations that facilitate the flow of dairy products from producers to consumers through various activities, such as production, purchasing, processing and selling. Examples of market agents include farmers selling dairy products, retailers, wholesalers, dairy cooperatives, importers and exporters.

Milk producers: Rural subsistence farmers, rural market-oriented farmers, commercial dairy farmers and city and peri-urban milk producers.

Milk collectors: *Dhodhis*, contractors, village milk collection centres and dairy cooperatives (MPOs).

Dairy processors: Large-scale private dairy processing corporations.

Retailers: Milk shops, peri-urban farmers-cum-*dhodhis*, traditional *dodhis*, rural subsistence and market-oriented farmers and retail shops.

Cooling tank: A refrigerated unit used for milk storage; also known as a "chiller".

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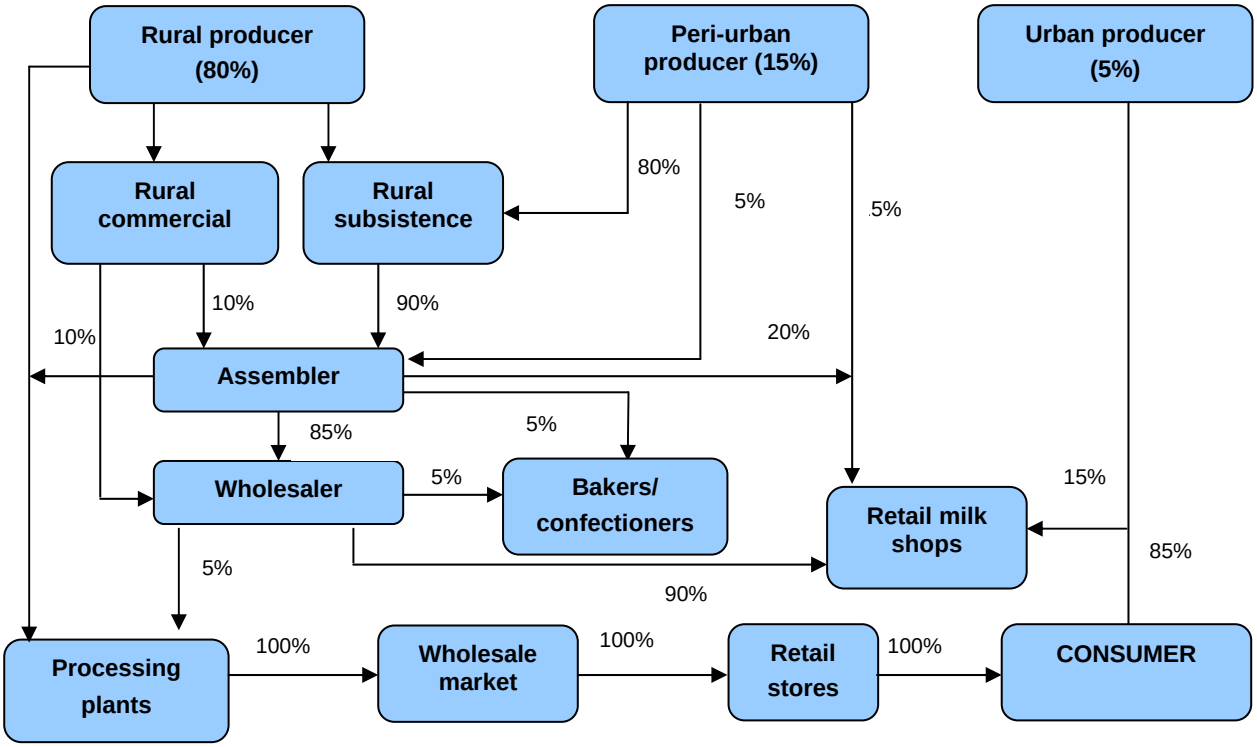
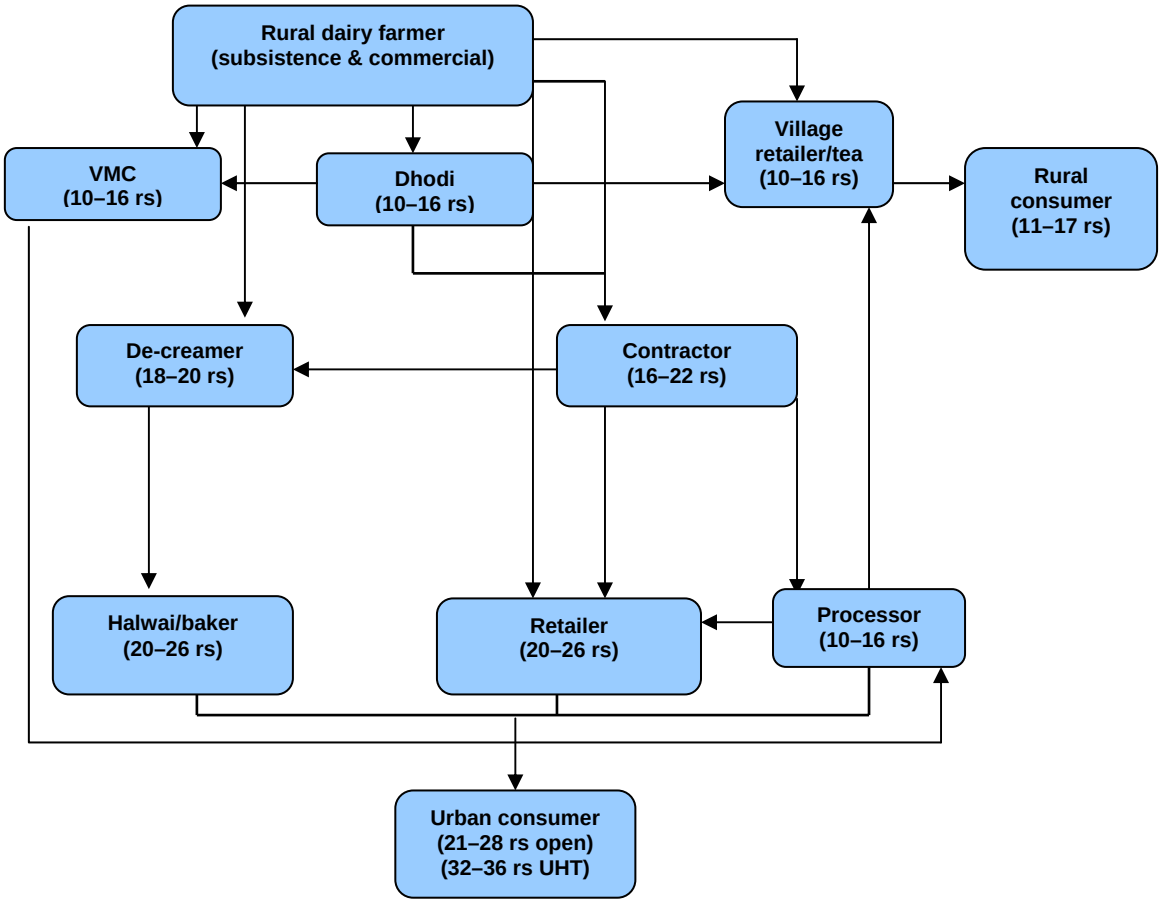
Annex I: Milk flow chart example



Source: Pakistan livestock marketing action plan 2003. From Analysis of the milk marketing chain, report prepared for FAO TCP/PAK/3004 technical cooperation programme project: Assistance in Up-Scaling Dairy Development in Pakistan by Umm E. Zia, August 2006.

Annex II: Milk price chart (rupees)



Source: Pakistan livestock marketing action plan 2003. From Analysis of the milk marketing chain, report prepared for FAO TCP/PAK/3004 technical cooperation programme project: Assistance in Up-Scaling Dairy Development in Pakistan by Umm E. Zia, August 2006.