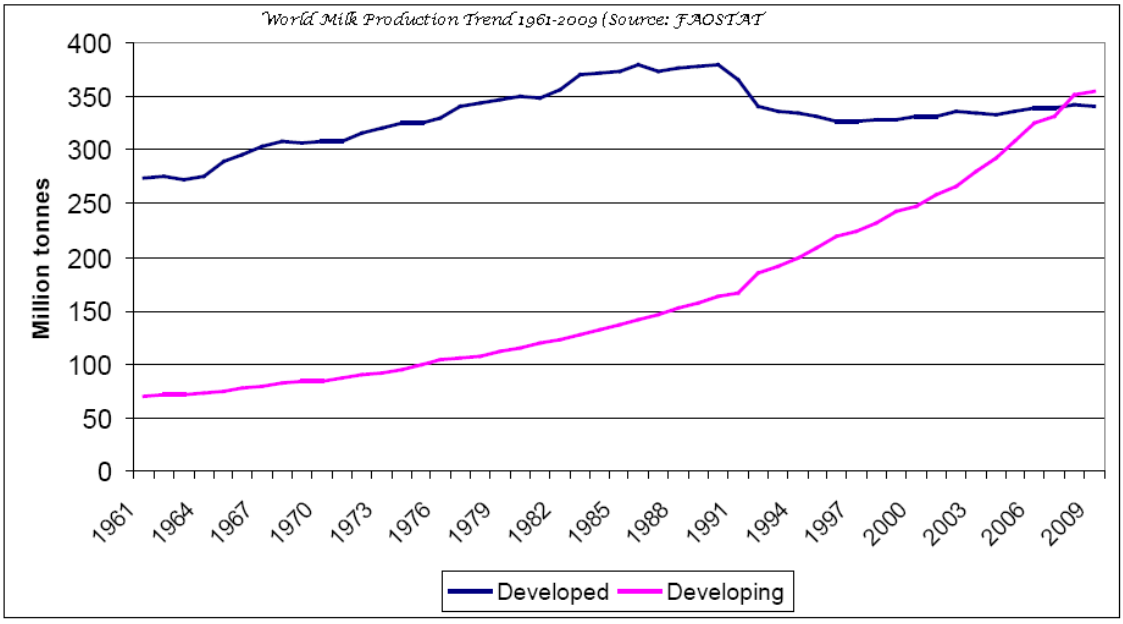
Milk Marketing Strategy Study

Report Submitted to National Dairy Development Board
Hariharbhawan



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Acronyms

ABD	Animal Breeding Division
AD	Anno Domini
AGDP	Agricultural Gross Domestic Products
AHTC	Animal Helath Training Centre
AI	Artificial Insemination
APP	Agriculture Perspective Plan
Avg.	Average
BMSS	Biratnagar Milk Supply Scheme
BQ	Black Quarter
CBS	Central Bureau of Statistics
CC	Chilling Centre
CDCAN	Central Dairy Cooperatives Association of Nepal
CDR	Central Development Region
CEEC	Central and Eastern European Countries
CLDP	Community Livestock Development Project
COB	Clot on Boiling
CoP	Code of Practices
CTEVT	Council for Technical Education and Vocational Training
DDC	Dairy Development Corporation
DFTQC	Department of Food Technology and Quality Control
DIA	Dairy Industries Association
DLS	Department of Livestock Services
DLSO	District Livestock Service Office
DM	Dry Matter
DMPCUs	District Milk Producers Cooperatives' Union
DMSS	Dhangadhi Milk Supply Scheme
DoA	Department of Agriculture
DoC	Department of Cooperatives
DDP	Dairy Development Policy
EC	Executive Committee
ECM	Energy Corrected Milk
ED	Executive Director
EU	European Union
FAO	Food and Agriculture Organization of United Nations
FMD	Foot and Mouth Disease
FPCM	Fat and Protein Corrected Milk

FWDR	Far Western Development Region
GAP	Good Agricultural Practices
GDP	Gross Domestic Products
GHG	Green House Gasses
GMP	Good Manufacturing Practices
GoN	Government of Nepal
HF	Holstein Friesian
HKH	Hinda Kush Himalaya
HMSS	Hetaunda Milk Supply Scheme
HS	Haemorrhagic Septicaemia
IFCN	International Farm Comparision Network
INGOs	International Non Governmental Organizations
INR	Initial Negotiation Right
IPCC	Intergovernmental Panel on Climate Change
EDR	Eastern Development Region
JMSS	Janakpur Milk Supply Scheme
LCA	Life Cycle Assessment
LDC	Least Developed Countries
LMSS	Lumbini Milk Supply Scheme
LMY	Lacation Milk Yield
MASF	Market Access for Smallholder Farmers
MCC	Milk Chilling Centres
MFN	Most Favoured Nations
MoAC	Ministry of Agriculture and Cooperatives
MoAD	Ministry of Agriculture Development
MPAs	Milk Producers Associations
MPCs	Milk Producers Cooperatives
MSS	Milk Supply Scheme
MT	Metric Ton
MWDR	Mid Western Development Region
MWMSS	Mid Western Milk Supply Scheme
NARC	Nepal Agricultural Research Council
NCDB	National Cooperative Development Board
NDA	Nepal Dairy Association
NDDB	National Dairy Development Board
NGOs	Non Governmental Organizations
NLBC	National Livestock Breeding Centre

NMSS	Nepalgunj Milk Supply Scheme
PMSS	Pokhara Milk Supply Scheme
SAARC	South Asian Association for Regional Cooperation
OECD	Organization for Economic Cooperation and Development
SMP	Skimmed Milk Powder
SMPP	Skimmed Milk Powder Plant
SNF	Solid Not Fat
TB	Tuberculosis
TRQ	Tariff Rate Quotas
UK	United Kingdom
UMMB	Urea Molasses Mineral Block
US$	US dollar
USA	United State of America
USDA	United State Department of Agriculture
VAHW	Village Animal Health Worker
VAT	Value Added Tax
WDR	Western Development Region
WHO	World Health Organization
WMP	Whole Milk Powder

Executive Summary

The dairy is the most important subsector of livestock in the country contributing almost 2/3rd of livestock GDP and providing employment and income generating oppertunities for hundred of thousands of households. The sector is well known for flow of money from urban to rural sector in the country.

Current milk production in the country stands at 1.56 million metric ton of which 71% is produced by buffaloes and rest 29% by cattle despite of having higher total cattle population (7.2 million) compared to only 5 million buffaloes. The country is annually importing milk products mainly SMP, baby foods, condensed milk, butter and cheese worth around 1 billion ruppees in addition to live dairy animals.

Increasing human population, rapid urbanization, change in demographic structure, increasing income level and changing food habits are some of the driving force for increasing demand for milk and milk products. Researches carried out has shown that demand for dairy products is income elastic particualrly in low income countries rather than in the well off countries.

Current Milk Marketing Strategy Study has been commisoned with the objectives of understanding dairy production system and situation, current milk marketing system and associated constraints and to recommend appropriate strategies for strengthening and streamlining milk marketing system in the country for the betterment of producer farmers, processing industries and general consumers.

Farmers, Primarary Milk Porducers' Cooperatives, DMPCUs, CDCAN, Dairy Industries, NDA, DIA, Service Providers (DLS/DLSO, NARC), hawkwers, retailers and consumers of different districts (Ilam and Morang in East, Chitwan, Rasuwa and Kathmandu valley in Central, Nawalparasi, Rupandehi and Kaski in west, Dang and Surkeht in mid west and Kailali and Dadeldhura in far west) representing hills and terai agro ecozones across all development regions were interviewed and consulted and secondary data and study reports were extensively reviewed and analyzed for this study.

The current study revelaed that to tap the increasing demand for milk in the country, commercial dairy farming has been gradually emmerging, whereas with higher rate of immigration of youth to cities and aborad for search of works, the subsistence dairy animal farming has gradually been fading out. Commercial dairy herd of as large as 300 cattle has been already started and smallholder farmers are gradully shifting towards medium to large scale commercial farming in the major dairy pocket areas of the country.

Commercial farmers' preference have been changing towards cattle farming from buffaloes mainly due to the realization that cattle are comparatively better milk producer and easy to handle than buffaloes. However, some farmers still prefer buffaloes as it produces high fat milk prefered by most consumers, has salvage values at the end of

productive life, and also it has been their long tradition. Dairy cattle farmers have been also found to be keeping few buffaloes for producing milk for household consumption.

The average number of dairy animals in different surveyed districts varied considerably but the average ratio of milking cattle to the total cattle population ranged from 38 to 52% in different districts. The average daily milk production ranged from 12 litre (4.5-34 lit) in Ilam district to 69.2 lit (150-180 ltr) in Nawalparasi district. A farmer producing more than 400 lit milk daily was found in Chitwan district. Average household conumption ranged from 4.7% of the total daily milk produced in Nawalparasi district to 8.1% in Kaski district.

Several milk marketing channels have been recognized to be operating in the milk market. The most common milk marketing channel is the Farmer-Milk Producers' Cooperative-Dairy Processors-Retailers-Consumers or one line shorter in value chain Farmers- Dairy Processors- Retailers-Consumers and has been refered to as formal milk marketing sector. Processed milk and milk products reach to the consumers thorugh this channel. Other informal channel includes direct sell to consumers by producer farmers (door to door service or consumers coming to the farm), farmers-milk hawkers-consumers and farmers- retail dairy shops established in the nook and corners of town and cities-consumers. Further in some peri urban areas, producer farmers partially process milk to produce intermediate products such as *Khowa, Chhena* which are sold in the sweet shops for producing final dairy products (sweets). Some of larger scale commercial dairy farmers are found to be directly selling milk to the processng industries (DDC and private dairies).

The price for milk to the producer farmers is generally determined by DDC in consultation with concerned stakeholders and private dairies follow DDC, thoguh there is a trend that private daireis offering slightly higher price than that fixed by DDC. The price is determined by the fat and SNF content in the milk and nearness to the chilling centres. The industries provide extra price for Total Solids (TS) to run the cooperative and also chilling charge if copperatives own it. Some portion of the receipt from TS is also provided to the producer farmers by some cooperatives. To encourage evening milk collection for maintaining quality of milk, additional 2-3 Rs per kg TS is paid to the cooperative by processors. The consumer price for milk and milk products in the formal market is also determined by DDC and unlike in international markets neither price to the farmers nor to the consumers in Nepal are found to fluctuate in both direction, but only found to be increasing over the years. the The analysis revealed that producer farmers cooperatives, processing industries and retailers are getting 57%, 7%, 34% and 2% respectively of the consumers price for processed and packaged fluid milk in the formal sector.

Despite absence of processing cost, farmers are getting more price for milk when sold direct to the consumers rather than selling to cooperatives or small dairies established in city centre. However, the option is only available to the farmers in urban areas or near to the town to the limited extent. Farmers prefer to sell milk directly to the consumers as far as they can for this reason.

Consumers preference for fresh milk rather than processed milk seems to be associated with the flavour (off flavour) of the packaged milk to which the consumers are not

accustomed to. Consumers were often found to be complaining about the falvour of podwer milk which are used for reconstituting milk mainly due to inadequacy of fluid milk that comes into formal market for processing.

The flow of raw milk in the formal market for processing (through cooperatives or directly to industires from their chilling centres established at strategic locations) has been highest in central development region followed by eastern development region and western development region. All medium to large scale dairies (both DDC and private dairies) have been established in these regions. Milk flowing into formal market in mid western and far western regions are minimum, but has been recently getting momentum with establishement of MWMSS and DMSS at Kohalpur, Banke and Attaria, Kailali respectively by DDC.

It has been estimated that about 15% of the total milk produced in the country comes into fomral market. Interaction at DMPCUs in some districts revealed that milk collection through cooperatives has been gradually increasing. Over the last four years, daily milk collection through cooperatives has been found to be increasing at 19.0% annually in chitwan district and at the rate of 15.6% annually in Nawalparasi district. Average daily collection of some MPCs in Chitwan district was also found to be declining over years due to withdrawl of some cooperative members to supply milk with the formation of other dairy cooperative or due to emmerging large commercial farmers directly selling milk to the processing industries.

Small dairy shops selling raw milk, curd, paneer, ghee etc are emmerging rapidly in the cities and towns of the country. In the towns of mid and far western regions, farmers themselves have been found to be encouraged to establish such dairy shop to address the growing demand for milk and products in the town and absecne of well organised dairy industries in these areas. Such medium to large scale dairy farmers having their own dairy shops also buy milk from the neighbouring farmers to cater the demand of the market. Flat rate on negotaition depending upon quality, fat based or fat and SNF based milk pricing system in such dairy shop is prevalent.

The household survey revelaed that consumption of cheese and butter (not ghee) at household level is still not common. None of the respondents said that cheese or butter is consumed regularly though some respondents said that they occasionally consume these items at especial occasion or in special food such as pizza. However consumption of paneer has been found to be gradually increasing at household level.

There has been recent controvery regarding daily fluid milk deficit in the country. Depending on established processing capacities of small to large scale dairy industries including DDC, it has been estimated that around 550000 litre fluid milk is defict in the country at present which might be 10-20 % higher during lean season (Mar-July) and 10-20% less during flush season (Aug-Feb). However, there is no any proof that if these industries run into full capacity, there will be market demand for all these milk and milk products in the country. The present import of dairy products worth around 1 billion rupeese from other countries (data from custom department) through formal route, recent

import of around 100,000 litre of fluid milk from India (by DDC and private dairies) and unaccounted amount of import through illegal route, it has been estimated that the country is currently facing deficit of around 125,000 lit milk during flush season and 225,000 lit during lean season, though slightly higher figure might be true with the speculation that with easy availability, the actual market demand would be slightly higher.

Demand for milk and milk products during festive season generally increases but supply in this time decreases due to increase in the level of household consumption.

Marketing constraints at present in dairy value chain can be summerised as higher cost of production and lower market price for milk and untimely and delay payment from farmers perspective, poor quality and insufficient quantity of fluid milk supply in the formal market from processors perspective and poor quality (off flavour and adulteration) and higher market price from consumers perspective. In addition, the private sector processing industries are facing the problem of unhealthy competition with state owned and supported dairy industry and competition with the cheaper imported (through formal and illegal route) dairy products. Industrialists are seeking some sort of support in the form of exempting VAT on dairy products, provision of soft loan with minimum interest rate, subsidies on electricity and tax waiving for import of dairy equipments as provided to the cooperative owned processing industries. Some sort of protection to the national dairy industries including dairy farmers have been felt essential in absence of which, the whole dairy sector might one day be collapsed in the competitive dairy market of the world.

Some sort of campaigning to increase consumption of milk and milk products seems to be essential, while integrated programme including breeding, feeding, health care and management for increasing dairy animal productivity need to be implemented. Strengthening and expanding collection centres with chilling facilities and bringing more milk to the formal market would be the immediate strategies for addressing current fluid milk deficiency. Exploring possibility of establishing milk product processing industries in the mid and far west region to bring more milk into formal market and supply in the more demand area of the country with reduction of transportation cost would be of great significance.

Chapter 1 Introduction

1.1 Background

Nepal is predominantly an agricultural country. More than 65% of active population are involved in agriculture sector, which provides about 38% to the Gross Domestic Products (GDP) of the country. Livestock is an integral and important component of mixed farming system in Nepal. The sector shares about one third of the Agricultural Gross Domestic Products (AGDP) of the country. The dairy sub sector is the most important component of livestock sector and contributes almost two third (63%) of the livestock GDP shares. The sector not only contributes in national GDP, but also ensures flow of money from urban to rural sectors. Above 450,000 dairy farmers deliver milk, with a large number engaged in the milk processing industry in both rural and urban areas. Similarly, thousands of people are engaged in production and marketing of indigenous dairy products like Ghee, Hard Cheese and *Khoa*[1]. Cattle and buffaloes are the major dairy species in the country and yak (*Nak*[2]) to some extent in the high mountain region of Nepal. Almost three fourth and one half of the households in Nepal keep cattle and buffaloes respectively. Despite larger cattle population, the buffalo contributes around 71% of the annual milk production and only rest 29% by cattle. This is mainly due to extremely low productivity of non-descript indigenous cattle as compared to the productivity of buffaloes. Buffaloes are also being kept for meat whereas the contribution of yak and their crossbred in the high Himalayan region as pack animals is also substantial. The yak cheese is a unique product, which has great potential for export. The dairy sector is gradually emerging as commercial/ semi commercial enterprise particularly in the peri urban areas of the country.

The historical developmental initiation of livestock in Nepal can be traced back to 1917 Bikram Era (1850 A.D.) in which the then Rana regimes brought some European cattle breed in the country. The first official organization "Livestock Improvement Section" was established in 1952 for development of livestock in the country with main objectives of improving genetic potentialities of indigenous cattle through introduction of exotic cattle breeds. Thereafter Red Sindhi, Jersey and Brown Swiss cattle and Murrah buffaloes were introduced in Nepal. These animals were initially kept at Singh Durbar Livestock Farm, which later on moved to Khumaltar from Singh durbar in 1969. Later on Holstein Friesian cattle breed was also introduced in the country. To speed up genetic improvement programme, artificial inseminations using warm semen at initial stage and with frozen semen later were initiated in Nepal.

Before advent of the Dairy Development Corporation (DDC), marketing of milk was limited to nearby town by the individual producer farmers. Even, in some part of the country, there was taboo of not selling milk with the fear that their animals would be harmed with this activity.

[1] Evaporated and condensed indigenous dairy products
[2] Female of yak

Organized dairy development activities in Nepal began in 1952 with the establishment of a Yak cheese factory in Langtang of Rasuwa district under Food and Agriculture Organization (FAO) assistance in 1953. In 1954, a Dairy Development Section was established under the Department of Agriculture (DoA) and also a small-scale milk processing plant was started in Tusal, a village of Kavre district. Central Dairy Plant with processing capacity of 500 litre per hour was established at Lainchaur in Kathmandu in the year 2056. In the mean time, two additional cheese factories were established in alpine regions under Department of Agriculture.

The Dairy Development Section was established within Department of Agriculture in 1954. A Dairy Development Commission was formed in 1955, which later on 1962 converted into Dairy Development Board. Again, the Diary Development Board was converted into Dairy Development Corporation in 1969 under the Corporation Act of 1964. With this institutional set up, milk supply schemes and dairy product production schemes were established, which have been involved both in collection and processing of milk. The involvement of private sector on dairy development started in the late 1970s. Milk Producers' Associations and later on Milk Producers' Cooperatives were formed to channelize raw milk marketing in the formal sector in the country. There were 1748 such cooperatives at the end of Ashad 2068. As milk is of perishable nature and the range of skills involved in its production and marketing, dairying requires a number of services that can best be provided by cooperative action. It is not surprising therefore that the cooperative movement has featured prominently in the development of the dairy industry worldwide.

In 1992, the government established National Dairy Development Board (NDDB) with the major functions and responsibility of formulating and recommending policies and plans for dairy development in Nepal; and strengthen the dairy sector by bringing coordination between private and public sector.

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Chronology of Dairy Sector Development in Nepal

1917-	Importation of European cattle in Rana regime
1952-	Establishment of Livestock Improvement Section
1952-	Yak cheese production in Rasuwa with FAO support
1953-	Small scale milk processing plant in Tushal
1954-	Dairy Development Section within DOA
1955-	Dairy Development Commission
1956-	Central Dairy Processing Plant (500 lph capacity) in Lainchaur
1962-	DD commission changed into Dairy Development Board
1969-	Dairy Development Corporation (DDC)
1973-1980	BMSS, HMSS, KMSS, PMSS established
Late 1970s-	Involvement of private sector
1980-	Milk producers' cooperative and Association
1990-	Ten year Dairy Development Plan with Danish support
1992-	National Dairy Development Board (NDDB)
1995 -	Establishment of SMPP in Biratnagar
2009-10	SMPP in Kaski and Chitwan (private sector)

The government has also approved Nepal's Dairy Development Policy drafted by National Dairy Development Board to increase milk production and productivity at rural areas; minimize import of milk and milk products by product diversification according to the feasibility of internal market; increase the export of quality milk products; and supply adequate amount of hygienic milk and milk products to the consumers.

The cooperative movement has been the mile stone and driving force for milk marketing in the country. Despite decades of cooperative movement and gradual shifting toward formal milk marketing sector, a large proportion of milk and milk products in Nepal continues to be marketed through the 'informal or unorganized sector'. The informal sector comprising middlemen, private milk traders and direct sale from producer to consumer, still accounts for nearly 70 percent of marketed milk and milk products in the country. Trends indicate that, the informal sector will continue to play its dominant role in milk marketing in the foreseeable future.

The profitability and sustainability of dairy production depends upon its cost structure and a remunerative price, for which a good marketing outlet is crucial. Therefore understanding prevailing milk marketing structure, analyzing associated constraints and developing proper strategies for holistic dairy sector development in the country is extremely essential.

1.2 Rationale for Marketing Strategy Study

NDDB is the policy body formed by the government of Nepal in 1992 for holistic dairy sector development of the country. Functions and duties of NDDB includes formulation and recommendations on policies on import and export of good necessary for production and promotion of milk and milk products, acceleration of the implementation of approved

policies; formulation and recommendation on pricing policy of milk to Government of Nepal; encouragement to development of dairies through the medium of co-operatives; monitoring, evaluation and review of dairy development; and registration of dairy industries.

NDDB conducted a National Milk Marketing and Strategy Study in 2001 and produced a comprehensive document. Since then drastic change in the dairy sector has been occurring. The past scenario of milk holidays has been completely reversed and there is a reported situation that the country is facing gross deficit of fluid milk for running dairy industries in full installed capacity. This has been the result of establishment of medium and large-scale dairy industries from the private sector. Consequently, gradual commercialization of dairy animal farming has been coming up to fill the gap of fluid milk deficit. This demand and supply gap may further widened with rapid urbanization, changing food habits and improving economic status. Presently, the real figures on import of milk products such as Skim Milk Powder to reconstitute into fluid milk and other dairy products are also lacking. Thus, it has become very essential to analyze the real situation of dairy sector so that appropriate strategy could be developed and recommend for holistic dairy sector development in the country for the benefits of dairy farmers at large. The present study is therefore being commissioned to develop appropriate marketing strategy of milk and milk products.

1.3. Objectives of the Study

The main objective of the current study is to concretely develop dairy marketing strategy based on ground reality such that the risk factor for investor in dairy sector is reduced significantly with the following specific objectives:

- Analyze current status of dairy animal production system in the country
- Analyze current status of milk and milk product markets in the country
- Identify the market potential for milk and milk products within and outside the country
- Analyze demand and supply trend for milk and milk products and dairy animals
- Prepare an outline of five year dairy sector strategy plan with emphasis on marketing strategy, products diversification and market development
- Supplement the database of NDDB by providing market and consumer information and export/import data for various dairy products in Nepal

1.4 Scope of the Study

In line with the objective, the scope of the study has been framed to

- Review current Dairy Development Policy and recommend required policy reform
- Review current dairy animal production system in Nepal and analyze existing constraints
- Analyze regional demand and supply of milk and milk products and regional gap
- Analyze consumer behavior in the milk and milk product market

- Analyze the potential consumer market for product diversification
- Assess the regional milk processing facilities
- Analyze the export potentialities of dairy products
- Analyze the price trend of milk and milk products
- Forecast demand of milk and milk products at least for next 5 years
- Conduct the competitive analysis of the milk and milk product market
- Review the inter related sectors and their likely influence in the milk and milk product market
- Prepare an outline of dairy strategy plan for next five years with special focus in bringing milk to the market

1.5 Study Methodology

The study methodology comprised basically of two components namely desk study (review) and field study. Under desk study, thoroug reviwing, critically analyzing and syntehsizing the available information on national and internation dairy sector were done. Reports of DDC and other privated dairies and DMPCUs were extensively studied for analysing trends. Report of Department of Custom were reviewed for analysing trends of import and export of dairy products in the country. Agriculture policy papers including Dairy Development Policy 2064 were critically reviewed and recommendation on ammendment needed and implementation mechanism suggested. International Dairy Reports including IFCN reports were also extensively reviewed to have some ensight on international dairy sector outlook.

Primary data were collected from different stakeholders i.e. milk producing farmers, dairy cooperatives and their unions, milk processing plants, whole sellers and retailers and general consumers.

Under field study, household survey among randomly selected dairy animal farmers in selected districts both comprising hill and terai agro-ecological regions were carried out to characterize dairy animal farming system and to identify existing constrains on farming and marketing of dairy produce in the country. One high hill/ mountain district (Rasuwa) was also included in study to have some information on yak and chauries (minor dairy animal). Pre-tested semi structured questionnaire was used to collect information from household level. Sample primary milk producers cooperatives (MPCs) and district milk producers' cooperative unions (DMPCUs) were also consulted to collect information for which checklist had been prepared. The president or managers of MPCs and DMPCUs were contacted. The small, medium as well as large dairy industries producing range of dairy products, small household dairies that have been established in the nooks and corners of major cities without registration, the middlemen supplying milk to households were also consulted. Telephonic interview was also employed for survey on consumers' behaviors on dairy products. Focus group discussions at district level with involvement of officials form District Livestock Service Offices, representatives from MPCs and DMPCUs were also conducted. Interaction with personnel from CDCAN, DIA and NDA were also made.

The following were the direct source of information for this study:

- Milk producing farmers,
- Maangers of the Milk Producers Cooperatives
- President or managers of the District Milk Producers Cooperative Unions
- Perosnnel of large, medium and small scale dairy industries
- Milk vendors, hawkers
- Sweet shop owners
- Consumers
- Officials of NARC, NDDB, DDC and DLS and financial institutions

Table 1: Sample Districts for the Study

SN	Development Region	Geographical Region	
		Hills	Terai
1	Eastern Development Region	Ilam	Morang, Sunsari
2	Central Development Region	Kathmandu, Lalitpur, Bhaktapur, Rasuwa	Chitwan
3	Western Development Region	Kaski	Nawalparasi Rupandehi
4	Mid Western Development Region	Surkhet	Dang
5	Far Western Development Region	Dadheldhura	Kailali

Chapter 2: The Dairy Sector Outlook

2.1 World Dairy Sector Outlook

2.1.1 World Milk Production

World milk production during 2010 was 721 million MT compared to 709 million MT during 2009 with growth rate of 1.8%. Cow milk represented 83% of the total milk produced globally whereas buffalo milk production making 13% of total world milk production. India and Pakistan produce more than 90% of the total volume of buffalo milk (93 million MT), but smaller volumes are also produced in Egypt, China, Iran, Italy, Nepal and South East Asian countries. The goat milk represented 2.2%, sheep milk 1.3% and camel milk 0.3% of total global milk production. Most of the goat milk was produced in Asia (59%), with Africa at 21% and Europe at 16%. Globally, the average milk production of cows and buffaloes stand at 2267.0 and 1583.0 kg/head/yr.

Table 2: World Milk Production Scenario (2010)

Species	**Number of milking animals**	**Annual Milk Production (MT)**	**Productivity (Kg/head/yr)**
Cattle	264470504	599438003	2267.0
Buffalo	58447633	92517217	1583.0

Source: FAOSTAT (**http://www.fao.org**)

The growth in global milk production varied considerably between different countries. Growth was higher in Ireland (8.1%) and in India (3.1%), was moderate in USA (1.8%), China (1.6%), New Zealand (1.1%) and Australia (0.9%). Growth was also moderate in Italy, Germany and the Netherlands whereas it was only sustained in UK and France. Poland and Romania experienced production drop of 1.3% and 7.9% respectively. Most South American countries saw increased growth in milk production. Higher milk prices stimulated production, while bad weather conditions and natural disasters prevented growth in some parts of the world.

Table 3: Milk Production by Continents in 2010

Continent	**Annual Milk Production (MT)**		
	Cattle	**Buffalo**	**Total**
Africa	31749061.0	2725000.0	34474061.0 (5%)
Americas	176224782.0	0	176224782.0 (25.5%)
Asia	157989481.0	89573914.0	247563395.0 (35.8%)
Europe	207371385.0	218303.0	207589688.0 (30.0%)
Oceania	26103295.0	0	26103295.0 (3.8%)
Total	599438004.0	92517217.0	691955221.0

The share of Asia in global milk production was highest (35.8%) followed by Europe (30.0%), Americas (25.5%), Africa (5%) and Oceania (3.8%). The milk production gaps between developed and developing countries have now converged to almost equal level

compared to nearly four folds difference in early sixties. However productivity of dairy animals among different regions still varies greatly (Figure 1).

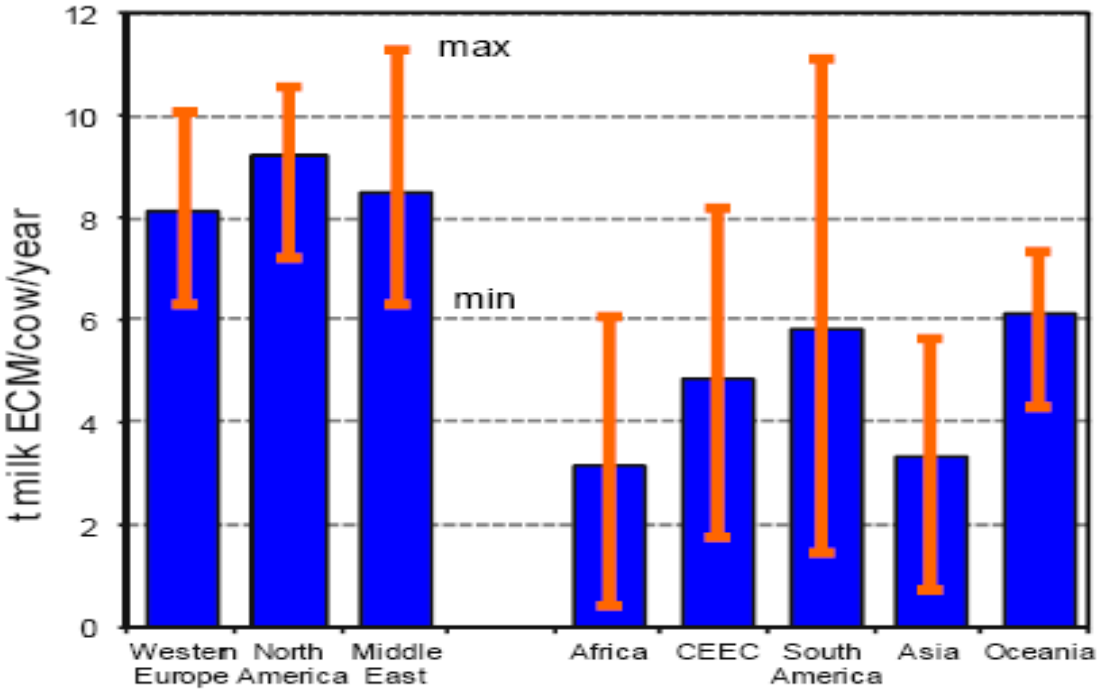
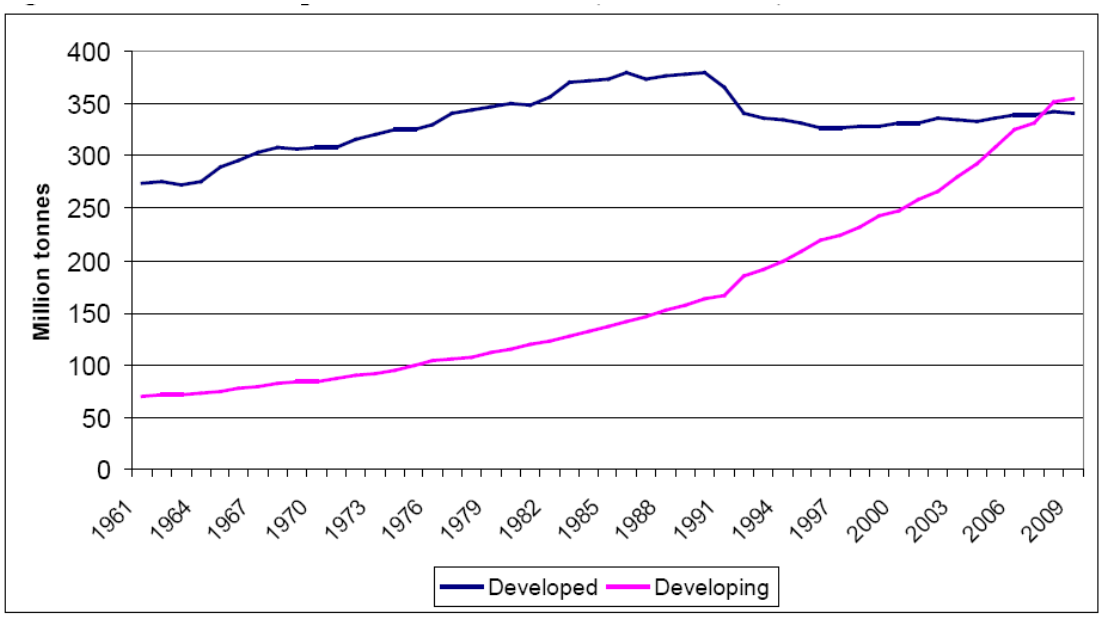


Figure 1: Milk yield difference in world region (Source: IFCN)



Source: FAOSTAT

Figure 2: Convergence between developed and developing worlds in global milk production

Table 4: Average Lactation performance of Dairy Cattle in some selected countries

Countries	**Number of milking Cows**	**Avg LMY (kg)**
Israel	126000	9405
USA	9132000	9219
Denmark	545424	8434
Canada	994800	8176
Finland	296069	7956
Netherlands	1443000	7450
Germany	4029800	7048
Spain	903287	6753
Mexico	1610000	6426
France	3845820	6338
Australia	1617000	5703
Ireland	1087000	4784
New Zealand	4167121	3801
India	38000000	1129
Myanmar	2106075	465
Nepal	**908712**	**432**
Mongolia	839400	367

Source: Dempfle (2010)

2.1.2 World Dairy Animal Farm Structure

In the IFCN Dairy Report 2011, milk production profiles for 90 countries are shown, representing about 98% of milk production worldwide. These 90 countries have an average herd size of only 3 cows per farm. This is mainly due to the fact, that in developing and transition countries many small scale dairy farms with 1 to 2 cows exist. On the other hand only 11 of the 90 countries have an average farm size of more than 100 cows. The extremely high differences in farm structures can be shown via the example of comparing the farm structures of the USA with Pakistan. In the USA twice the amount of milk is produced compared to Pakistan, but this is produced in the USA from only less than 1% of the amount of dairy farms Pakistan has. IFCN studies allowed clustering the farms into three categories:

Farm size 1 - 10 cows: 78% of all farms and 56% of the cows are in this category. A large part of the milk produced in these farms is consumed by the family, whereas the rest of the milk is sold locally and often to an informal market. Milk selling is providing the daily cash for the family subsistence. These dairy farms can be described as "household farms".

Farm size 10 - 100 cows: 22% of all farms and 28% of the cows are in this category. Most of these farms can be described as "family farms" as most of the work is done by

family members. The economic aim of these farms is to generate a sufficient income for the family members.

Farm size more than 100 cows: Only 0.3% of the dairy farms having 16% of the cows are in this size category. These farms can be described as "business farms" as most of the work is done by employees. The main aim of these enterprises is to generate the expected return on investment.

2.1.3 Cost of Milk Production

Cost of milk production has increased greatly across the world particularly due to increased price of feed. According to IFCN Report (2011), the average production cost per 100kg ECM (4% Fat and 3.3% Protein) milk ranged from slightly below US$ 30.0 to as high as US$ 53.0. The production cost was lowest in African continent followed by South America. Production cost in Asia and Central and Eastern European Countries (CEEC) was slightly higher than that in Oceania. Whereas production cost was highest in Western European countries followed by Middle East and North America.

The cost increase was strongest in high yield dairy farming systems. In addition, a wide number of emerging countries like China, India and Brazil showed strong cost increase driven by rising wage levels. In terms of dairy farm profitability the year 2011 shows good results as in most countries milk prices have increased more than costs.

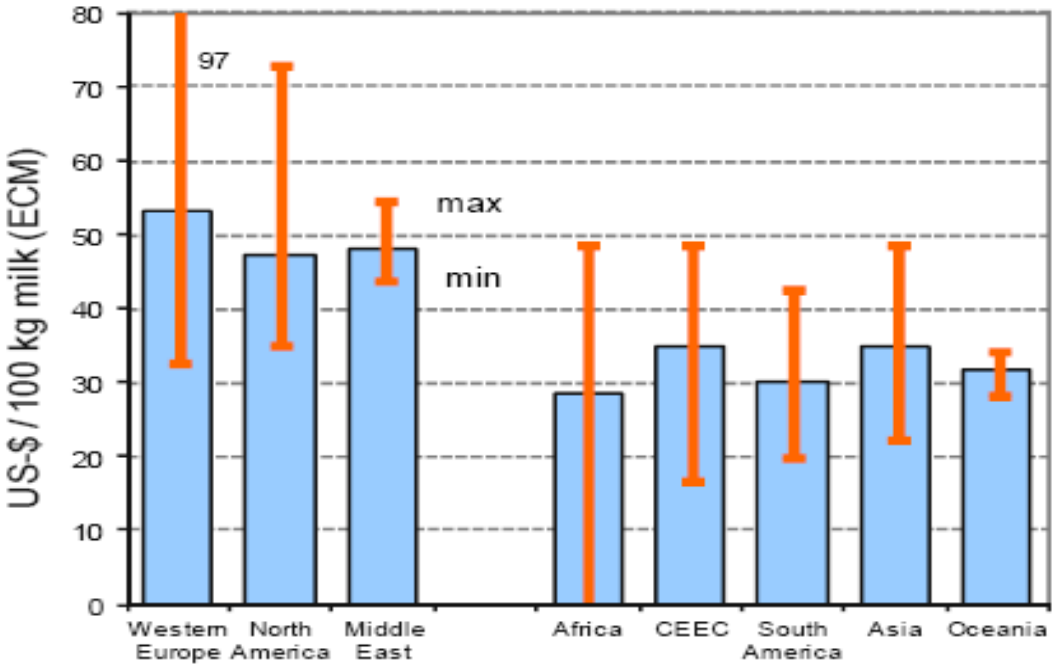


Figure 3: Cost of Milk production in world regions (Source IFCN, 2011)

2.1.4 World Milk and Milk Products Price Trend

The trend of average milk price (to the consumers) across the globe (Figure 4) indicates great fluctuation. During 1996 to 2004 the global milk price stood at US$20/100 kg ± US$5.

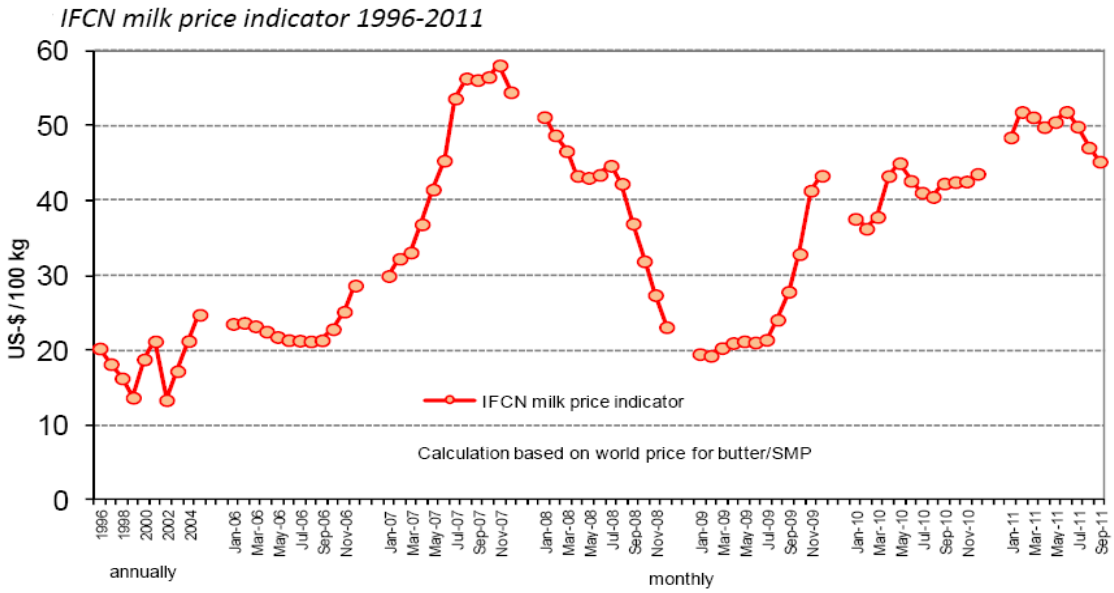


Figure 4: Trend of global milk price (Source: IFCN 2012)

The price trend remained same during first three quarters of year 2006 but started rising sharply in the last quarter of the same year and continued throughout the year 2007 reaching to the peak of around US$ 60.0/100kg. From the middle of the year 2008, the global milk price again started declining and by the start of year 2009, it reached to the level equal to price at the year 1996-2004). Again from the mid of 2009, the milk price started to rise and stood between US$ 40-50.0 during whole year of 2010 and 2011.

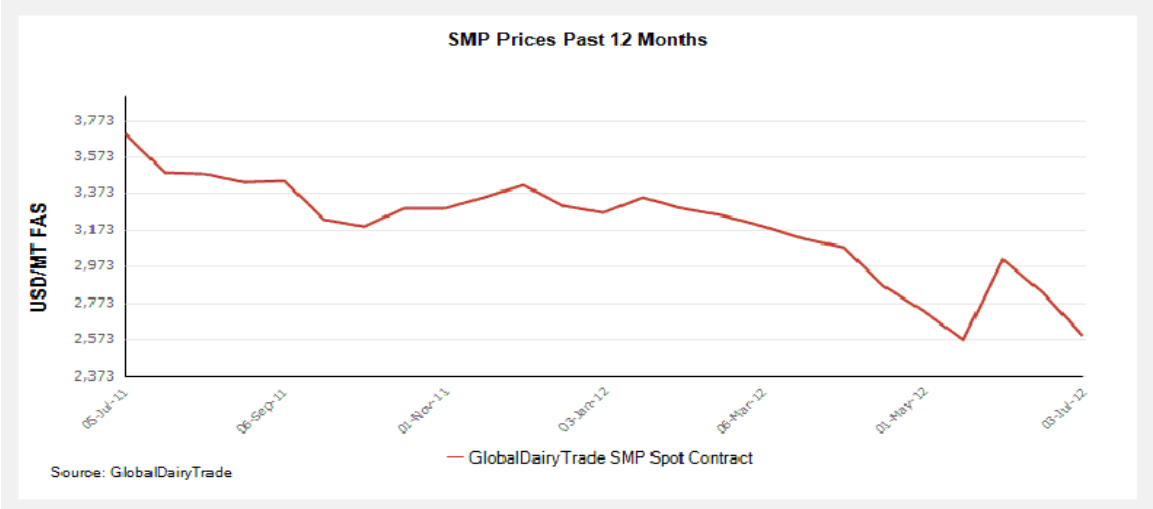


Figure 5: Trend of SMP Price- July 2011 to July 2012 (Source: Global Dairy Trade)

The SMP price at global auction has dropped sharply from last year. It has reached to US$ 2573 per ton in July 2012 which was US$ more than US$3600 in July 2011.

2.1.5 World Trade of Milk and Products

In 2010 world dairy trade volume (excluding intra-EU trade) amounted to about 51.9 million tonnes milk equivalents (non-fat solid content). This was nearly 9% above previous year. Barely 6 to 7% of the world milk production is traded internationally. The bulk of the world dairy trade is in cheese, butter and powders. A growing shift towards cheese is expected in the near future. Two dynamic products with a substantial projected growth in the coming years are yoghurt and dessert (Global Dairy Trade,).

Table 5: Major exporters of dairy products (000 Ton product weight)

	2008	**2009**
Whole Milk Powder		
World	**1 936**	**1 901**
New Zealand	618	664
European Union *	484	386
Australia	138	166
Brazil	83	121
Argentina	103	115
Skim Milk Powder		
World	**1 198**	**1 072**
New Zealand	248	307
USA	380	195
European Union *	177	165
Australia	117	158
Butter		
World	**792**	**771**
New Zealand	325	357
European Union *	150	140
Belarus	62	65
Australia	48	58
Cheese		
World	**1 794**	**1 670**
European Union *	555	520
New Zealand	295	281
Australia	207	151
Belarus	102	100

* Excluding intra EU trade (Source: Global Dairy Trade)

The international dairy trade is dominated by four players - EU, New Zealand, Australia and USA - which together account for 85% of all exports. New Zealand and Australia export as much as 80 and 50% of their milk production respectively. The Asia-Pacific region has been net milk importer. In contrast, most cheese imports go from developing countries to developed countries such as Japan and the United States.

The dairy industry is regulated in most countries through various ways. Imports are commonly restricted, and exports frequently subsidized. High dairy price supports in many countries are put in place to stimulate production to the extent that subsidies for exports are necessitated to maintain domestic dairy Programmes.

2.1.6 World Milk Consumption

The current global per capita milk consumption stands at 108kg with great disparity between developed and developing countries. Asia is the largest consuming region, but consumption per capita (67 kg) is low compared to Europe (277 kg). This is due to the fact that in more developed dairy regions like the EU, North America and Oceania, dairy products are considered staple foods, while in other regions they are not part of a traditional diet, and is often considered to be luxury goods. Continent wise total consumption of milk and milk products are:

Asia: 39%
Europe: 29%
North America: 13%
South America: 9%
Africa: 6%
Central America (incl Mexico): 3%
Oceania: 1%

Countries in Northern Europe have the highest consumption per capita of liquid milk in the world. Estonia, Ireland, Finland, UK and Iceland have consumption per capita of more than 100 kg, with consumption quantities in Estonia, Ireland and Finland being twice as high as the average consumption in the EU as a whole. Highest per capita butter consumption is found in Western Europe, with France at the top (7.5 kg per capita, twice as high as the EU average).Western Europe have the highest average consumption of cheese, with Luxembourg and France at the top, both countries consuming more than 25 kg per capita.

Significant divergences exist in the consumption of different dairy products by region. Cultural factors are a significant influence on regional/national consumption patterns, however relative disposable incomes help explain significant variation in the consumption of value added dairy products.

- Per capita consumption of dairy products is weakest in least developed and developing nations.
- The variation in per capita consumption between developed and developing regions is clearest when analyzing the more value added products.

Table 6: Per Capita Consumption of Milk and Milk Products (2007)

Countries	Per Capita Consumption (kg/yr)			
	Total Milk Equivalent	Cheese	Butter	Cream
Developed	213.7	12.44	2.8	2.18
Developing	55.2	0.64	1.0	0.04

Source: Stefano Gerosa and Jakob Skoet (2012)

2.1.7 Dairy Animal Farming and Global Warming

Dairy animal farming is closely linked with emissions of green house gasses namely methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). According to a global Life Cycle Assessment (LCA) of the cattle dairy sector in 2007 the sector emitted 1 969 million tonnes CO_2-eq, of which 1 328 million tonnes were attributed to milk. The contribution of the global milk production, processing and transportation to total anthropogenic emissions is estimated at 2.7 percent (FAO, 2010) of the total anthropogenic GHG emissions reported by IPCC (2007). Methane emissions are by far the largest contributor, accounting for about 52 percent of the total from the sector, followed by nitrous oxide and then carbon dioxide.

Globally, emissions per unit of milk product are estimated at 2.4 kg CO_2-equivalent per kg of fat and protein-corrected milk (FPCM) at the farm gate (FAO, 2010). However, values vary greatly among different regions.

At the same time, the livestock sector is itself affected by the degradation of ecosystems and climate change. Climate change will have far-reaching consequences for animal production through its effects on forage and range productivity, as well as on feed intake and feed conversion rates. The probability of extreme weather events is also likely to increase. Some of the greatest impacts of climate change are likely to be felt in grazing systems in arid and semi-arid areas, particularly at low latitudes. In the non-grazing systems, which are characterized by the confinement of animals (often in climate-controlled buildings), the direct impacts of climate change can be expected to be limited and mostly indirect, e.g. feed, energy and water costs. Climate change will play a significant role in the spread of vector-borne diseases and animal parasites, which will have disproportionately large impacts on the most vulnerable men and women in the livestock sector (FAO, 2009).

2.2 National Dairy Sector Outlook

2.2.1 Dairy Animal Population, Distribution and Trend in Nepal

Cattle, buffaloes, yak and their crossbred are important dairy animals being reared in the country. The estimated population of cattle, buffaloes and yak/crossbred are 7.2 million, 5.0 million and 63 thousand respectively during the year 2010/11. Of the total cattle population, the distribution in hill agro ecological region was highest (48%) followed by Terai (40%) and least in the mountain agro-ecological region. Similarly, the cattle population was found to be mostly concentrated in the Eastern Development Region (28.8%) followed by Central Development Region (23.6%), Mid Western Development Region (18.0%) and Western Development Region (16.6%). The cattle population was least in the far western development region (13.0%)

Table 7:Cattle Population by Development and Ecological Region (2010/11)

Ecological Regions	Development Regions					
	EDR	CDR	WDR	MWDR	FWDR	Total
Mountain	252649	184250	11321	197051	225267	870538 (12%)
Hills	744597	825357	773751	735714	386146	3465565 (48%)
Terai	1085027	693507	417976	367485	325951	2889946 (40%)
Total	2082273 (28.8%)	1703114 (23.6%)	1203048 (16.6%	1300250 (18.0%)	937364 (13.0%)	7226049

Source (MOAC, 2012)

The distribution of buffaloes was also highest in the hill agroecological region (52.4%) followed by in Terai (39.0%) and least in mountain region (8.6%). Likewise distrbution of buffaloes in CDR, WDR, EDR, MWDR and FWDR were 25.6%, 25.2%, 23.3%, 15.3% and 10.6% respectively.

Table 8: Buffalo Population by Development and Ecological Region (2010/11)

Ecological Regions	Development Regions					
	EDR	CDR	WDR	MWDR	FWDR	Total
Mountain	146682	148047	88	34273	99185	428275 (8.6%)
Hills	427286	644691	934358	404927	205464	2616726 (52.4%)
Terai	587724	486383	325513	324924	224104	1948648 (39%)
Total	1161692 (23.3%)	1279121 (25.6%)	1259959 (25.2%)	764124 (15.3%	528753 (10.6%)	4993649

Source (MOAC, 2012)

The estimated population of yak and crossbred (Chauries) in the country was 6900 during FY 2010/11 and are found in the 28 Northern high hills and mountain district of the country.

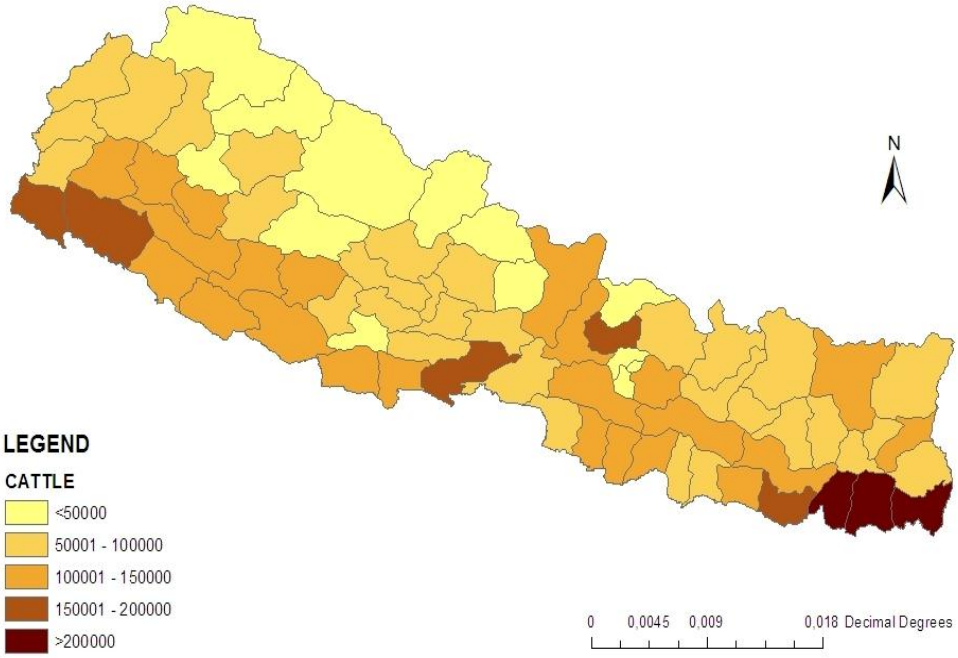


Figure 6: District-wise cattle distribution in Nepal

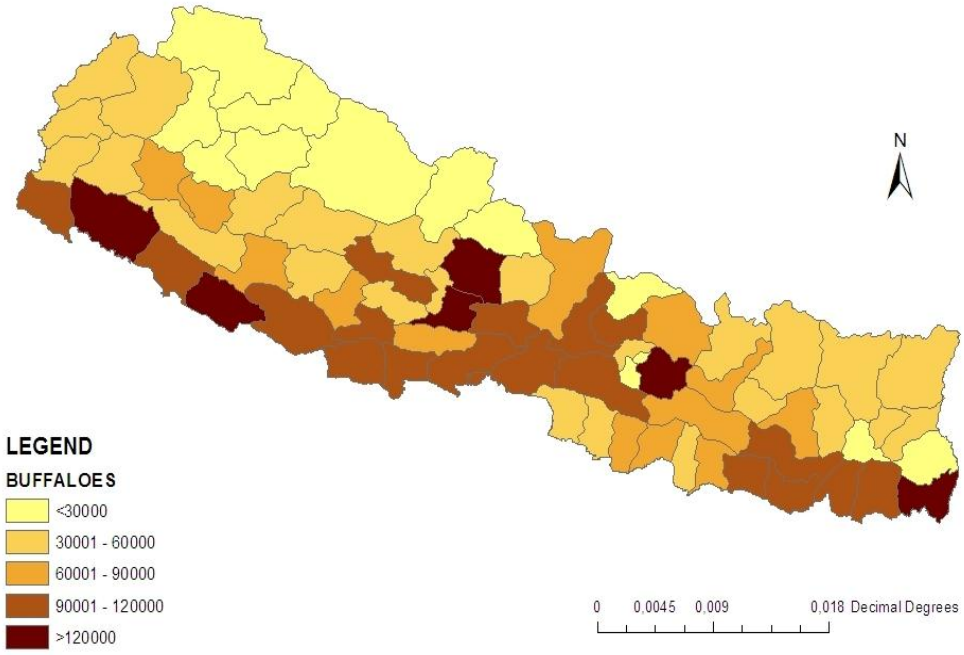


Figure 7: District-wise buffalo population distribution

Though statistics on population of cattle and buffaloes segregated by breed is not available, it is estimated that around 10-12% of the cattle population and 25-36% of buffalo population are considered to be exotic or crossbred (DLS, 2010).

The crossbred/ improved populations are mostly concentrated in the peri urban areas of hill and Terai regions with comparatively better infrastructures and marketing facilities. Holstein Friesian and Jersey are the predominant exotic breeds of dairy cattle introduced in Nepal for genetic improvement of indigenous cattle, whereas Murrah is the only exotic buffalo breed introduced for the same purpose. Of the total cattle and buffalo population in the country, it has been estimated that about 13% and 26% are in milking stage. Both solo and mixed species are being raised by the farmers particularly for milk production and sale. Majority are smallholder farmers with some medium sized and extremely few large scale producers (Shrestha *et al*., 2010) with median cattle herd size of 5.

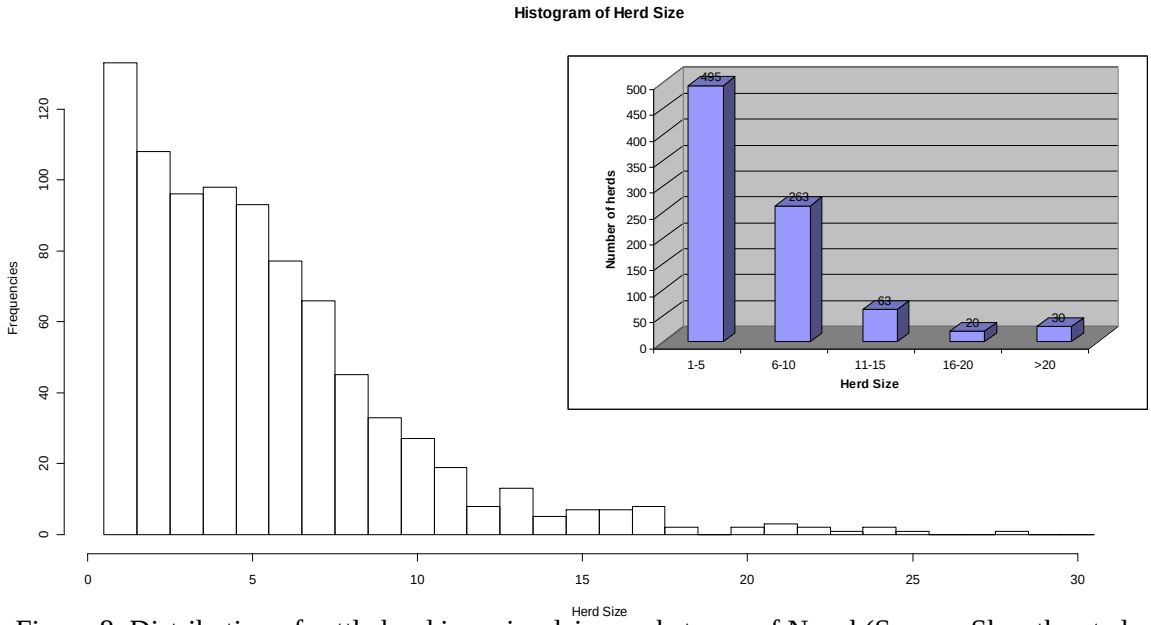


Figure 8: Distribution of cattle herd in major dairy pocket area of Nepal (Source: Shrestha et al, 2010).

Trend of Dairy Animal Population

The cattle population has remained static or increased slightly (0.35%/annum) whereas annual increase of 3.7% in buffalo population during the last 10 years has been observed. However, critical observation in the villages makes one to speculate that the population of indigenous cattle and buffaloes are decreasing at dramatic rate which needs to be verified. Export of live buffaloes to India particularly from the far western region of the country has been recently noticed.

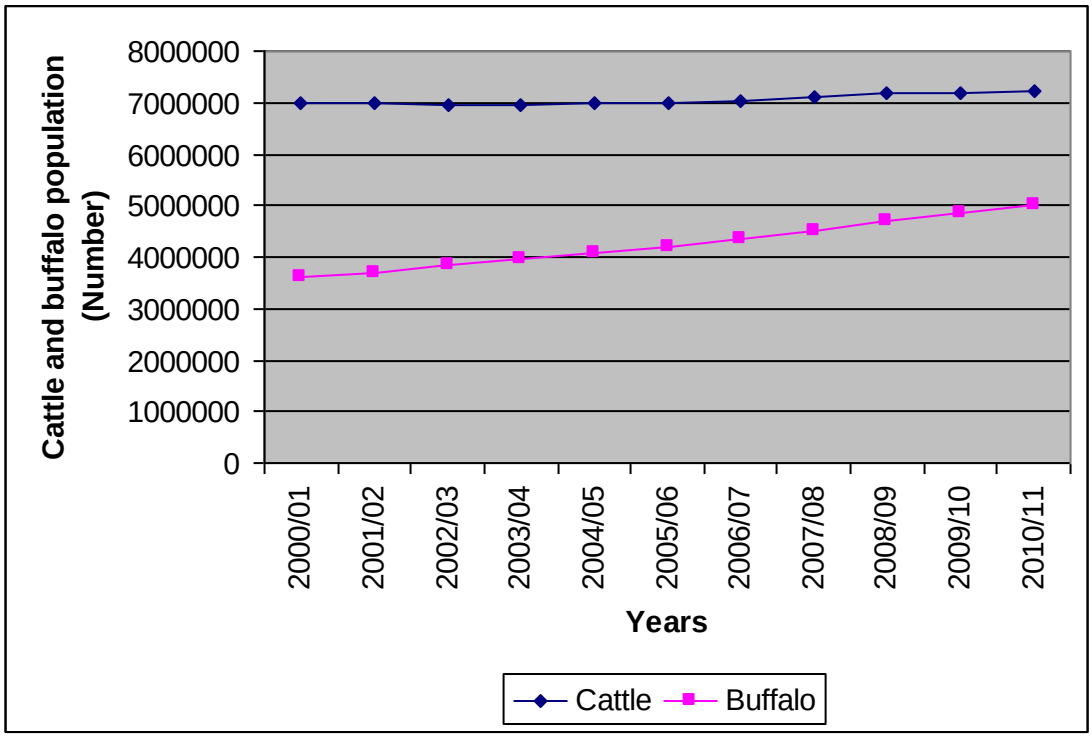


Figure 8: Trend of cattle and buffalo population growth

2.2.2 Annual Milk Production

The estimated annual milk production in the country in the year 2010/11 was 1.56 million MT, a 3.95% higher than that in the year 2009/10 (DLS, 2012). The annual milk production was highest from the hill region (52.5%) followed by Terai (40.5%) and least in the Himalayan region (7.0%). The average milk production per milking cow and buffalo stood at only 459 kg and 859kg respectively. Again the productivity of animals in Terai and Hills were higher as compared to the productivity of animals at Himalayan region mainly due to gradual replacement of indigenous cattle and buffaloes with exotic or crossbred animals particularly in the region where milk collection facilities from organized sector (DDC and private dairies) have been established.

Table 9: Annual Milk Production by Ecological Region (2010/11)

Ecological Regions	Cattle			Buffalo			Total Milk (MT)
	Milking animal	Milk Prodn (MT)	Productivity (kg/yr)	Milking animal	Milk Prodn (MT)	Productivity (kg/yr)	
Mountain	113294	38466	339.5	98438	71009	721.4	109475
Hills	495228	220431	445.1	734191	596161	812.0	816592
Terai	365600	188288	515.0	459015	442155	963.3	630443
Total	974122	447185	459.1	1291644	1109325	858.8	1556510

Source: DLS (2012)

Similarly, the annual milk production in CDR was highest (29.7%) followed by production in EDR (25.5%), WDR (23.2%), MWDR (11.6%) and least in FWDR (10.1%) also coinciding with the milk collection network established in the country.

Only recently milk collection and processing facilities have been established in the far western development region.

Table 10: Annual Milk Production by Development Region (2010/11)

Development Regions	Cattle			Buffalo			Total Milk (MT)
	Milking animal	Milk Prodn (MT)	Productivity (kg/yr)	Milking animal	Milk Prodn (MT)	Productivity (kg/yr)	
EDR	302767	151113	499.1	300644	245338	816.0	396451
CDR	238973	120941	506.1	347604	341970	983.8	462911
WDR	156800	72396	461.7	352959	288257	816.7	360653
MWDR	147788	53021	358.8	151443	126997	838.6	180018
FWDR	127794	49714	389.0	138994	106763	768.1	156477
Total	974122	447185	459.1	1291644	1109325	858.8	1556510

The trend analysis of milk production from cattle and buffaloes shows gradual steady increase in both total production and number of milking animals, but the productivity improvement has been marginal both for cattle and buffaloes. Programme for increasing the productivity of dairy animals rather than increasing the absolute number of animals would be quite essential to minimize additional burden on already limited availability of livestock feeding resources.

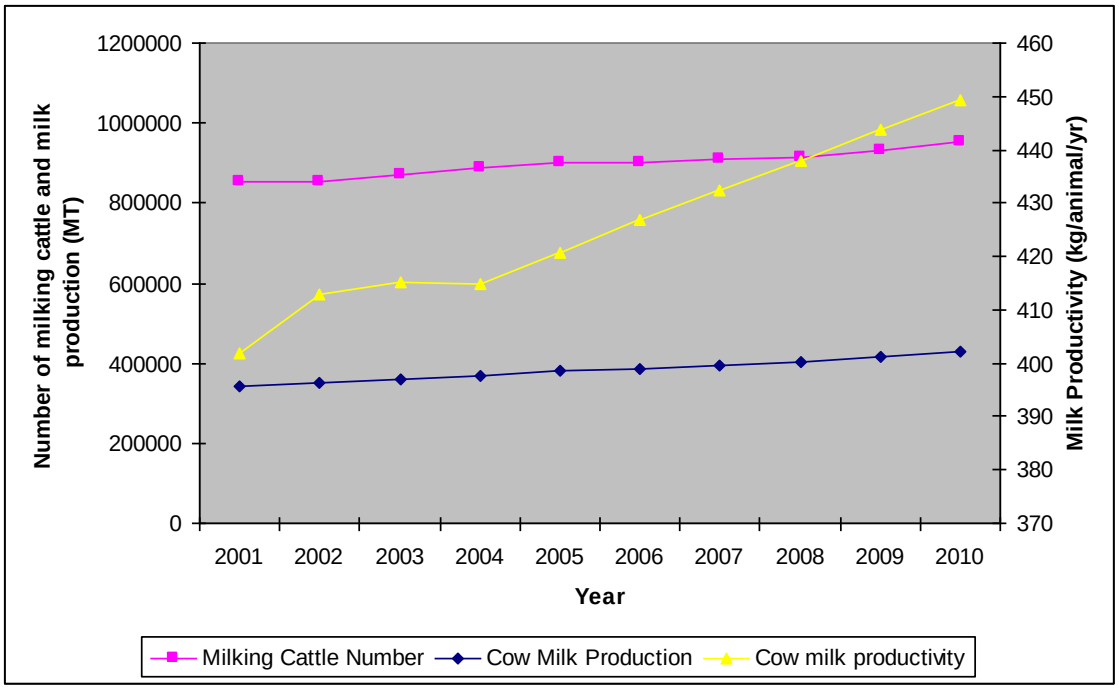


Figure 9: Milking cattle and cow milk production trend in Nepal

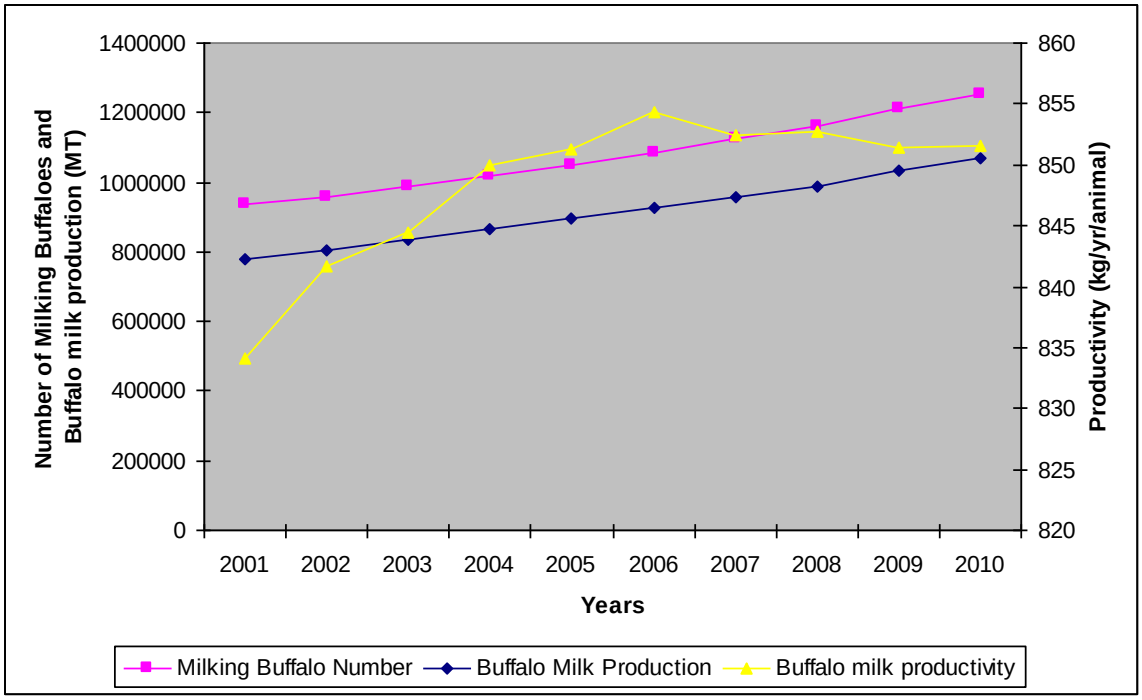


Figure 10: Milking cattle and cow milk production trend in Nepal

2.2.3 Per Capita Milk Availability

Per capita milk availability in Nepal is around 58 kg which is far below the 250g/day (91 kg/annum) recommendation of WHO. The per capita availability of milk in developed world is 222kg. Among the South Asian countries, Pakistan has highest per capita availability (230kg), followed by India (98kg). Per capita availability of milk in Bangladesh (18kg) and Sri Lanka (33kg) is below compared to the figure in Nepal. It has been estimated that annual milk production growth rate of 8-9% is required to meet the WHO/FAO recommended per capita consumption of milk (Table 11)

Table 11: Projection on Annaul Growth rate required to meet milk consumption recoomended by FAO/WHO by 2020.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Milk Production (MT at current growth)	1556510	1610988	1665466	1719944	1774421	1828899	1883377	1937855	1992333	2046811
Human Population	26620809	26993500	27366192	27738883	28111574	28484266	28856957	29229648	29602340	29975031
Per capita availability	58.5	59.7	60.9	62.0	63.1	64.2	65.3	66.3	67.3	68.3
Milk Production (5% Annual Growth)	1556510	1634336	1712161	1789987	1867812	1945638	2023463	2101289	2179114	2256940
Per capita availability	58.5	60.5	62.6	64.5	66.4	68.3	70.1	71.9	73.6	75.3
Milk Production (7% Annual Growth)	1556510	1665466	1774421	1883377	1992333	2101289	2210244	2319200	2428156	2537111
Per capita availability	58.5	61.7	64.8	67.9	70.9	73.8	76.6	79.3	82.0	84.6
Milk Production (9% Annual Growth)	1556510	1696596	1836682	1976768	2116854	2256940	2397025	2537111	2677197	2817283
Per capita availability (kg)	58.5	62.9	67.1	71.3	75.3	79.2	83.1	86.8	90.4	94.0

2.2.4 Dairy Animal Breeds and their Production Performance

In Nepal, seven indigenous breeds of cattle including yak and 3 indigenous buffalo breeds have been characterized and performance evaluated. Indigenous cattle are generally poor in milk production performance; rather they are being kept for manure, power for agricultural operation and for religious purpose. The value of indigenous cattle as dairy animals particularly in reference to commercialization is very poor. However, their utility for production of crossbred dairy cattle through imported frozen semen or bulls is tremendous. They have their unique nature and are considered to be resistant against diseases and parasites e.g. indigenous cattle are not affected by ticks. Achhami cattle, the smallest cattle breed in the world (Epstein, 1984) found in western hill districts of Nepal are capable of producing milk compared to their body size in adverse environmental condition. Similarly Lulu cattle, the only humpless indigenous cattle breed found in mountainous region are also considered to have potentiality to produce in poor management condition.

Table 12: Productive and reproductive performances of native cattle (Values are means ± standard errors)

Breeds	**Age at 1st service (months)**	**Age at 1st calving (months)**	**Gestation length (days)**	**Calving intervals (months)**	**Average daily milk yield (litres)**	**Lactation length (days)**
Lulu cattle	42 (36-56)	52 (46-58)	*280*±1.7	18 (12-24)	1.6±0.31	*195 (180-210)*
Achhami	48 (36-60)	60 (48-72)	285±1.8	17 (12-24)	1.5±0.22	*225 (180-270)*
Siri	40 (36-48)	50 (42-70)	295.2±2.2	19.6±0.9	4.5 ±0.22	*268.6±2.0*
Khaila	45 (40-60)	55 (50-65)	288*±1.85*	18.0	2.5 (2-3)	*305.0*
Yak	45.3±0.65	56.6±0.75	252.2±1.5	21.3±0.76	0.8 (0.5-2.0)	*160 (180-210)*
Terai	39.4±0.50	49.9±0.46	296.1±0.25	16.3±0.23	2.1 (2-3)	246.0
Pahadi	*48 (40-55)*	*50.1±1.1*	*275±1.65*	*17.6±1.98*	*1.1 (1-1.5)*	*240±2.1*

Source: Neopane and Pokharel (2005)

Three indigenous breeds of buffaloes namely Lime, Parkote and Gaddi have been characterized so far. Of the three breeds, Gaddi are found only in the far western hills of the country, whereas other two breeds are scattered throughout the country. Buffaloes are rare in the northern Himalayan districts.

Among the three indigenous buffalo breeds identified, Gaddi buffaloes found in far western hill districts are comparatively better in terms of lactation performance. The average daily milk yield for the first three months was 4.69 lit from two teats and 4.62 lit in next three months with one teat for calf. The lactation length varied from 14 to 22 months (Pokharel, 2007). Average lactation yield of Lime and Parkote buffaloes have been observed to be 963 and 1022 kg respectively (Shrestha, 2003). A great deal of variation within indigenous buffaloes (figure 12) has been observed among indigenous buffaloes and selective breeding strategy in supplement to cross breeding with Indian Murrah buffalo has been lately suggested

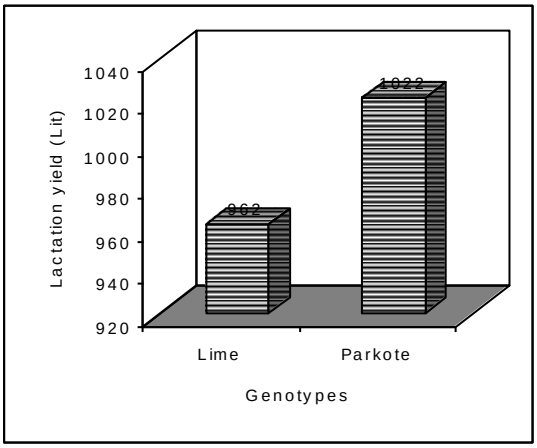


Figure 11: Lactation yield of indigenous buffaloes

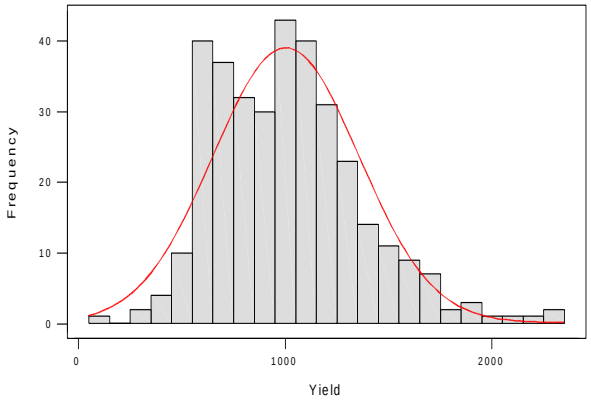


Figure 12: variation in the lactation Performance of indigenous buffaloes

Source: Shrestha et al. (2003)

Yak (female are known as Nak) and their crosses with hill cattle (known as Dimjo and Urang Chauries) are important livestock species in the high hills and mountains of Nepal. Though milk production potential of Nak is poor (less than 200 lit in 6 months lactation period) crossbred Chauries are better in lactation performance (around 400 lit). Crossing Nak with Brown Swiss frozen semen was attempted in Nepal. The crossbred Chauries produced more than 1000 lit of milk in a whole lactation (number of crossbred Chauries was only 2)

Jersey and Holstein Friesian are the two primary breeds of dairy cattle introduced in Nepal either through importation of live animals (limited numbers) or through upgrading by importation of frozen semen. After some years of promoting both Jersey and HF cattle in the country, the government later considered that HF is not suitable under Nepalese farming system and management condition. Many reproductive problems were reported in these crossbred animals. Therefore, DLS stopped producing frozen semen from HF bulls in its centre. Artificial insemination with Jersey semen to the crossbred HF cattle were practiced and three breeds cross cattle were produced. Some farmers were not happy with the government decision and illegal import of HF semen from India was continued in the boarder areas. However, recently the government revisited its policy of not promoting HF cattle due to farmers' demand and restarted production of frozen semen from HF bulls also. Apart from Jersey and HF, Brown Swiss, Ayreshire, Tarentase semen were also introduced in Nepal, but their uses were limited. Likewise Red Sindhi and Sahiwal cattle have also been introduced, some blood of these breeds can also be found in the farmers' cattle herds. Significant improvements in the production potential of these crossbreds and upgraded cattle have been achieved. Milk production of these crossbred are many fold higher than that of the indigenous cattle breed, and also the age at first calving and calving intervals are considerably lower in these crossbred cattle. However, some reproductive problems (repeat breeding, post portem anestrous, delayed puberty) have also been encountered mainly due to the management fault.

The estimated (based on monthly recordings) milk yield of crossbred cattle in the major dairy pocket areas of the country is presented in Table 13.

Table 13: Performance of cattle breed in major dairy pocket areas of Nepal

Breeds	300 day Milk yield (kg)		Fat %		Protein %		Valuable solid (kg)	
	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev
Predominant Jersey	2469.0	853.6	4.5	0.7	3.3	0.2	192.7	67.2
JXHFXNepali	3056.0	991.9	4.4	0.8	3.3	0.2	236.5	79.1
Predominant HF	3239.1	1107.1	4.2	0.6	3.3	0.1	241.8	78.3
Jersey Cross	2838.8	839.2	4.4	0.7	3.3	0.1	217.3	63.1
Holstein cross	3200.0	1008.0	4.3	0.7	3.3	0.1	240.2	74.0
Unknown/mixed	2640.4	921.1	4.5	0.6	3.3	0.1	201.7	67.4
Overall mean	2801.8	975.1	4.4	0.69	3.29	0.15	214.6	73.2

Source: Shrestha *et al.* (2010)

The overall 300 days lactation yield of crossbred cattle has been found to be 2800 lit, with HF performing better (3239 lit) than that of the Jersey (2469 lt). The three way cross also performed better compared to Jersey. The overall fat content (averaged over whole lactation) of crossbred cattle has been found to be 4.4% with slightly better in Jersey (4.5%) compared to HF (4.2%). However, the protein content across breed didn't vary. The valuable solid (Fat + Protein) produced during 300 days lactation was slightly better in HF (241.8 kg) compared to Jersey (192.7kg). The variation in lactation performance, fat and protein content and valuable solid yield have been depicted in the following figures

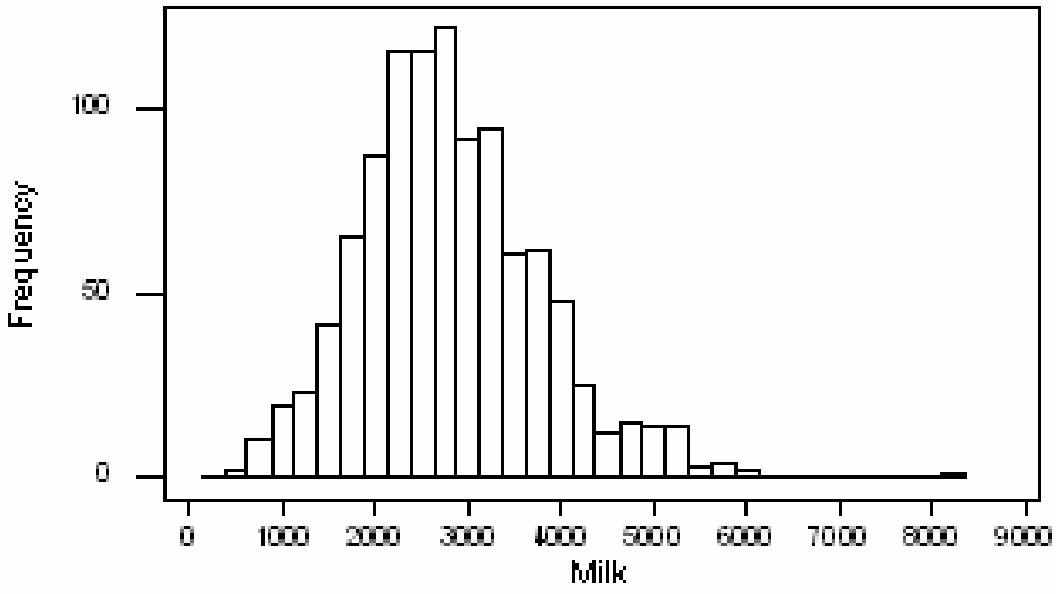


Figure 13: Histogram of 300 days lactation in crossbred cattle in Nepal

The principal buffalo breeds imported in Nepal for upgrading indigenous buffaloes is Murrah. Nili Ravi buffaloes have also been imported (semen), but the number is insignificant. Some Surti buffaloes are also observed to be unofficially introduced in Nepal. About 10% buffaloes in the hills and slightly greater than 10% in Terai are considered to be exotic Murrah and their crossbred with indigenous buffaloes. However, the CBS (2001/02) report gives this figures to be slightly less than 2% of the national buffalo population and highly contradicting with this report, DLS estimates that about 24.6% of the buffalo population are improved (exotic and crossbred). Kavre, Rupandehi, Sarlahi, Saptari, Dhanusha, Nawalparasi, Dhading, Chitwan, Nuwakot and Kaski are some of the districts having higher number of exotic buffaloes. The occasional importation of Murrah she buffaloes and continuous upgrading of indigenous buffaloes with frozen semen and Murrah bull distributed are basic buffalo development strategies adopted in the country. Recently, government has made a policy to unrestricted upgrading to Murrah in Terai and maintenance of upto 62.5% Murrah blood in the hills. However, the regulation and monitoring mechanism is very poor to implement the policy.

The herd average of Murrah buffaloes at Livestock Development Farm, Lampatan in 1990s was 1265 lit per lactation which has improved significantly to 1543 lit in a standard lactation of 305 days in recent years through continuous selection and culling practice. The average milk yield per buffalo per year in the farm has reached to 1847 lit excluding milk offered to calves, which is generally for a period of 5 months. The herd performance in different lactation is: 1st lactation – 1279±288 lit, 2nd lactation – 1556±318 lit, 3rd lactation – 1520±305 lit, 4th lactation – 1562±283 lit and 5th lactation – 1578±192 lit. in 305 days (LDF, 2064/65).

In western hills, Rasali *et al.*, (1998) revealed that, the average lactation performance of crossbred Murrah buffaloes were as follow:

50% Murrah cross = 1222.7 lit

75% Murrah cross = 1560.3 lit

In Chitwan, Kolachhapati *et al*., (1993) found the average lactation milk yields of crossbred buffaloes to be 1927.95±76.618 lit in 10.42 months. Crossbred buffalo had nearly 50% higher milk yield and the age at 1st calving was shorter (4.69±0.07 years) when compared to local buffaloes (4.91±0.08 years).

Better performances of Murrah/ crossbred buffaloes have been reported from eastern Terai region of Nepal also (Table 14).

Table 14: Lactation Milk Yield of Murrah/crossbred Buffaloes in Dhanusha District

	Number and percent of buffaloes with lactation yield of							
Sites	**>2400 litres**		**>2100 <2400 lit**		**>1800 <2100 lit**		**<1800 litres**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Sapahi	18	57	9	28	3	9	2	6
Kurtha	0	0	6	27	6	27	10	46

Laxmipur	8	47	6	35	3	18	0	0
Sinurjora	8	22	13	36	14	9	1	3
Overall	34	32	34	32	26	24	13	12

Source: Annual Report of ABD (2065/66)

Of the recorded animals, about 64% of the individuals had lactation yield of more than 2100 litre, whereas only 12 % of the buffaloes yielded less than 1800 litre of milk in a lactation period.

2.2.5 Dairy Animal Management System

Milk production in Nepal broadly can be classified into two systems 1) traditional subsistence milk production system and 2) market linked commercial/ semi commercial milk production system. Under traditional subsistence production system, majority of the dairy animals are of indigenous origin, are kept in low input and mostly under grazing management with rare uses of external inputs. Under this system animals are kept for milk and milk products mainly for household consumption. Surplus milk if any is sold to village tea shop if the opportunity for this exists in the village. The products particularly *Ghee* (clarified butter) are traded in the nearby town. The system is under pressure and gradually shifting towards commercial/ semi commercial production, once the villages are connected by road network and national milk grids. In the areas lacking these opportunities, farmers are gradually abandoning raising of animals in search of other employment opportunities in cities or abroad. The second type of milk production system which is emerging in the country is described under following sub headings:

2.2.5.1 Smallholder dairying

Smallholder dairy systems are common throughout the developing countries. Market-oriented dairy farming by smallholders practicing a mixed crop-livestock form of farming can be a key to economic development in many areas of the HKH including Nepal. Over the past 10 to 15 years, considerable changes have taken place in the structure and management systems of smallholder dairy farming within the mixed crop-livestock farming systems. In particular, there have been notable changes in the species and breeds of the dairy population, infrastructure, and market developments. Increasing urban markets and improved marketing systems have led to a slow but steady move towards dairy farming as a means of supplementary income generation and even as a commercial venture rather than as part of a subsistence system.

Devendra (2001) categorized smallholder dairy production system into three systems:

1. Traditional, usually with ad hoc marketing arrangements such as many peri urban farms
2. Cooperative, formed from natural aggregation and concentration of farms
3. Intensive, where herd sizes become larger

Smallholders manage their herds in order to maintain a steady supply of milk. The number of milch animals that can be reared in a smallholder system has a certain ceiling. The obvious determining factors to this are the size of landholding, the availability of feed, and human labour. In the major dairy pocket areas of Nepal, majority of the dairy farmers are smallholders. Out of 880 farms under recording scheme for genetic improvement programme across 14 hill and Terai districts of Nepal, the median herd size was found to be 5 with majority of households (56%) having cattle herd size of 1-5. Very few households were having more than 10 cattle and extremely low had herd size of more than 20 cattle. Some of the smallholder dairy farmers keep the mixed herd of cattle and buffalo, some only buffaloes and rest only cattle with their unique explanation for such practices. Although government programmes have promoted crossbred cows for use as dairy animals, the use of buffalo is becoming popular among small farmers because of their adaptability to local feed resources, high milk fat content, and salvage value in the hills. The milk produced from these smallholder farmers come into formal milk market through organized private and public dairy sector in the country. Some farmers are still opt to supply milk directly to the consumers or to the intermediate processor (hotel and restaurants producing sweets) as they get better price for milk compared to the price when they sell it to the formal milk market.

In Nepal's hills and Terai, areas that are accessible via the road network have experienced significant growth in smallholder dairy farming. The marketing of milk has been facilitated by the establishment of milk collection canters that transport milk to the main chilling canters established by DDC (government), as well as by private dairies in strategic milk collection points.

Private sector involvement in processing milk from smallholdings is increasing. However, the private sector's efforts are also uncoordinated, and quality enforcement is lacking. The private sector also suffers from unfair competition with the subsidized public sector.

In the high hills and mountain areas, *Chauries* (crossbred between yak and hill cattle) are being raised mainly for milk production. The milk is being utilized for Yak cheese production by DDC owned and private cheese factories. Milk production from *Chauries* are seasonal (not milked during winter feed scarce period) and thus the operation of these cheese factories located in the remote high hills of the country are also seasonal.

2.2.5.2 Periurban milk production

Most of the smallholder dairy production development has been evolved around peri urban areas as there is good road link and good market potential for the milk and products in adjoining city centre. The state owned Dairy Development Corporation (DDC) initiated 5 different milk supply scheme namely Kathmandu Milk Supply Scheme (KMSS), Biratnagar Milk Supply Scheme (BMSS), Hetaunda Milk Supply Scheme (HMSS), Pokhara Milk Supply Scheme (PMSS) and Lumbini Milk Supply Scheme (LMSS) in Kathmandu, Biratnagar, Hetauda, Pokhara and Butwal respectively. Consequently, the smallholder as well as medium to large scale dairy farms emerged in the vicinity of these city centres. The collection and chilling centres were established

around these dairy farm settlements. The private dairy sectors also focused their activities on these established centres thus smallholder dairy grew faster in these peri urban areas. However, in the present context of short supply of around 400000 lit of milk daily to the established capacity of small to large dairy industries, the private sectors are expanding their coverage in new peri urban areas as well as in the villages where there is good road linkage. The lower oppertunity costs of land and labor in peri urban areas compared to that within the cities have greatly encouraged dairy development in peri urban areas. However, smallholder dairy farming is not uncommon in the city centre itself. Small to medium sized dairy farms are found in major cities like Kathmandu, Pokhara and Biratnagar. The feeding of these dairy animals kept in the city itself however differs from that kept in the peri urban areas. In the city centres, the animals greatly depends on straw and concentrates, whereas there is a practice of cultivating forage grass depending on availability of land in peri urban areas. Green grasses from fallow land and roadside and from fodder tree is also available in the peri urban areas.

2.2.5.3 Dairying through co-operatives

The fundamentals of the cooperatives is working together to build self reliant communities. Cooperatives are often cited as one of the most effective way of grouping small dairy farmers to deal with the challenges of producing and marketing milk. As a result of the perishable nature of milk and the range of skills involved in its production and marketing, dairying requires a number of services that can best be provided by cooperative action. It is not surprising therefore that the cooperative movement has featured prominently in the development of the dairy industry worldwide.

A dairy cooperative business is owned, operated, and controlled by the dairy farmers who benefit from its services. Members finance the cooperative and share in profits it earns in proportion to the volume of milk they market through the cooperative. Milk producers' cooperatives and association were formed for the first time in 1980 in Nepal to cope with the challenges being faced by smallholder farmers in milk production pockets. At present, there are 1748 Milk Producer's Cooperative Societies (MPCs) functioning in 62 districts in the country (as of Ashad 2068). These primary cooperatives used to have at least 25 member farmers. In the district level, District Milk Producers' Cooperative Unions (DMPCUs) are in function in 38 districts which coordinates and facilitates its member primary cooperatives within the district for dairy operation. Central Dairy Cooperative Association of Nepal (CDCAN) is the national level umbrella for primary cooperatives and union in the country.

The farmers' are paid for milk on basis of fat and SNF content of the milk. However, the primary cooperatives are additionally paid for total solid content of the bulk milk from DDC and dairy industries. This amount helps to run cooperative for its day to day operation. The salary to the personnel involved in the cooperative, transportation cost from collection to chilling centres or dairy industries, and purchase of chemicals and glassware required are also paid from these earnings of the cooperatives.

Farmer-owned dairy cooperatives engage in a variety of activities to provide members an assured market for their milk. Dairy cooperatives range widely in size and function-some solely arrange for the sale of members' milk and provide few services, while others manufacture range of products and may market their products directly to consumers. Most MPCs are engaged in milk collection, quality testing and distribution of milk payments. Some MPCs operate input supply, veterinary services, and consumer goods outlets for members. Feed manufacturing by the cooperatives and selling to the cooperative member is gaining popularity as there is greater quality assurance and payment ease in the process.

2.2.5.4 Dairy Animal Population, Milk Production, Consumption and Sale in Surveyed households

Table 15 depicts the dairy animal farming, daily milk production, household consuption and daily sell of milk among the surveyed households in selected districts. Most of the selected households were found to be raising dairy cattle. The average proportion of milking cattle to total cattle holding in the households ranged from 38% in Chitwan district to 60% in Rupandehi district. Of the total daily milk produced, 4-8% were found to be consumed at household level in different districts and rest 92-96% being sold to the market.

Table 15: Average dairy animal population, milk production, consuption and sell in surveyed householdsd

District	All cow	Milking cow	All Buffalo	Milking buffalo	Daily Milk production(kg)	HH Milk consumption (kg)	Daily Milk sale (kg)
Kathmandu valley	7.1 (0-40)	4.1 (0-25)	1.8 (0-8)	1.4 (0-6)	48.9 (3-320)	2.0 (0-5)	45.3 (0-320)
Kaski	5.9 (1-25)	2.6 (0-9)	0.4 (0-2)	0.2 (0-2)	28.1 (5-100)	2.3 (0-6)	25.7 (3-95)
Chitwan	14 (2-84)	5.3 (1-32)	0	0	58.3 (11-412)	3.9 (1-12)	54.4 (8-400)
Nawalparasi	14.1 (5-34)	6.6 (3-17)	0.7 (0-3)	0.4 (0-2)	69.2 (15-180)	3.2 (1-8)	66 (13-178)
Rupandehi	8.65 (3-114)	4.54 (1-83)	2 (0-6)	1 (0-4)	43.5 (4-820)	2 (1-5)	41.5 (4-820)
Morang	7.5 (2-40)	4.5 (1-15)	0	0	40.0 (5-150)	2.5 (1-5)	37.5 (4-145)
Ilam	3.35 (1-10)	1.74 (1-3)	0	0	12 (4.5-34)	1.5 (1-2)	10.5 (4-32)
Rasuwa#	22.9 (15-45)	10.8 (6-15)	0	0	27.6 (20-36)	4.5 (3-8)	23.1 (16-28)

Chauries in Rasuwa instead of cattle

Number in parenthesis are range

2.2.6 Dairy Animal Health Care and Breeding Services

2.2.6.1 Dairy Animal Health Services

Various diseases and parasites have been identified as major constraints in dairy animal farming in Nepal. Though sporadic information are available, comprehensive analysis of the economic loss due to these diseases and parasites in the country is still lacking. As rinderpest disease has been eradicated from the country, Hemorrhagic septicaemia (HS), FMD, mastitis, infertility, metabolic diseases and internal parasites are some of the economically important diseases prevalent in dairy animals. FMD is important disease, which causes significant economic losses mainly due to loss in milk and meat production, mortality of neonates, loss of draft animals due to lameness, and restrictions on trade (James and Rushton 2002). As in many developing countries, FMD is endemic in Nepal, where the disease has been reported in all 75 districts of the country and confirmed by laboratory testing in 61 districts (Gongal and Karki 2000). They have estimated economic losses due to FMD infection in Nepal which comes around USD 5.36 million per year. In another study on the economic impact of livestock diseases in rural areas of Nepal, Lohani and Rasali (1992) estimated that FMD could account for 26% of the overall economic losses in livestock production. Epidemics of FMD outbreak in 2009/10 throughout the country greatly affected smallholder dairy farmers. Mastitis is another important disease having greater economic significance, the loss being due to reduced milk production, discarding of spoiled milk and high cost of treatment. Internal parasites are also the cause of significant production loss in dairy animals. Apart from these diseases of economic significance, diseases like tuberculosis and brucellosis have public health concern. The overall herd health, farm sanitation and dairy production environment is regarded as poor in the country. It can be speculated that substantial loss has been occurring to the smallholder dairy farmers due to these diseases.

Listing of some of the diseases and parasites of dairy animals having economic and zoonotic significance:

- Ectoparasites and Vector borne haemoprotozoon diseases
- Endoparasites (Fasciola/Paramphistomum/Toxocara)
- Mastitis
- Reproductive disorders (Infertility/Abortion/Prolapse/Repeat breeder)
- Mycotoxicosis
- Specific infections (H.S., Anthrax, B.Q., Brucellosis, Calf scours)
- Tuberculosis and Paratuberculosis
- Foot and Mouth Disease (FMD)
- Nutritional and metabolic diseases (Milk fever)

Development of veterinary and animal production services in the country

- First veterinary dispensary to provide allopathic treatment to animals was established in Kathmandu in 1996 B S.
- 33 Hospitals, 21 dispensaries and 18 check-posts were established by 2021 B S with the assistance of India, FAO/OXFAM
- Department of Livestock Development and Animal Health was established in 2023 BS
- Animal Health and Livestock Services Act 2055, Regulation 2056 were formulated.

Service Delivery Network of the Government

- 999 Service/sub-service centers at village level
- 75 District Livestock Services Offices at district head quarters
- 5 Regional Labs
- 24 Animal Quarantine Check Post, 8 Animal Quarantine Office
- 5 Regional Directorates
- 5 Regional Training Centers
- 10 Central Offices

The service provided from this government networks are:

- Treatment, prevention and control
- Disease investigation & diagnosis
- Hygienic production
- Research
- Training
- Package services

Vaccine produced in country

- H.S.Vaccine-Alum precipitated
- Cattle -5ml S/C
- Calves -3ml S/C
- B.Q.Vaccine-Alum precipitate
- Cattle -5ml S/C
- Calves -3ml S/C
- H.S. Aerosol vaccine(Live)-Freeze dried
- Nasal spray
- H.S.&B.Q. Combined Vaccine-Alum Precipitated

- Cattle -5ml S/C
- Calves -3ml S/C
- Anthrax spore vaccine(Live)-1 ml/Animal

The Village Animal Health Workers (VAHW) is the approach taken by the government through DLS to provide animal health services particularly in the remote areas.

Nepal Agricultural Research Council (NARC), an apex body for agricultural research in the country is responsible for carrying out researches to solve problems of the dairy animals and farmers through its Animal Health Research Division and other research stations located at different agro-ecological regions of the country.

Institute of Agriculture and Animal Science under Tribhuvan University and Himalayan College of Agriculture Sciences under Purbanchal University are responsible for producing veterinary and livestock production graduates to deliver the respective services in the country. Mid level technicians are being produced from different public and private institutions affiliated with Centre for Technical and Education and Vocational Training (CTEVT).

2.2.6.2 Breeding Service

The gradual development of dairy sector in the country can be greatly attributable to the breed improvement programme undertaken by the government of Nepal through support of different countries around the world. The native breed of cattle and buffaloes are greatly been upgraded to exotic dairy breed of cattle and buffaloes through use of artificial insemination and natural services from breeding bull distribution. National Livestock Breeding Centre (NLBC) formally known as Animal Breeding and Artificial Insemination Section under Department of Livestock Services is fully responsible for producing frozen semen in the country for cross breeding and upgrading of dairy animals. Animal Breeding Division under NARC is responsible to undertake research activities to improve productivity of dairy animals. The District Livestock Service Offices (DLSOs) have responsibility to provide suitable breeding bulls (cattle and buffalo) and carry out AI services through its networks and technicians. Each year DLSO has programme of distribution of breeding bulls in the districts. NARC and DLS is jointly undertaking Dairy Cattle Genetic Improvement Programme formally with the support of FAO and recently on their own in the major dairy pocket areas of the country.

Brief history of dairy animal genetic improvement programme in Nepal:

- AI with fresh semen started in 2017/18 BS
- AI with frozen semen started in 2025/26.
- AI Coverage- 207 AI centres including 34 private in 44 districts
- AI Coverage- 8.06% in cattle and 1.55% in buffaloes

- Frozen semen import – 300000 doses (Brown Swiss, Jersey, Holstein, Ayreshire, Tirentase breeds of cattle and Murrah buffalo),
- Average conception rate- 49%

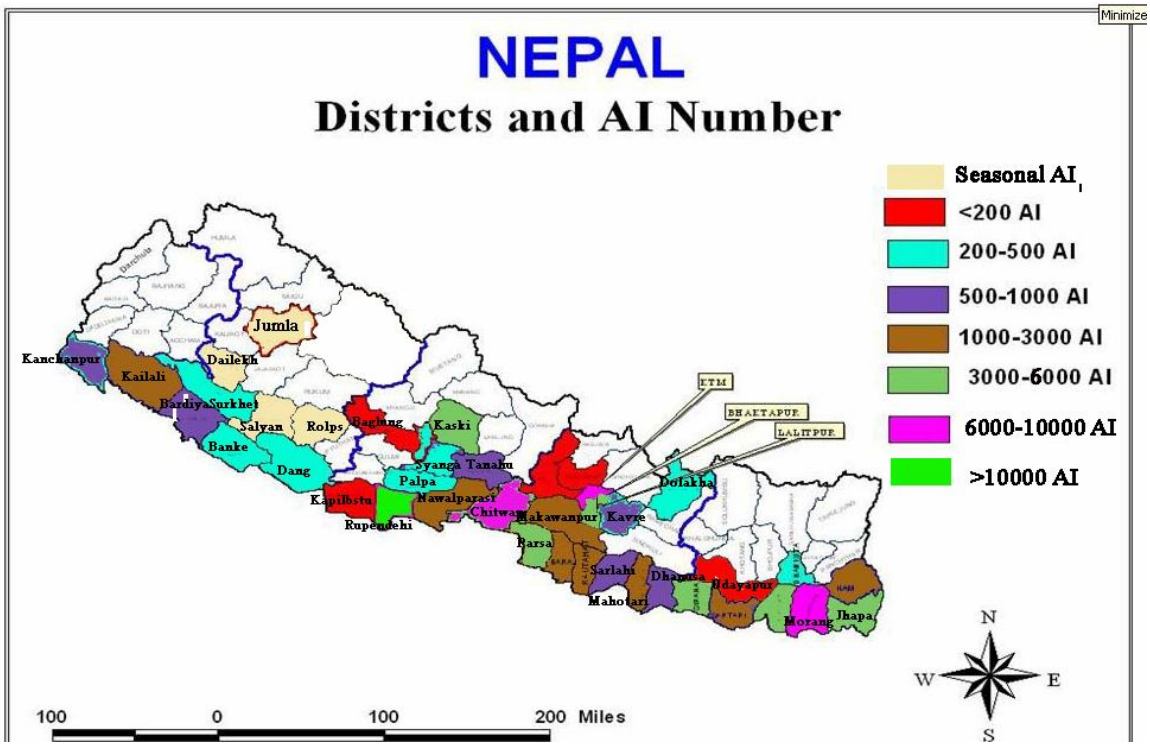


Figure 17: Map of Nepal showing AI coverage (Source: NLBC)

Currently AI services is available in 44 districts through the technicians/ veterinarians through District Livestock Service Office and its Service Centres/ sub centres. Private (technician not involved in government services) AI services are also available in the major dairy pockets of the country.

The number of AI in cattle and buffaloes has been steadily increasing over the years. AI is more in cattle compared to buffalos in Nepal. Currently Annual AI has reached well above 150 thousands (per. Communication BK Nirmal, 2010) and upsurge in the demand of AI has been noticed.

National Livestock Breeding Centre, Pokhara produces semen of Jersey bull and Murrah buffalo bulls fro AI in the country. It has recently restarted producing HF semen after the amendment in the breeding policy in the country. Informal import of semen from boarder area of India is not also uncommon in Nepal. Formally 10000 doses of semen of Jersey and HF bulls were imported during 2009 for the genetic improvement of dairy cattle in the country.

2.2.6.3 Dairy Animal Breeding Policy

The draft Livestock Breeding Policy has yet to be endorsed. There are currently two issues related to cattle that have been dealt in the proposed Livestock Breeding Policy. First issue is related with the conservation and utilization of native cattle genetic resource (as per Convention on Biological Diversity) that are of conservation significance namely Lulu, Achhami and Khaila cattle, the purebred population of which are declining alarmingly. Strategies for conservation and improvement of these cattle breeds have been incorporated in the proposed breeding policy.

The second issue deals with increasing the number of productive dairy cattle through cross breeding with Jersey and HF semen appropriate for different climatic and management conditions. Development of Nepalese Jersey and HF cattle with appropriate level of exotic blood in native cattle breeds (Pahadi and Terai cattle) has been proposed. The AI mission has set to increase annual AI number from 200,000 to 300000. This also focuses on increased coverage of AI in local cattle breed, which increases the number of crossbred (F1) animals that have at least 4-5 times more milk production potential compared to those of native cattle. Subsequently current issue of unavailability of productive dairy cattle will also be addressed.

The policy is however silent about the old and unproductive cattle in the country which has actually hinder the smooth improvement of the cattle in Nepal. They are adding burden to the scarce feeding resources for livestock.

Cross breeding with exotic breeds has been the cattle breeding policy to upgrade the indigenous breed for increased productivity. Jersey and Holstein breeds have been recommended as exotic cattle breeds for upgrading indigenous cattle with blood level restriction to 62.5% (50-75%) for hills and Terai regions.

The occasional importation of Murrah she buffaloes and continuous upgrading of indigenous buffaloes with frozen semen and Murrah bull distributed are basic buffalo development strategies adopted in the country. Recently, government has made a policy to unrestricted upgrading to Murrah in Terai and maintenance of up to 62.5% Murrah blood in the hills. However, the regulation and monitoring mechanism is very poor to implement the policy.

2.2.7 Dairy Animal Feeding System

The dairy animal feeding system in the country is determined mostly by the availability of feeding resources in the livestock farming areas and their production potentials. Thus great variation in the feeding system prevailing in the different locations of the country can be observed. Indigenous cattle, which are basically not meant for commercial milk production purposes completely depends on grazing on communal land, barren crop field and nearby forest with little or no supplementation except during early stage of lactation. In contrary, buffaloes, even indigenous are better cared particularly during lactation period as buffaloes are better producers of milk. In the villages not covered by the country's milk grid, where 1-2 buffaloes are being kept by the farmers, used to feed KUNDO (cooked mixed grains, byproducts with little salt) to their lactating animals.

Fodder based dairy animal feeding with limited supplementation of concentrates is common in the Ilam district in eastern part of Nepal, whereas, in Kathmandu valley, complete straw and concentrate (either purchased from feed mills or home made by mixing wheat bran, rice polish and cakes) feeding with grazing in the roadside and open land can be observed. In some part of the country, cultivation of fodder grasses in the cropping land for feeding productive (crossbred and exotic) dairy animals is also common, but depends on the availability of the land. The Community Livestock Development Project (CLDP) implemented by the Department of Livestock Service under loan support of ADB emphasized on utilization of community forestry for forage cultivation. Most of the dairy farms in the country are emerging on the main road corridor and within urban and peri urban areas, where the opportunity cost of land and labor is very high. The limited land and high opportunity cost has forced the dairy farmers to depend mostly on straw and concentrate based farming. During winter, straw is the major bulk of ration for the dairy animals. Price of straw has increased tremendously in the last few years.

Though straw constitutes the major feed constituents for dairy animal feeding and its intact nutritive value is very poor, the urea or ammonia treatment of straw is virtually non existent despite it has been emphasized by the government extension services. The non adoption of the practices could be attributed to less availability or affordability of urea as well as the risk associated with the improper use. However, chopping of straw mixed with green forage whenever available is the commonly adopted practices by the dairy farmers.

Both in peri urban areas and in the villages, uses of terrace risers and bunds for fodder production is common. Napier and Amliso are common forage species used in terrace risers, bunds and roadsides open land.

Tree fodder plantation for feeding animals during dry period is a common practice across hills of Nepal. They are important source of green feed for dairy animals during that period. In subsistence dairy animal production system, foliage collection form nearby forest (government or community forest) is also very common. Recently open land under community forestry has been extensively utilized for fodder production in the milk grid areas of the country.

Silage production to feed dairy animals during winter scarce period is only practiced in government farm or large scale dairy farms. However, the small scale plastic bag silage technology is gaining popularity among small holder dairy farmers in the country. Uses of Urea Mineral Molasses Blocks (UMMB) is also getting popularity among the dairy farmers again particularly during the feed scarcity period,

In general the dairy cattle feeding system in Nepal can be categorized into 3 categories on the basis of share of dry matter of straws, greens and concentrate in the dry matter of the ration offered to the dairy animals.

1. **Straw based systems** – where greens are not available for 9 months in a year and concentrates are used to supplement the ration. The share of each of the components, in the total dry matter (of ration) offered to dairy animals, range between:

- 50 to 60% through cereal straws,
- 25 to 40% through concentrates and
- 00 to 15% through Greens.

2. **Straw and limited Greens Systems** – These are systems where greens are available for 9 or more months of the year, but in limited quantities and concentrates are used to supplement rations. The share of each of the components, in the total dry matter (of ration) offered to dairy animals range between:

- 25 to 40% through cereal straws,
- 20 to 30% through concentrates and
- 25 to 40% through Greens.

3. **Green fodder based systems -** where green fodder is available in ample quantity for most parts of the year, it is supplemented by concentrates and straw is offered only to meet dry matter requirement (if needed). The share of each of the components, in the total dry matter (of ration) offered to dairy animals range between:

- 10 to 20% through cereal straws,
- 15 to 30% through concentrates and
- 60 to 75% through Greens.

Common feeding practices observed in dairy farms in Nepal:

- Most of the animal owners use home made feed mixtures for dairy animals.
- Commonly used ingredients are – maize floor, wheat bran, rice bran, pulse chuni and small quantity of oil cake (varies between areas). The ingredients are mixed in certain proportions – measures are used for adding ingredients.
- Compounded feed is purchased by many but is used as one of the ingredients.
- Most feed mixtures appear to be low in protein (considering limited use of oilcakes) and this could be a limiting factor for high producing animals and particularly in some parts of the year (except during winters when leguminous fodder is available). Animal owners need to be advised to adjust feed formulae.
- Majority of animal owners add mineral mixture and salt to feed mix (although not regularly) and some use vitamin mixtures and galactologues.
- The feed mixes are either cooked or soaked for feeding animals – very few feed the mixture dry. Some owners add wheat straw also to the mix while cooking or feeding (probably to increase the bulk).
- The feed mix is offered individually to milking animals - either in feeding manger or in a large vessel – usually with large quantity of water.
- Higher producing animals are given some extra quantity of feed mix.
- Practices of feeding Non-producing animals (growing or dry cows) vary between owners- small quantity of concentrate is of offered by most owners.

Fodder production and utilization*:*

- While most owners are aware of importance of green fodder for dairy production limitation of land is a major constraint and to some extent information about high producing crop varieties and their seeds.
- It is observed that much of the greens are cereals, except on a few farms and in winters. There is need to create awareness to have a mix of cereal and leguminous fodder,
- Most producers chop the fodder and some even mix greens with dry fodder for chopping. Introduction of more durable and efficient (low power consuming) choppers would be useful.
- In some cases quantity of dry fodder offered appeared insufficient (based on limited observation). Extension staff should pay attention to this aspect and advice animal owners suitably.

Maize Cobs and Sugarcane Bagasse as cheaper source of roughage

Considering high cost of cereal straws and likely availability of maize cobs in large quantities in view of extensive cultivation of maize it is worth exploring feasibility of urea treatment of cobs to convert it into roughage for cattle feeding. In the manner there is possibility of converting sugarcane bagasse into roughage through urea treatment (Bagasse and Cobs are used as fuel or just thrown away).

Feeding system of yak and Chauries

In the yak rearing regions, Yak and Chauries are normally grazed throughout the year. In winter (January/February) they do not receive supplementary feed and subsist on dead grasses and roots under the snow. Herders only provide grain supplements to the milking, working animals, young claves and weak animals. However, common salt is provided one or twice a week and cheese whey is fed to milking animals. In heavy snow fall day, some stall feeding of hay and concentrate feeds such as maize flour, soybean, potato, radish, gur and a mixture of mustard oil and poultry eggs, and local brewery by-products such as rice, maize, barley and millet is done.

Forages on natural grassland are in surplus in summer but deficient in winter under the traditional grazing system. The nutritional status of Yak can be improved by ensuring adequate protein intake in summer - but Yak suffer deficiency of crude-protein and of energy from grass in winter. The use of feed supplements seems vital if the productive and reproductive potentials of grazing Yak cows are to be developed. Concentrate and urea block supplements are effective in improving the productivity of grazing Yak and maintaining the body weight of animals in winter.

2.2.8 Major Constraints in Dairy Animal Farming

Nepal is one of the countries having highest livestock population densities per unit of cultivated land in Asia. However, the productivity of most of the livestock species is poor due to many inherent and external constraints. The poor genetic potential has been further aggravated by short supply of quality feeding resources and poor management practices. Some of the major constraints being faced by the dairy farmers throughout the country are:

- Poor genetic potential of indigenous dairy animals: leading to high cost of production .
- Non recommendation of proper exotic breed/ blood level for different agro ecological zones and production system for optimum productivity and profit.
- High cost of production associated with rising price of feeding resources particualrly concentrates
- Unavailability of quality seed of forages for livestock and lack of irrigation facilities
- Lack of appropriate insurance policies in the context of rising price for the dairy animals
- Prevalance of many economically important diseases and parasites causing great production and thus economic loss
- Infertility problem in crossbred animals-various form of infertility exists from delayed maturity to post portem anestorus, repeat breeding to abortion.
- Hygienic milk production related with trade and human health (SPS measures)
- Policy regarding animals with diseases (TB, Brucellosis etc.) and infertility problem
- Price control system
- Low investment from public sector, high interest rate
- Frequent strike and blockade- trasnsportation problem
- Insufficient chilling centre- problem in bringing evening milk- thus negatively impacting on quality of milk delivered
- Environmental issues – methane gas emission from dairy animals

In the present context of global climate change, livestock production being blamed for green house gas emission and country having already high number of cattle and buffaloes, it is imperative that increasing the productivity rather than the number of animals is absolute necessary.

2.2.9 Recent Development

The young generation particurlay educated and those returning from foreign employment have recently shown great interest for dairy cattle farming in the country. This has been the aggregate effect of the gross milk deficit situation in the country with establishement of powder milk plants from private sector in the country. These people are seeking technical advise as well as animal resource centre to establish dairy animal farms. However, most recently due to problem in selling of SMP produced by the private diaries (Sujal and Chitwan milk), the future also seems to be somewhat uncertain. The issues have to be resolved so that the booming dairy sector doesn't dwindle again in the country.

CHAPTER 3 MILK MARKET and MARKETING CHANNEL

Typically, marketing includes the market research, product design, promotional activity, distribution, pricing and sales promotions etc. In the market one needs to consider several macro and micro factors.

Macro issues:

- Political/regulatory environment,
- Financial/economic environment,
- Socio cultural issues and technological infrastructure.

Micro issues:

- Competitive considerations
- Local infrastructure such as transportation & logistics network and
- Availability of mass media for advertising is important.

The major three components of marketing consists of Availability, Acceptability and Affordability. For proper functioning of the market, the products must be readily available in the market, the consumers must accpet it (apealing and willingness to pay) and also should be affordable by the consumers. At present all 3A's, basic components of marketing for milk and products are in stake. Availability is already not sufficient to cater national demand alone, poor trasnport infrasturcutre has hindered major chunk of milk produced in rural part from being entering to the formal market. Acceptability is occasionally disrupted by lack of ethics among some business communities (recently quality and hygene aspects of *Gundpak* and fluid milk due to adulteration and unhyegenic production practices). Affordability is one of the major concern for expaning markets for dairy product. It has been reported that demand for dairy products is highly income elastic, at least in the least developed countries, incresing icome or reducing cost of production for lower consumer's price for milk products would certainly help for expanding the markets for it.

3.1 Existing Dairy Animal Markets and Marketing System

Marketing of dairy animals in the country is quite unorganized. Farmers wishing to adopt dairy animal farming has to search for availability of animals in the neighbours or nearby villages or even outside the district. Farmers having excess animals (inability raise the extra number due to resource, labor or other constraints) used to sell their excess animals to the other needy farmers. There has been no organised dairy animal reosuce centres from which one can buy the required numeber of animals (recently a dairy cow research centre has been established in Geetanagar of Chitwan by one of the milk producers' cooperatives). However, for buffaloes there is regular weekly *Haat Bazar* particularly in the Terai region, from where farmers can buy dairy buffaloes. Middlemen also used to bring animals (recently calved buffaloes) to major dairy pockets for selling to the needy farmers. There is system of disposing of buffaloes after termination of lactation and buying new one for ensuring regular sell of milk and income.

Despite favorable situations (increasing demand for fluid milk, enhanced collection network and current gross deficit of fluid milk supply) the availability of dairy animals

are limited. This is partly due to the recent past situation of "Milk Holidays", which frustrated many dairy farmers and retracted them from properly rearing heifers. This has been also aggravated by the high cost of production, inadequate availability of quality feeding resources, disease outbreaks, inadequate efforts in AI coverage in indigenous cattle breeds etc.

Importing dairy cattle from other countries or upgrading indigenous stock with imported or country produced frozen semen from bulls of dairy breed particularly Jersey and Holstein Friesian are the available options to make dairy cattle available in the country. In the past dairy cattle were imported or provided as grant/gift from neighboring and developed countries. Still some importation of dairy cattle from neighboring countries particularly India through middlemen are in practice though the exporting country has policy of not exporting dairy animals. For immediate solution to tackle gross deficit of fluid milk, dairy entrepreneurs are of the opinion that we should import dairy cattle from India and China. However it couldn't have been materialized so far. This seems possible only if two governments initiate bilateral agreement in this regard.

The most reliable option to increase availability of dairy cattle in the country is through upgrading of native cattle either though AI or distribution of breeding bulls in AI inaccessible areas. However it takes at least 2-3 years that the crossbred progenies having at least 4-5 times more milk production potential compared to native cattle comes into production stage. To encourage AI in native cattle, government/ development agencies should provide subsidies (free semen and services) to the farmers. Rather than attempt to increase absolute number of dairy animals which further puts pressure on scarce feeding resources, attempts should also be made on improvement of productivity of animals.

3.2 Existing milk and milk products marketing system

The existing milk and milk products marketing channel operating in the country is summarsized in the following table and diagram

Table 15: Milk marketing channel and number of intermedireis

Milk Marketing Channels	Number of intermediaries
Producer-consumer	0
Producer-milk hawker-consumer	1
Producer-processor-consumer	1
Producer-processor- retailer-consumer	2
Producer-milk trader—consumer	2
Producer-dairy co-operative –processor- retailer consumer	3
Producer-dairy coop cooperative-processor-retailer-consumer	3

The number of intermediaries involved will have a bearing on both producer and consumer milk prices. The shorter the channel the more likely that the consumer prices will be low and the producer will get a higher return.

From the consumer point of view, the shorter the marketing chain, the more likely is the retail price going to be low and affordable. But this is only the one side of the coin. Actually the price paid to producer by consumers in direct channel (no middlemen) or short channel (through Hawkers) might have to even pay higher than the processed milk, because of consumers' preference for whole milk rather than reconstituted processed milk. This explains why, following the liberalization of the dairy industry, direct sales of raw milk from producers to consumers (channel 1) or through hawkers (channel 2) has been on the increase despite the public health risks associated with the consumption of untreated milk and milk products. Milk producers may not necessarily benefit from a short marketing chain i.e. milk processors may be paying farmers the same price as hawkers. However, farmers sometimes prefer selling milk to hawkers because other factors such as prompt payments and inaccessibility to formal market outlets such as producer co-operatives or lack of near by milk processing factory. The biggest disadvantage of direct milk sales to consumers by hawkers is the total lack of quality control and the frequent rate of adulteration of milk with (dirty) water, which is illegal.

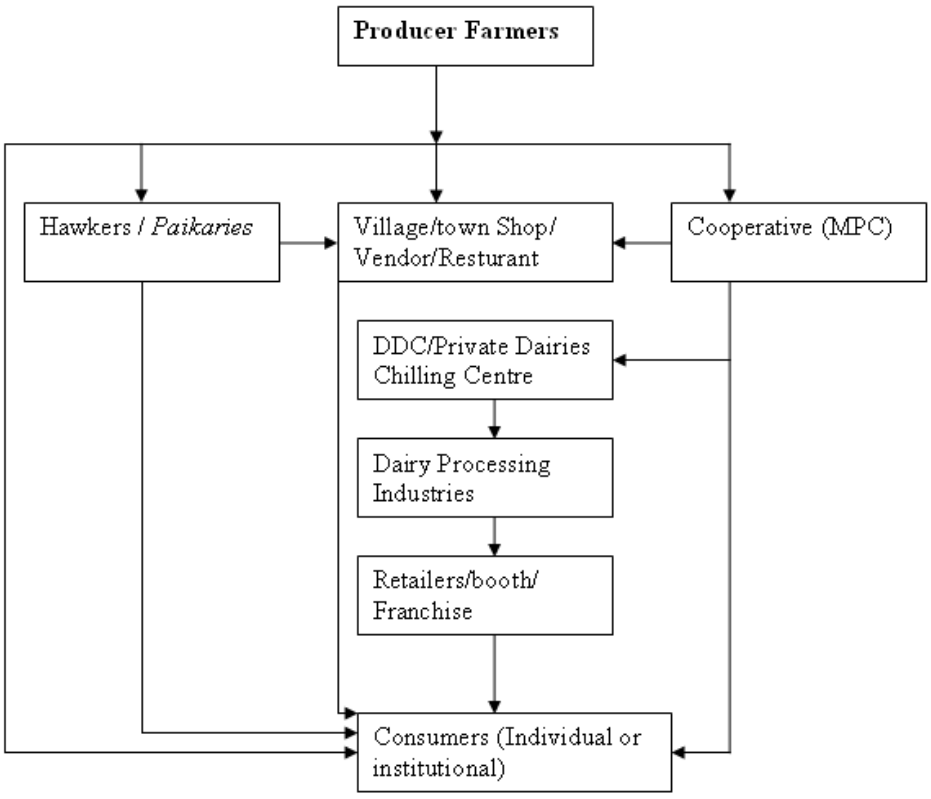


Figure 18: Milk Marketing Channel in Nepal

Table 16: Advantages and disadvantages of varipus milking channels

	Strength	Weakness
Cooperative	• Offer an assured permanent market • Offer Services- feed, vaccine etc • No limit to quantity farmers can suppy • Quality control- fare trade • Ownership feeling • Investment opportunity-share • Bonus payment • Collection centre not far from producing farm	• Relatively lower price where competition exists • Sometime there might be delay in payment • Farmers end up bearing the cost of mismanagment • Over politicization
Vendors/ Hawkers/ Middlemen	• Pay somewhat higher price where competition exists • Prompt payment • Collects milk from farmers doorstep • Provide market outlet in region not well serviced by formal procurement system	• Chance of disapperance without payment • Not a reliable market • No supply of input or services or no credits on them • Arbiitary change of price without prior knowledge • No quality control on milk
Hotel/ Resturants	• Higher prices than cooperative • Payment can be negotiated • A reliable market • Can not disappear	• No security- business can be closed at any time • No Input and service support • Can't take all milk
Consumers/ neighbors	• Collects from farm/ or delivered • Flexible time • Price is usually higher	• Not a reliable source • Can delay payment
Dairy Industries	• Generally prompt payment • Give price for true weight and content • Relatively better price where competition exists	• Sometimes delayed payment can occur if their products are stored for long time • Tries to control over price paid to producer

The prevailing milk and products marketing channel can be further simplified as:

- Farmers to Consumers- Fluid milk and products such as Curd, Paneer, Khowa, Chhurpi
- Farmers to hotel/Restaurants (Fluid Milk) to consumers- Fluid milk (in tea coffee), *kheer*
- Farmers to Sweet shop (Fluid milk and partially processed products: *Chhena, Khowa*) to consumers- various sweets (*Barfi, Penda, Rasbari, Lalmohan* etc)
- Farmers to cooperatives (fluid milk) to consumers- Fluid milk and products (Panner, Ghee, Curd, *Lassi*)

- Farmers to cooperative (fluid milk) to processor (fluid milk) to retailers/vendors (products such as pasteurized milk, yoghurt, cheese, paneer, sweets, ghee etc.) to consumers (the same products)

In a nutshell, while the informal sector scores over the formal sector by virtue of the fact that in many areas it is the only marketing channel open to the rural producer and other factors related to, paying slightly higher prices, offering short term instant cash credit and providing milk collection service at farmer doorstep, the formal sector provides an assured and permanent market as well as a number of other livestock support services.

The collection network under different Milk Supply Schemes under DDC is presented in Table below. Chilling Centers (CC) established under the Milk Supply Schemes are in operation across the country for chilling the milk collected from the MPCCs:

Table 17: Milk collection networks of DDC

Schemes	**MPCCs**	**Chilling Center**	**District Covered**
KMSS	281	30	7
BMSS	126	11	4
HMSS	167	8	3
LMSS	63	6	4
NMSS	40	3	4
MPSS	49	14	8
JMSS	25	7	6
DMSS	24	5	2
TOTAL	791	63	34

Source: DDC (2067/68)

The large scale dairy industries have been mostly established in Kathamndu valley and othe major cities of western, central and eastern development region. Thus, there collection networks are more or less in the same dairy pockets in the country and thus creates competition among buyers (processing industries), this in one hand benefits the farmers of the region by getting competitive price whereas the processing industries have to face the deficit on fluid milk as required but restricting oppertunities of selling milk in the other parts of the country.

3.3 Milk Production Cost

Milk production costs differ from country to country, from one producer area to the next, and among production economies. Determining production costs is therefore a delicate matter and should be done on a case-by-case basis. Extrapolating from the figures obtained can only produce approximate results. Certain amounts of data are needed on the context of the dairy farm or business to be costed:

- geographical context
- economic climate
- available farmland
- staff
- products other than milk
- herd size and composition
- fodder system
- animal housing and milking systems.

In all surveyed households, generally farmers were not found to be keeping appropriate records on cost occurred and income derrived from dairy animal farming. Farmers used to only say that their cost of product is high and the price they recived from selling milk are not satisfactory. However, with further discussion, small to medium farmers where most of the labor required are fulfilled from the household members, and grasses are produced in own farm land, they agreed that the production cost (Rs./kg of milk) generally comes around to be nearly half of what they used to get from selling milk to formal milk market without accounting for the HH labor and home produced feed. The major expenditure on dairy animal farmings in this system are on purchased feed, vet medicine and service and breeding service charge.

A study carried out by NDDB in 2010 revealed that the average cost of milk production was Rs. 26.60/ lit of milk and ranged from Rs. 17.34 in Ilam district to Rs. 32.22 in Kavre district.The higher cost of production in Kavre was mostly attributable to greater number of buffaloes being kept for milk production in the district and farmers also generally get higher price for the buffalo milk compared to cow milk. The lower cost of production in Ilam was attributable mainly to the forage based milk production system prevailing in the district.

Table 18: Milk Production Cost (Rupee) per Liter of Milk

Districts	Total HH	Total Milking Animal	Milk Production	Total Cost (Rs)	Price/liter
Tanahun	54	87	339,120.00	9,986,683.73	29.45
Morang	54	74	253,140.00	7,171,435.04	28.33
Dadeldhura	28	44	93,690.00	2,603,438.54	27.79
Kailali	54	75	209,550.00	6,480,771.38	30.93
Chitwan	54	96	368,520.00	10,977,871.36	29.79

Kabre	52	93	397,665.00	12,812,594.15	32.22
Ilam	54	94	629,910.00	10,923,943.98	17.34
Surkhet	54	110	437,940.00	11,486,839.72	26.23
Rupandehi	50	115	495,480.00	13,910,400.42	28.07
Banke	55	91	247,860.00	5,312,986.21	21.44
Total	509	879	3,472,875.00	91,666,964.51	26.40

Source: NDDB, 2010

3.4 Milk Pricing System

The price of a product in the market is an important factor influencing consumer demand. Hence to be marketable, a dairy product must be competitively priced. This implies that the costs involved in raw material procurement, processing, packaging, storage, marketing and distribution must be kept as low as possible. Generally the price of a dairy product will involve the following costs:

a. Cost of raw milk
b. Cost of raw milk collection and transportation
c. Cost of processing
d. Cost of packaging
e. Cost of marketing and distribution
f. Taxes and tariffs
g. Profit margins at each stage of the marketing channel (Collection, Processing and marketing margins)

Historically, milk was not supposed to be sold. Probably it was so because every household used to produce milk for their own consumption. Milk has, however, been traditionally processed into curd, country butter, *Chhurpi*, *Shergham*, ghee, sweets etc., all indigenous products. Processed products were bartered or sold for cash within and outside the country. The products from high mountain areas found their market in the north and from plains in the south across Nepalese borders.

Later, as the population started growing and the urbanization process began, milk went into market to serve those who could not afford to keep milking animals. In urban areas milk was sold on cash or credit by producers directly to consumers. Later on middlemen entered into the marketing channel. It the beginning years, there was no system of price fixation. Prices were bargained between the buyer and the seller and payment was made in cash at the time of purchase or after a week, a fortnight or even a month, as mutually agreed by both parties.

Milk Price in formal Sector

It was only in early 1950s that a pricing and payment system was introduced in Nepal. It was the time when HMG of Nepal first initiated buying milk from farmers to process it

into cheese and other milk products. The Dairy Development Section, under the Department of Agriculture introduced a system of milk payment based on criteria of price determination and frequency of payment.

In the early stages, Slab System was adopted in which milk price was determined on the basis of fat content in milk. Different rates were fixed for milk containing different ranges of fat, say 4 to 6, 6 to 8, and above 8 percent of fat, with proportional variation. The payment was made at intervals of 15 days.

Later Linear fat percentage system was adopted learning lesson from the slab system in which accounted Rs X per fat percentage per unit of milk for all milk delivered which contained above the minimum fat level fixed at 5%. A penalty rate was fixed for milk testing less than 5% fat. This system worked very well. Farmers realized that they did not gain anything by adulterating the milk. This system was in practice for long time.

With increasing number of crossbred cattle in the country, the linear fat system didn't work properly as fat content in cow milk was comparatively lower. Therefore a system of milk price determination based both on SNF and Fat content (dual axis) came into existence. A minimum level of fat and SNF was fixed. Different rates per kg of fat and per kg of SNF were introduced on the basis of distance and season of procurement. However, the seasonal differences in price have been halted now, but the private diary industries are advocating for reinstating the similar system again.

On average farmers are getting Rs 28.0-35.0 for cow milk and Rs 30.0 -40.0 for buffalo milk depending on supplying centre and milk constituents. Beside price paid to Fat and SNF content, some bigger cooperatives are also providing some top up to the farmers they get for the TS from milk processors.

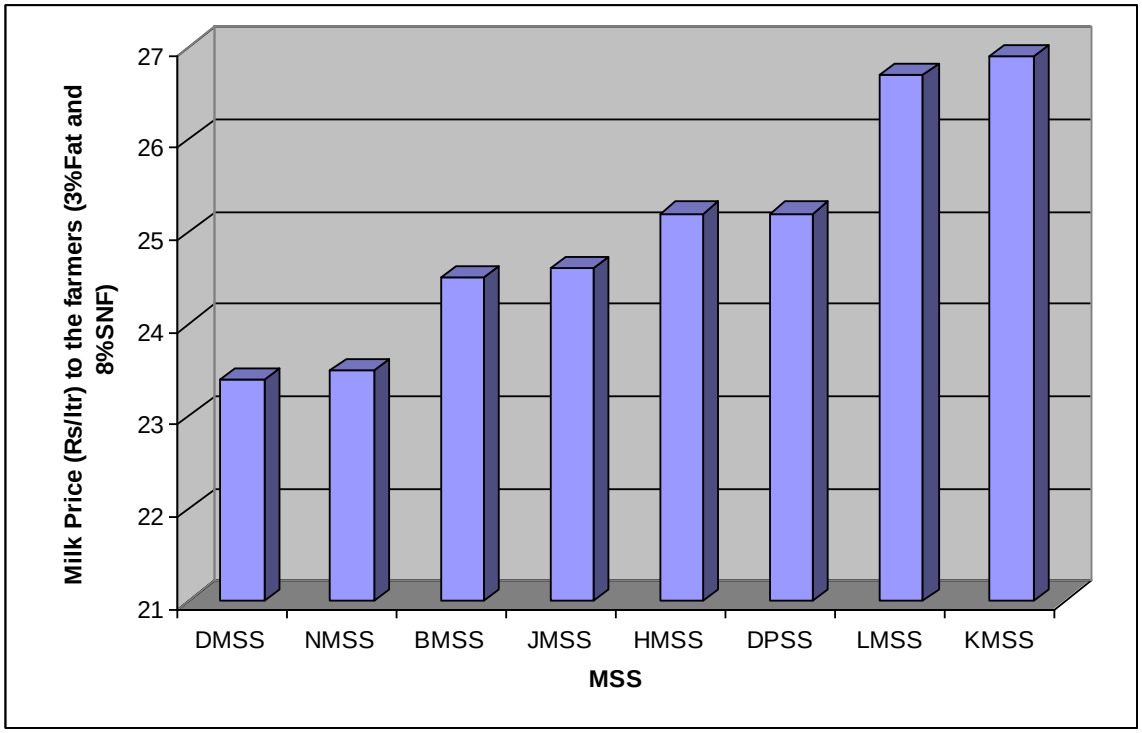


Figure 19: Price offered to the farmers through cooperatives by various MSS of DDC (before rise in 2012)

The NDDB had been given responsibility for recommending milk price through scientific study on cost of production to the government. However in the later years DDC is playing major role in fixing milk price paid to the farmers and private dairies are following DDC but offering a bit higher price (5-10%) to the farmers in the advent of fluid milk deficit to attract the producer farmers. This double axis payment system has also brought many problems of adulteration with sugar, soda, starch, urea etc. in order to raise SNF which is very difficult to detect these adulterations at field level. A quality payment system in which, microbiological quality in addition to milk fat and protein content has been recommended but not in practice yet. In this system premium price to the quality milk and penalty system for low quality milk has been provisioned.

Milk Price in Informal Sector

The milk price in informal sector is still determined by negotiation between the sellers and buyers again depending upon the quality of milk supplied. This quality is not other than the consumers experience rather than testing for any milk constituents or microbial quality. In the small dairies that have been established in the nooks and corners of major cities, payment for milk price based on flat fat content is also in practice. For example in small dairies in Kathmandu Valley, the price offered ranged from Rs 8.50 to Rs 9.25 per unit of fat content in milk i.e. farmers on average would received Rs. 45.0 per liter of milk containing 5% fat. This flat system has encouraged buffalo farmers to supply buffalo milk in these dairies. Farmers used to sell Khowa and Chhena @ Rs. 300/kg.

Table 19: Price Received (Rs./Ltr) by Farmers when sold directly to consumers or to hawkers

SN	Districts	Sell to consumers	Remarks
1	Ilam (Ilam Bazar)	Rs. 30.0-35.0	
2	Morang (Biratnagar)	Rs. 50.0-55.0	
3	Chitwan (Narayangarh)	Rs. 40.0-45.0	Higher price for buffalo milk
4	Nawalparasi (Parasi)	Rs. 40.0-45.0	
5	Rupandehi (Bhairahawa)	Rs. 40.0- 50.0	Depends on water adulteration If sold to Paikari (Hawker) farmers get Rs 36.0-38.0
6	Kathmandu/Lalitpur	Rs. 50.0- 70.0	One farm was found selling at Rs 70.0/ltr
7	Kaski (Pokhara)	Rs. 40.0- 60.0	Higher price for buffalo milk
8	Surkhet (Birendranagar)	Rs. 40.0-50.0	Higher price for buffalo milk
9	Dang (Ghorahi)	Rs. 40.0-50.0	Higher price for buffalo milk
10	Kailali (Dhanghari)	Rs. 40.0-50.0	Higher price for buffalo milk
11	Dadeldhura	RS. 40.0-50.0	Higher price for buffalo milk

In the formal sector, the analysis revealed that farmers are getting around 57% of the consumers' price per liter of processed (pasteurized and packed) milk. The cooperatives are getting 7% of the consumer's price which is being utilized for managing cooperatives. The parts of this earning from Total Solid are also being provided to the producer farmers. Processing cost and margin for the processors accounted for 34% of the consumer's price and the retailers are only getting around 2%.

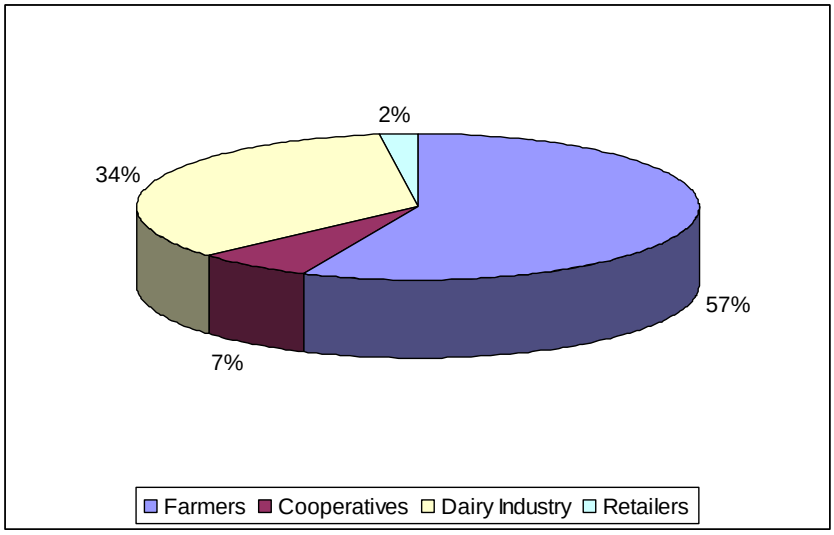


Figure 20: Proportion of consumers price of processed milk that the actors in dairy value chain recieve

The farmers share on the consumers' price for processed milk in our country seems to be somewhat better that the producers farmers share in USA where farmers received about 46 percent, cooperatives 6 percent, wholesale processors 36 percent, and retailers over 12 percent of the retail price of a gallon of 2 percent milk (the most common type of milk purchased)

Trends on Price of Milk and Milk Products

Unlike in the global market, the consumers' price for milk and milk products in our country are only rising. Once the price is raised, it generally doesn't fall as we have system of price fixing rather than determination through free market economics. During 1990s the rise in milk price was slow and steady which abruptly started rising faster since 2007. The price of pasteurized milk has increased by 118% compared to price in the year 2000/2001 or above 10% annually. The rise in consumer price for local and special curd was even higher, increasing at the rate of 16.7 and 15.7% per annum respectively since the year 2000/01.

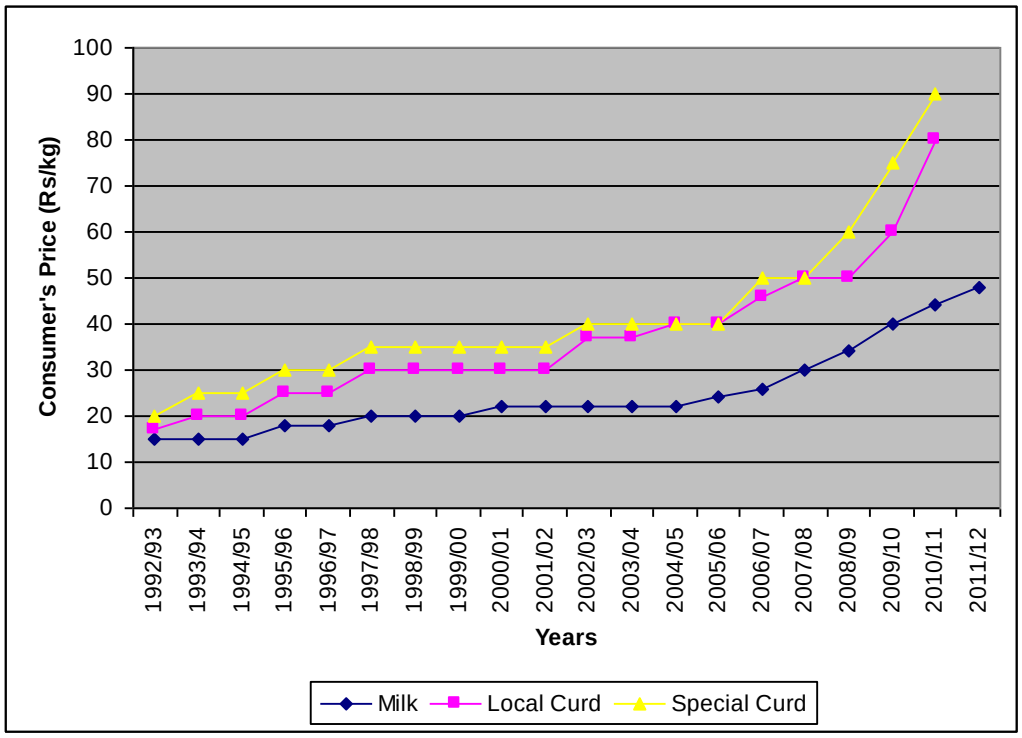


Figure 21: Trend of consumer price for milk and curd (Source: DDC)

The price of cheese both yak cheese and Kanchan cheese (cow milk) also increased steadly over years, however unlike in fluid milk, ther was also drop in price in some years. The average annual increament from year 2000/01 to 2010/11 for yak cheese and Kanchan chesse were 10.7 and 7.8% respectivly.

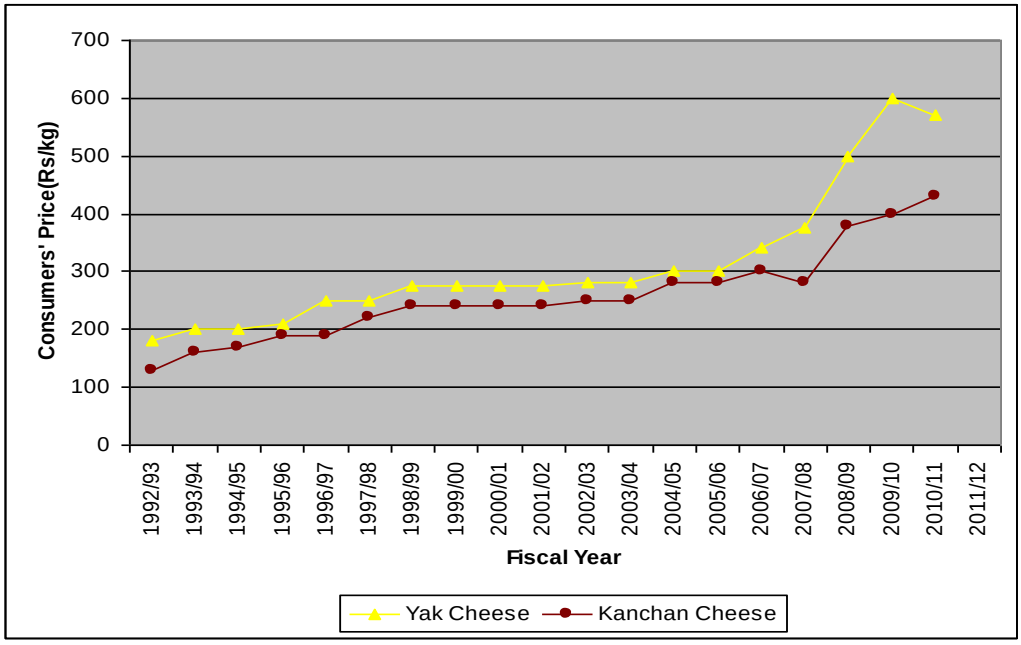


Figure 22: Trend of consumer price for Yak anc Kanchan cheese (Source: DDC)

The avearge annual increase in price of butter, paneer, cream and ghee were 11.8, 8.1, 6.4 and 11.9% respectively during the last 10 year period.

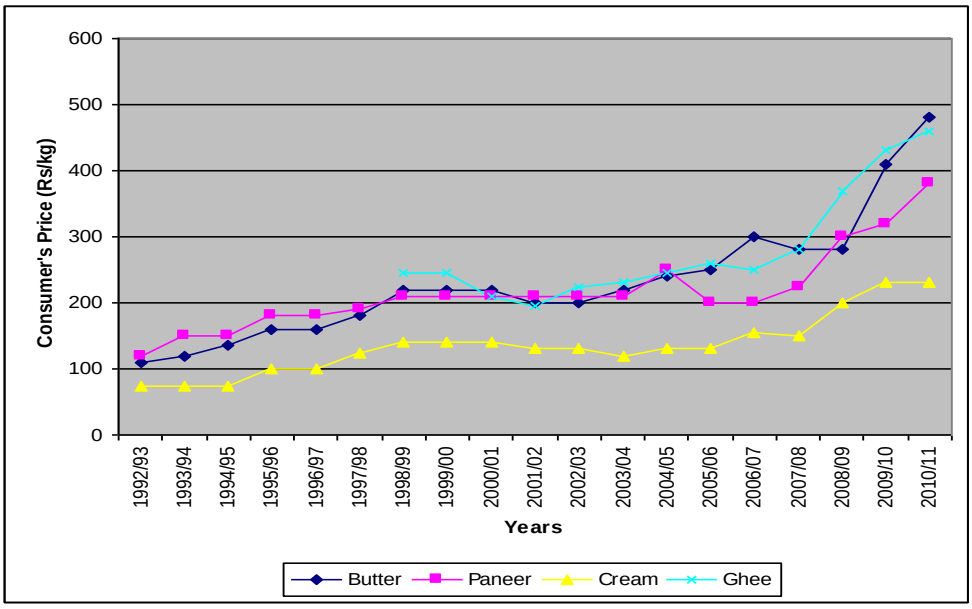


Figure 23: Trend of consumer price for butter, paneer, cream and ghee (Source: DDC)

3.6 Current Demand and Supply Situation of Milk and Milk Products and Trend

There has been inconsistency in the recent figures reported by various stakeholders regarding fluid milk deficit in the country. It has been reported that around 300,000 to 600,000 litre fluid milk is deficit in the country. However, it has to be ascertained first on the basis for calculating such deficit. One criterion for deriving such figure might be the installed capacity of all dairy industries throughout the country and their annual operational performance. This method doesn't seem convincing without properly accessing demand side for milk and milk products.

Table 20: Installed capacity (demand of industries) based fluid milk deficiency estimation:

Industries	**Capacity (l/d)**	**Avg. daily operation**	**Deficit/Surplus (l/d)**
DDC	225000	175000*	50000
Large Dairy (4)	380000	190000**	190000
Medium Dairies (10)	130000	65000**	65000
Small dairies (30)	150000	75000**	75000
Other small dairies (706)	350000	175000	175000
Total	1235000	680000.0	555000

Source: For Dairies and capacity: DLMP

* Source: DDC

** Discussion with entrepreneurs quoting on average running at 50% of the capacity

In the absence of real demand figure from consumers' side it would be more convincing to estimate current deficit based on the annual import of dairy products in the country. However due to porous border, it is also difficult to truly estimate the annual import figure. Industrialists have reported that there is great amount of illegal import of milk products from south neighbouring country.

Based on 2010/11 dairy product import figure (Custom Department), experience of 2012 fluid milk import figure and rough estimation of half the amount of dairy products brought in the country through illegal route will show the following picture of fluid milk deficiency in the country:

Annual Import (2010/11) of milk products	Rs. 914682000.0
Estimated half amount from illegal route	Rs 457341000.0
Total Import	Rs. 1372023000.0

Equivalent to 45734 MT fluid milk annually (based on Rs 30.0/kg)

It is equivalent to 125000 ltr milk daily

Further in the year 2012 DDC and Private dairies are importing about 100000 ltr milk daily (for lean season only). Thus based on these figures, the real fluid milk deficiency

would be 125000 l. milk during flush season and 225000 l. during lean season.

It has been estimated that there is annual growth of around 11% in milk and products demand mainly in the urban city centres due to population growth and migration (9%) and increase consumption (2%) (NDDB, 2001). As livestock products are income elastic, it can be speculated that the demand for dairy products in the country further accelerates once the economic development starts and stabilise.

Table : Import of dairy products from various countries (QTY in MT and Value in Million US$)

	2009		2010	
Exporting Country	**Qty**	**Value**	**Qty**	**Value**
India	4,212.70	10.15	3,455.14	9.69
New Zealand	512.19	1.07	317.2	0.89
Australia	90.66	0.17	137.82	0.28
Singapore	219.6	0.51	121.69	0.27
Netherlands	273	0.49	122.93	0.26
China	311.6	0.5	67.4	0.14
Germany	14.99	0.08	69	0.14
Belgium	0	0	7.94	0.02
Thailand	16.79	0.01	13.02	0.02
Malaysia	17.21	0.02	8.64	0.02
Ukraine	0	0	19.39	0.01
Denmark	16.83	0.05	0.2	0.01
France	0.91	0	0.54	0
China, Hong Kong SAR	0.71	0.01	0	0
Bangladesh	20.39	0.03	0	0
Bahrain	0	0	0.11	0
Switzerland	5.07	0.03	0	0
USA	5.43	0.01	0.31	0
Austria	0	0	0.09	0
Italy	0	0	0.01	0
United Arab Emirates	0	0	0.81	0
Total	**5,718.08**	**13.13**	**4,342.24**	**11.75**

Source: UNCOMTRADE

Trend of Milk Supply from DDC and Private Dairies

The share of processed milk marketing of DDC caompared to that of private sector has declined over year. Private dairies are supplying slightly more processed milk than the DDC and the share gap can be expected to widened in favor of private dairies in the year to come.

Year	Estimated Processed Milk Sell (MT/Yr)		
	DDC	Private Diaries	Total
2005/06	55957	53187	109144
2006/07	53328	55846	109174
2007/08	52262	58639	110901
2008/09	52049	61571	113620
2009/10	55316	64649	119965
2010/11	58082	67882	125964
2011/12	60968	71276	132244
2012/13	64035	74839	138874
2013/14	67237	78581	145818
2014/15	70599	82510	153109
2015/16	74129	86636	160765

Source: FAO (2010)

Trend in milk collection through milk producers' cooperatives

There has been gradual and steady increase (about 10% per annum) in the collection of milk by the milk producers cooperatives in chitwan distirct. There is around 153 active milk producer cooperatives with around 15000 members supplying 1010000 ltr milk daily. If we see the statistics of district milk production, the collection through cooperative nearly accounts for more than 95%. Probably there must be some error in statistics of total annual milk produciton in the district. The average daily collection per cooperative was 708 ltr (60-5000 ltr).

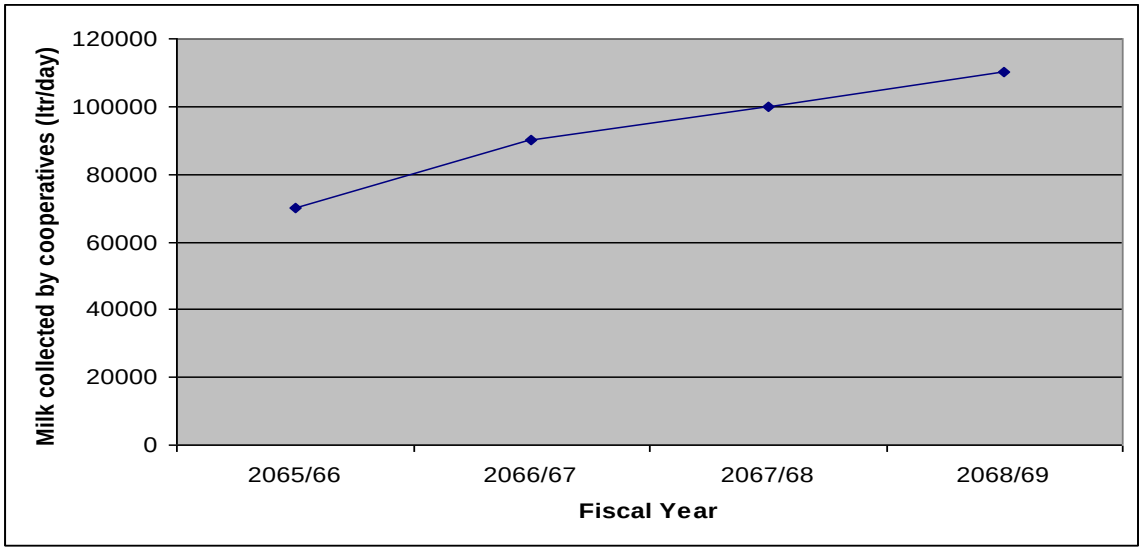


Figure25: Trend of milk collection through cooperatives in Chitwan district

Source: District Milk Producers' Cooperative Union, Chitwan (2012)

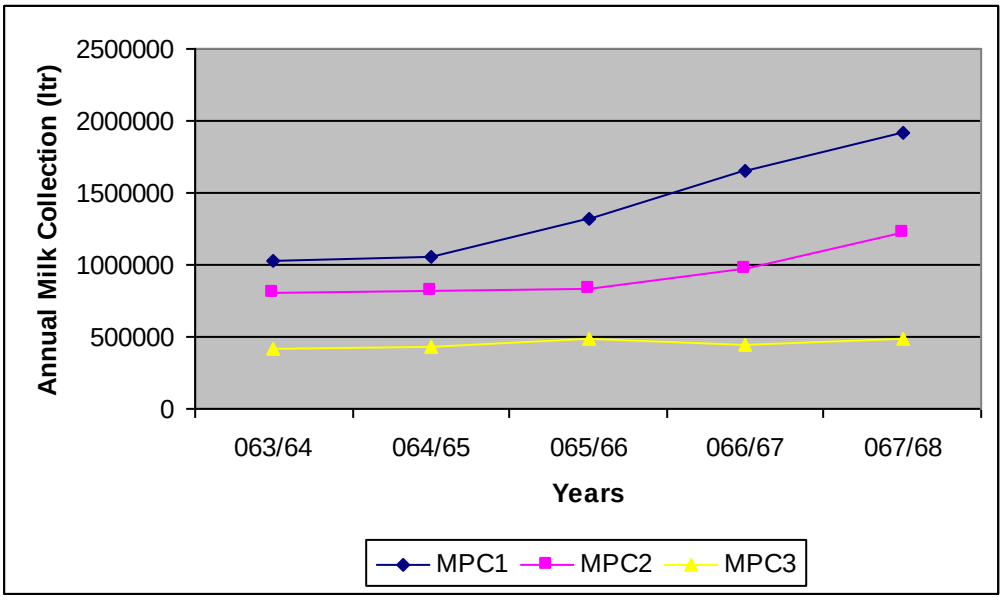


Figure 26: Trend of Milk collection by three different cooperatives in Nawalparasi district

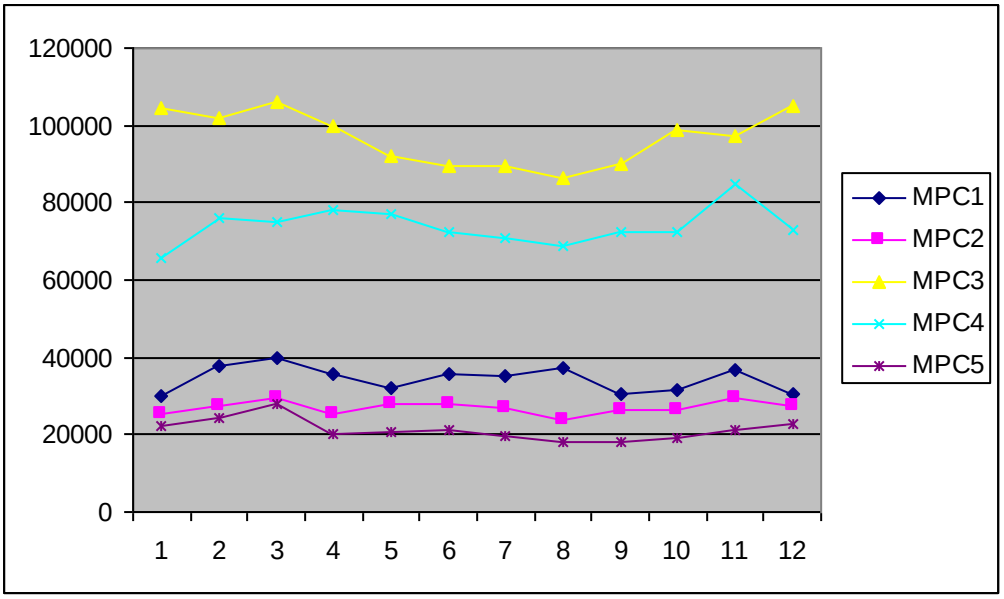


Figure 27: Monthly milk collection in different milk producers cooperative in Chitwan district

Milk collection, preservation and transportation

Except to the milk directly sold by producer to the consumers or to the hotel and restaurants, milk produced by the individual farmers are collected in the collection centres developed by DDC or private dairies collection Network through milk producers cooperatives. Two times a day collection is most prevalent system in most of the collection centres in Terai but only morning collection is prevalent in the hilly region. Fat and SNF are tested for the payment to the producer farmers. Fortnightly payment for the milk is common. Milk collected in these collection centres are transported to the nearest chilling centres either in the backpack or by animals or by using any transportation means. Care is taken not to delay the transportation of milk to avoid spoilage. Preservatives are generally not added at this point but in the hot season in Terai region, sodium bicarbonate is added as milk preservative. In some collection centres operated by producers' cooperatives, some milk products such as curd, ghee, lassi and paneer are prepared and sold to the local markets. Remaining milk is transported to chilling centre and delivered to DDC or private dairies operating in the country. Large scale dairy industries and DDC have their milk transport tankers equipped with cooling facilities and scheduled to pick up milk from different chilling centres to their factories.

Milk supply chain

The collected milk transported to processing plant is subjected to pasteurization, filling in suitable containers (poly packs) and stored at 4-5^{o}C for whole night till delivered to retailers/ booth man in the next morning. The processed milk thus is made available to the consumers from these retailers/ boothman located in various points of the city. There is a provision of fixed amount (depending on volume of sell) of commission for the retailers/ boothman. The system is prevalent both in DDC and other private or cooperative dairies.

In some places, middlemen are involved in collection of milk from the producers and directly sell to the consumer (door to door delivery) and hotel/ restaurants in the city centers without any further processing. There is chance of water adulteration in this system, however, the consumer price is also determined by the amount of adulterated water in the milk.

3.7 Regional Demand and Supply Analysis

The annual milk production in 5 different development regions are CDR 462911 MT (29.7%), EDR 396451 MT (25.5%), WDR 360653 MT (23.2%), MWDR 180018 MT(11.6%) and FWDR 156477 MT (10.1%). However, the collection and sell in the formal sector was mostly concentrated in the central development region. This is also evident from the distribution of milk producers' cooperative and most of the large and medium scale dairy industries conglomerated in the CDR.

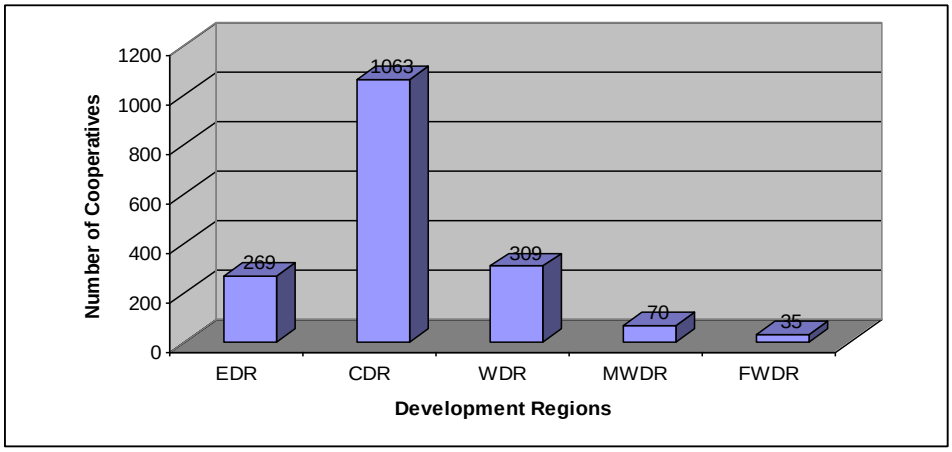


Figure 26: Milk Producers Cooperative by development region

Of the total 1747 primary milk producers cooperatives (MPCs) registered in Divisional Cooperative Office, 1063 are in CDR (61%) with around 50000 copperative members.

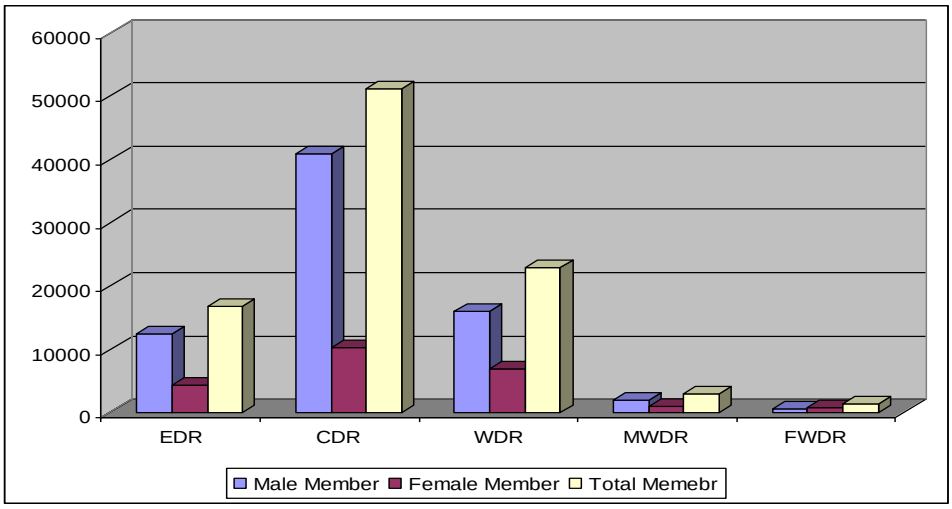


Figure 27: Members in milk producers' cooperative in different dev regions.

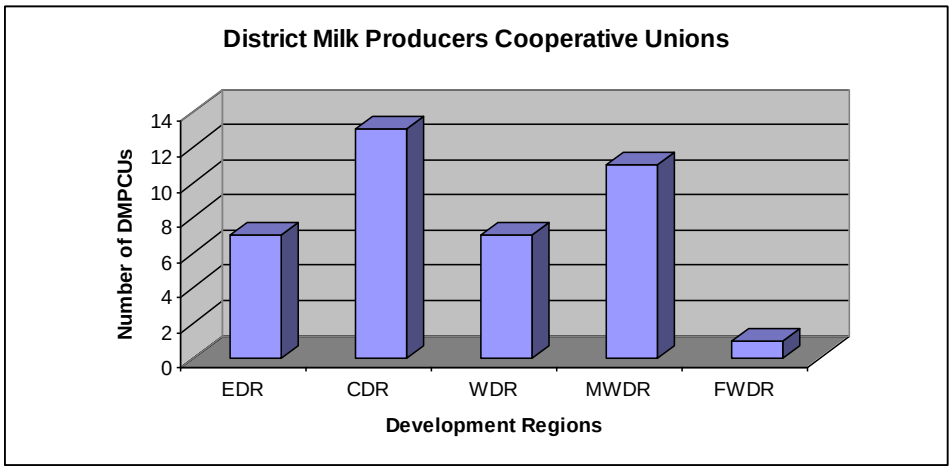
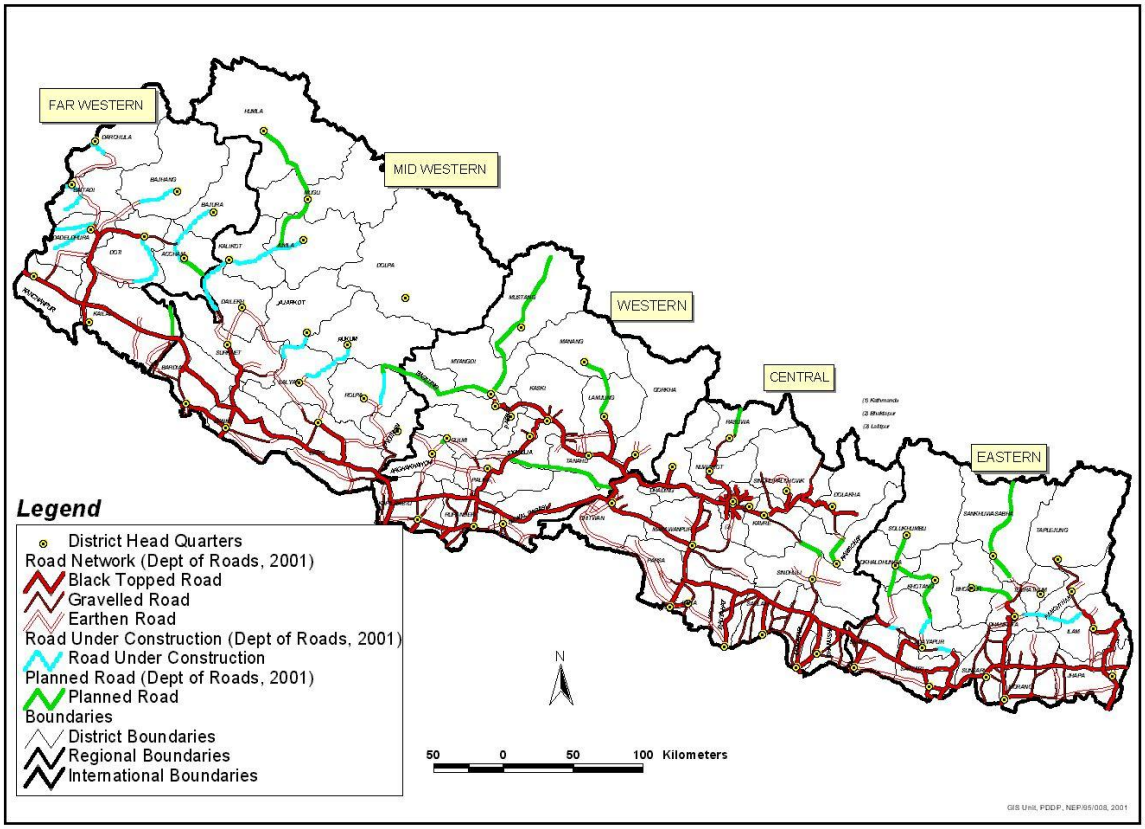


Figure 28: Distribution of DMPCUs in different development regions

The poor infrastructure particularly road in the mid western and far western development regions had hindered overall dairy sector development in the country. Even DDC has initiated its Milk Supply Scheme lately in these region. Large scale private dairies still don't have milk collection centres from these regions. But it has been speculated that the demand and supply for milk and milk products in these regions would also be increased once balanced development initiate in the country.



Map of Nepal showing road network

Table 21:Cooperatives and dairy Industries (small and large scale) in surveyed districts

	Dairy Industries		**Milk Producers Cooperatives**		
District	Number of Dairies	Dairy Products	MPCs Number	Memebr HHs	Daily milk collection
Ilam	58	Cheese, Panner, Lalipop, Chhurpee Bambaysan, Ghee	135	7590	26000
Morang	10	Paneer, Ghee, Yoghurt, Ice cream, Sweets,	27	2230	

		processed milk			
Kathmandu	109	Cheese, butter, Paneer, Ice cream, Yogurt, Ghee, Sweets, processed milk	34	1091	
Lalitpur	23	Paneer, butter, Ice cream, Yoghurt, Ghee, Sweets, processed milk	47	1691	
Chitwan	17	Paneer, Ice cream, Yoghurt, Ghee, Sweets, SMP	143	14182	108000
Nawalparasi			26	3244	35000
Rupandehi	5	Milk, Ghee, Ice cream, Chhurpee, butter, Paneer	67	4000	50000
Rasuwa		Cheese, butter	1	338	130
Dang	3	Ghee, milk, ice cream, yoghurt, paneer	20	874	2000
Surkhet	20	Milk, ghee, panner, dahi, chhurpee	21	1014	5400
Kailali	14	Curd, Butter, Mahi, Khuwa, Paneer	18	611	4600
Dadeldhura			10	246	900
Kaski	8	Ice cream, butter, ghee processed milk, paneer, sweets, SMP, Whitner	25	2159	40000

3.8 Consumer's Behaviour

Consumers while purchasing dairy products look for freshness, quality, taste and texture, variety and convenience. How to make milk and milk products affordable for the large majority with limited purchasing power is essence of the challenge in the present scenario. In contrast, with a constant increase in disposable incomes among the strong middle income class also, the scope of marketing of milk has widened. Since the consumers are not homogeneous, the consumption pattern of milk like quantum of purchase, mode of purchase, source of purchase, brand preference etc., is continually varying. The socio-economic profile of the consumers, viz. income status, occupational position, educational level, age and region are the major determinants of the consumption patterns of milk.

The majority of respondents said that number of young and elderly present in the households have great influence in the daily purchase of milk. Generally fluid boiled milk is only consumed by these categories of family members. Most of the other members in the family used milk only in tea. Equal numbers of respondents were found to be purchasing processed packed milk or loose pack from vendors or directly from producer farmers. The general average per household milk consumption was found to be 1 litre ranging from 0.5 to 3 litres (surveyed in Chitwan, Kathamdnu, Lalitpur, Pokhara) which might go much higher at festive occasion. Consumption of other dairy products is either

seasonal (ice cream, yoghurt) or in the festival (sweets in Tihar) season. Butter and cheese are still not the common dairy products that are consumed at household level though few respondents said that they used to occasionally bring cheese for consumption.

Majority of the respondent expressed the view that they prefer to consume milk directly from producer farmers as they are of original taste as long as it is easily available. However consumers were not found to be quite influenced by the other quality of milk. Respondents those purchasing pasteurized and packed milk were firstly influenced by the acceptability for taste (some said that they don't like particular brand for their off taste) and then by the easy accessibility (availability in the nearby area). As price of processed milk is same for all brand within the territory, it has no influence on the consumption pattern.

Various brands of the locally produced as well as imported modern and traditional milk products of varying categories are sold in the urban markets of Nepal. Kathmandu valley is the main market of the milk products. The major milk products available in the markets are imported Skim Milk Powder (SMP), Full Cream Milk or Whole Milk Powder (WMP), infant milk formula, dairy whitener, cheese, butter, sweetened condensed milk, ice cream and ghee; and locally produced cheese, butter, ghee, ice cream, *paneer* and yoghurt. Milk products from more than 20 countries from Asia, Europe, Australia and North America compete in the Nepalese market. Different varieties with various sizes and from ordinary to advanced packaging are available for most of the products.

3.9 Import and Export Situation of Dairy Animals, Milk and Milk Products

The country is net importer of dairy products importing more than 6000 MT of skimmed milk powder, 3000 MT whole milk baby food and 2000 MT of condensed milk annually (NDDB, 2001). Sizeable amount of cheese and ice cream are also imported in the country, whereas Ghee is only the product exported from the country in substantial amount beside yak cheese in small quantity. However, the oficial figure on import of dairy products including skimmed milk powder has dropped down signficintly probably due to increasing supply of milk in formal sector and establishment of powder milk plant within the country. Also there is possibility that the official figure of dairy products import might have dropped due to entry of dairy products from illegal route.

The monitory value of total dairy products imported during 2008/09 was around 1 billion rupees which droped to around 860 million during 2009/10 again again slightly increased to NRs 915 million during 2010/11. Whereas the export of dairy products particlarly ghee and some yak cheese remained more or less constant at NRs 136 million.

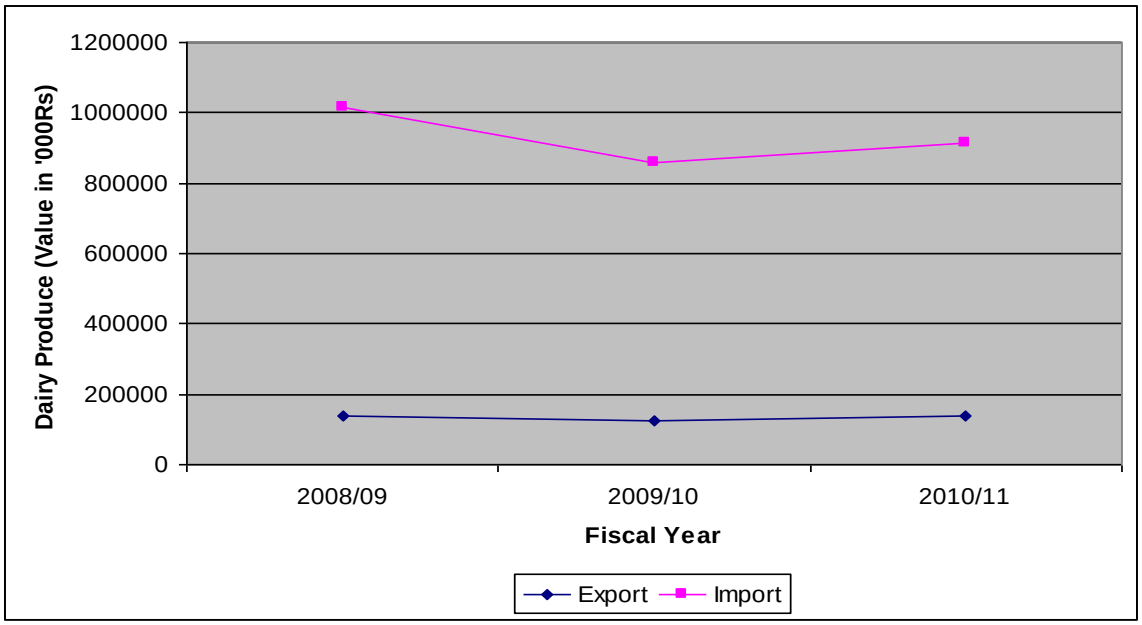


Figure 29: Trend on export and import of dairy products

Import of cheese has been increasing over years while that of butter is gradually and steadly decling over the years.

Import of dairy animals from India is generally through unofficial route brought by middlement whereas export is mainly confined to unproductive cattle from east border and some buffaloes from far western hills of Nepal . During fiscal year 2010/11, there was net import of NRs 140 million particualrly buffaloes (both milking and for meat purpose), while during the same year export was worth NRs. 27.7 million.

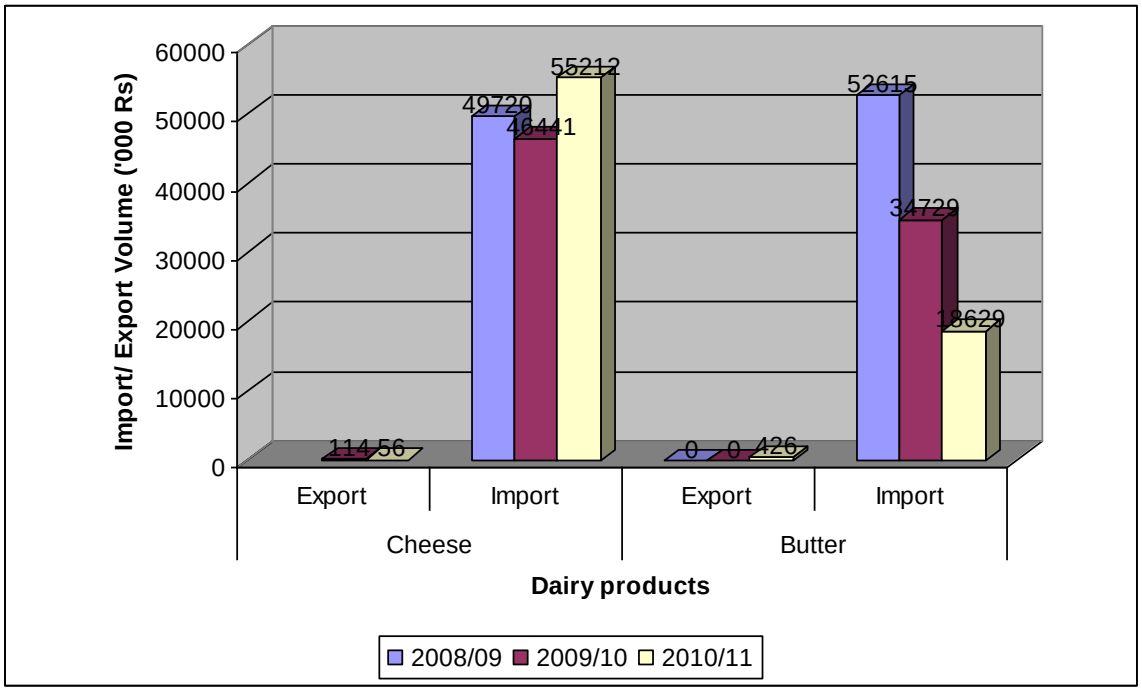


Figure 30: Import and export of dairy products

Import and Export of Milk and Milk Products (2066/67)
Unit KG

	Import from India	Import from third countries	Total Import	Export to India and Third countries
Fresh Milk	333619		333619	
SMP and Condensed Milk	3075763	445864	3521627	50000
Butter and Ghee	626510	167620	794130	565557
Cheese	99516	83221	182737	1800
Other dairy products	70465	11223	81688	2357

3.10 Prospects for International Trade

The international trade of milk and milk products particualrly export from the country is limited and seems only to have little prospects for some years to come. Though small quantity of skimmed milk powder were exported to Pakistan and Bangladesh from Sujal Foods and Chitwan milk in the year 2011, but it has not been regular.

The competitiveness of the products has been one of the major hinderance for international trade as well as prevalence of diseases such as FMD among dairy animals in the country also restricts the possibility for internation trade. Ghee (clarified butter) and Yak cheese are the dairy products exported from the country. Recent news is that there is

demand of Chhurpee from USA (particualrly as feed for dogs) and such niche market need to be further explored.

3.11 Dairy Value Chain

The charateristics, challenges and intervention needed in each actors of the dairy value chain is presented in Table 22. number of actors in dairy value chain are equally important and value addition mostly takes at processor level. At other level only operation margin are added.

Table 22. Characteristics and challenges of Dairy value chain system:

Actors	Characteristics	Challenges	Intervention needed
Farmers	➢ Subsistence ➢ Small to Medium scale commercial ➢ Concentrated in road corridor and formal sector collection network ➢ Have strong network in the form of MPCs	➢ High cost of milk production ➢ High calf rearing cost ➢ Disease/parasites- economic and zoonotic importance ➢ Infertility in dairy animals ➢ Poor access to technology/inputs ➢ Quality feeding resource and cost ➢ Poor adoption of available technologies	➢ PoPs to mitigate constraints ➢ Market and Technology Information ➢ Resource centre development not only for animals but also for technology and inputs ➢ Training ➢ Feed resource development
Input/ information suppliers	➢ Well organised ➢ Not effectively delivered and used by subsistence farmers	➢ Inadequate technologies ➢ Quality of inputs (genetic materials) ➢ Lack of resource centre	➢ Coordination among stakeholders/ service providers ➢ Knowldege update of technical service providers
Hawkers	➢ City Centred ➢ Limited capacity	➢ Hygienic milk handling ➢	➢ Training
Cooperatives	➢ Strong organiztion ➢ Works not only for milk collection but also product processing, chilling, input supply to farmers ➢ Have district level organization (DMPCUs)	➢ Quality of milk offered ➢ Limited capacity to product diversification ➢ Electricity problem for cooling ➢ Transportation hassle ➢ Sometimes delayed payment by processing industries	➢ Training on proper handling and product diversification ➢ Market Information ➢ Two time collection

Processor	➢ Small to Large scale ➢ In urban areas ➢ Various products ➢ Government and private sector ➢ Registered in Dpet of industry	➢ Quality and quantitiy of milk received ➢ Product diversification knowledge ➢ Capacity not fully utilised ➢ Electricity and transport ➢ Illegal imports of dairy products	➢ VAT for agricultural produce ➢ Soft loan ➢ GMP and HACCP ➢ Prompt payment system ➢ Price based on quality
Retailers	➢ In city ➢	➢ Low transaction margin ➢ Sometimes milk spoilage	➢
Consumer	➢ City centred ➢ Quality concious ➢ Rural consumers- less frequent	➢ Quality of products ➢ Price gap- consumers and producer	➢ Mass Awareness ➢ Public Health Campaign

3.12 Traditional and Value added Dairy Products of Nepal

Traditional dairy products

Before entering into formal milk marketing system, the subsistence farmers used to make *Dahi* (Curd), a fermented and cultured milk product from the extra milk that were left after consumption. Farmers used to make Ghee (clarified butter) by churning the Dahi which were either home consumed or bartered with other goods.

Khowa, *Gundpak* an indigenous *khoa* based milk product especially produced in Kathmandu valley adding sugar, gudh, ghee, edible seeds, dried fruits on Khowa and some other Khowa based or Chhena based traditional milk products of Nepal. In the high hills Chhurpee and Sherkam produced from milk of yak/ Chauries are also the list of traditional dairy products.

Dahi is the most representative yoghurt-type product and is the starting point for a variety of other products. It is made throughout the country with cows' and buffaloes' milk being used in the southern and midland areas and milk from yak and 'zomo' in the Himalayas. After heating for 60-90 min at 70-80 deg C, and cooling to 30-40 deg C the milk is cultured for 12 h with a starter taken from the previous days' batch of dahi, in clay pots insulated with rice chaff. Dahi was found to contain Gram-positive bacteria, lactic cocci and rods, and yeasts. Recently the Nepalese Dairy Development Corp. has begun to manufacture Western style yoghurt using pure strains of Lactobacillus bulgaricus, L. casei, Streptococcus lactis and Str. thermophilus. Dahi is separated by churning into butter (makhan) and buttermilk (lassi); makhan made by hand churning contained 2% milk protein. Ghee is made from either dahi or cream. Dahi is churned to butter and then

heated at 80 deg C to remove water (25-35%) and then at >100 deg C until the curd separates from the butter oil. The flavour of the ghee depends on the acid content of the dahi, churning time and heating temp. and is best if heating temp. does not exceed 115-120 deg C. Ghee can also be prepared by heating fresh cream without churning but it does not have such a good flavour. In the Himalayas a dry cheese, churpi (chorpi), is made from the buttermilk formed by churning dahi. The curd is formed by heating, cut into blocks and air dried; samples contained 7-11% moisture, 77-85% protein, 4-15% fat and 0.55-0.70% ash. Khoa is a concentrated milk product which possibly developed under Indian and Islamic influence. Milk is concentrated in 5-litre containers to about 6 times its original solids content by heating over a charcoal fire for 4-6 h. The product is brown in colour and has a caramel-like flavour. It is eaten, sweetened with syrup. Various confectioneries are made from milk. Lal mohan is made by frying in ghee, balls made from dried milk, wheat flour, baking powder and milk. Rhasbhari is made by mixing casein with wheat flour and baking powder, and boiling for 20-25 min in whey which has had sugar added.

Value added and Imported dairy products

Ice cream, butter, cheese are some of the value added dairy products being produced and consumed in the country. All these products are both locally produced as well as some imported from other countries also.

Ice cream : Local brands like Azzbko, Nepal Dairy (ND's) and Dairy Development Corporation (DDC) and international brands like Baskin-Robbins State owned DDC is one of the major players in the ice-cream industry, enjoying around 30 per cent market share. DDC produces 1,000 litres of ice-cream per day in 10 different flavours from its three different production plants — in Hetauda, Biratnagar and Lainchaur. It has two outlets in Pokhara and three in the valley. Vanilla, Straw-berry, Chocolate, Pistachio are some of the popular flavours from DDC brand. DDC ice-creams come in 100 ml, 500 ml, one-litre, and four-litre packs and prices range from Rs 30 to Rs 500.

Another local brand is Nepal Dairy or ND's which offers in 22 flavours of ice-cream ranging from Vanilla, Strawberry and Chocolate, to Pineapple, 21 Love, et cetera. ND's ice creams are available in all the major cities like Pokhara, Dharan, Itahari and Narayanghat, while it has its own outlets at Mahabouddha, Baneshwor, Maru and Kumaripati in the valley. The company claims to enjoy 25 per cent market share.

Azzabko ice cream is also creating a niche in the market with number of creamy, sweet, and delicious flavours. Available in over a dozen flavours in 100 ml, 500 ml, one-litre and four-litre packs, the brand offers flavours like Azzabko Vanilla, Pineapple, Apple, Mint, Strawberry, Chocolate, Mango, Litchi, Vanilla Chocochips, Coffee, Butterscotch,

Pistachio, Rum Raisin, and Mango, among others. The factory is producing 2,000 litres of ice cream per day. Azzabko has 680 outlets in the country and enjoys 25 per cent of the total ice-cream

The annual sell out of the imported ice-cream, Baskin-Robbins averages 22,000 litres during summer season. It comes in half-, one- and four- litre packs and in regular and premium sizes with six flavours in the regular segment and 19 refreshing flavours in the premium. The price of Baskin-Robbins' ice-creams range from Rs 400 to Rs 2,200, depending on the flavour.

The annaul production of cheese from public and private sector dairy industries in th eyear 2008/09 was 114 ton yak cheese, 410 ton Kanchan cheese and 34 ton mozerrela cheese, while butter prodcution was 90 MT. The import of cheese and butther duirng 2010/11 was 55 and 18 MT respectively.

Table 23: Status of annual production of cheese and other dairy products (2008/09)

Sector	**Dairy products (kg)**			
	Yak Cheese	**Kanchan Cheese**	**Mozzarella cheese**	**Paneer**
Public sector (DDC)	48317	124074	34046	90408
Private sector	65500	285575	NA	NA
Total	113817	409649	34046	90408

3.14 Major Marketing Constraints

Though the dairy sector in the country is gradually emmerging as commercial entreprise, the sector also faces various marketing problems at different points in its value chain apart from other production related constraints. Some of the constraints that were expressed during this study are;

At Farmers level

- Collection centre/ chilling centres are not in appropriate place
- There is inconvinience in bringing evening milk that sometimes cause spoilage of milk

- The milk carrying can is round which make difficulties in carrying by people in their backs.
- Sometimes they are cheated by not giving the exact amount as should have as per its content- reduction in fat content.
- There is no automated milk analyser in most of the collection centre.
- Payments are made sometimes too late making great trouble to the farmers
- High cost of production and lower margin
-

At Milk Vendor Level

- Consumers mostly complain about the quality of milk- mostly for adulteration of water

At Cooperative Level

- The quality of milk being brought by farmers are not always to the quality standards
- Sometimes compelled to make delay payment due to delayed payment from the processor
- Most collection centres don't have their own chilling centres and have to bring the collected milk to nearby chilling centre though the volume collected is low
- Frequent electricity disreption had increased their operation cost those shich have their own chilling vat.
- Frequent blockade has sometimes created havoc in their business
- Antibiotic adminsted animals are not withheld from being milked and sold

At Processor Level

- The most important issues that processors had with the quality of collected milk, they are mostly not at specified quality standards
- The VAT imposed on dairy products is making them leass competitive and illegal import of milk products from porous border is of great concerns
- Frequent blockade and electricity failure has created great rise in processing cost
- They are not getting sufficient amount of quality milk to the industries at full installed capacity
- No subsidies on electricity or waive on tax for dairy equipment that are provided to the cooperative level dairy.
- Price fixed by DDC and is not let to be fixed by free market economy.
- No system of pricing milk differently for lean and flush season
- Some processors try to cash the good will of well established dairy by mimicing the outlook of the branded products of well established dairies.

At vendor/ milk booth level

- Low marketing margin
- Sometime spoilage- leaking or clotting (consumers' complain)- they get no compenstation for it.

At Consumers' Level

- The quality of processed and packed milk is often not accpetable- off flavor
- The price of milk is always increasing
- Not strictly adherance of producer/ processors on GMP and CoP has hyegenic issues and implication
- Unethical business has lost the trust of consumers on the products (eg. Gundpak and fluid milk of some brands due to recent checking of products from authority

3.15 Ways to improve market and marketing in the formal sector

For improving milk and products marketing in the country flowing measures need to be taken

1. Programme for reducing the cost of milk production (high producing animals, fodder based feeding, health control measures etc), so that it becomes more competitive in the market and farmers get higher profit.
2. Implementing GMP, CoP across the value chain so that consumers trust on products increases and thus the consumption.
3. Increasing the number of small scale chilling vat such that evening collection is encouraged and quality of milk maintained.
4. Availing soft loan for dairy animal farming or establishing dairy industries to make the sector more competitive
5. Restructuring of VAT policies for making national dairy industries more competitive.
6. Provision of subsidies on electricity and energy
7. Awareness campaigns for increasing level of consumption
8. Penetration into the rural sector with infrastructure development for bringing more milk into formal sector
9. Diversifying the dairy products
10. Regulating illegal imports and quality of products

3.16 Drivers of growing consumption of milk and milk products

Levels of per caput consumption of dairy and other livestock products are determined by a number of factors, including economic ones such as income levels and relative prices, demographic factors such as urbanization, as well as social and cultural factors. Undoubtedly, the most significant factor underlying the growing consumption of livestock products in a large portion of the developing world has been economic growth and rising incomes. Both dairy and other livestock products have a high income-elasticity of demand, especially at low income levels. This means that increases in income leads to large increases in demand for livestock products. Thus per capita income growth will translate into particularly significant increases in demand for livestock products. It has been reported that income elasticity for dairy products in in developing world income is 0.8 meaning that for every 1.0% increase in income, demand for dairy product increase by 0.8% (Gerosa and Skoet, 2012)

CHAPTER 4: QUALITY CONTROL IN DAIRY SECTOR

Quality is an important aspect in the dairy sector both from the nutritional and health aspects. As is the milk perfect food for human nutrition so is also the perfect medium for microbes to grow and transmit diseases to the human beings. Quality philosophy, these days are considered to be the password to the market. Quality aspects encompasses right from the farm production and general health of dairy animals till the end products are consumed. Special attention need to be paid right at farm production, during transportation and post processing handling. Quality standard are set for nutrient content of milk and milk products and microbiological loads in it. Obvious contamination with dirt and dung are also the matter of concern.

Dairy farmers are in the business of producing food. They aim to ensure that the safety and quality of their raw milk will satisfy the highest expectations of the food industry and consumers. On-farm practices should also ensure that milk is produced by healthy animals under acceptable conditions and in balance with the local environment. The overarching principles applying to the production, processing and handling of all milk and milk products are:

- From raw material production to the point of consumption, all dairy products should be subject to a combination of control measures. Together, these measures (good agricultural practice – GAP and good manufacturing practice – GMP) should meet the appropriate level of public health protection.
- Good hygienic practices should be applied throughout the production and processing chain so that milk and milk products are safe and suitable for their intended use.
- Wherever appropriate, hygienic practices for milk and milk products should be implemented following the Annex to the Codex Recommended International Code of Practice – General Principles of Food Hygiene.
- GAP/GMP together should be effective.

All dairy farmers, suppliers to dairy farmers, milk carriers and hauliers, dairy product and food manufacturers, distributors and retailers should be part of an integrated food safety and quality assurance management system. Good farming practices underpin the marketing of safe, quality-assured milk-based products.

The role of dairy farmers is to ensure that good agricultural, hygienic and animal husbandry practices are employed at the farm level. The focus should be on preventing a problem (including animal diseases) rather than solving it after it has occurred.

Good dairy farming practices should contribute to ensuring milk and milk products are safe and suitable for their intended use.

4.1 Quality Standards for milk and milk products

The quality standards for 17 milk and milk products being used in the country as set by the DFTQC is given in Table 24.

Table 24: Quality standards of milk and milk products

SN	Products	Minimum Standards (Contents)	Other Standards
1	Cow Milk	3.5% Fat, 7.5% SNF	
2	Buffalo Milk	5.0% Fat, 8.0% SNF	
3	Ghee		RI at 40°C: 1.4538-1.4559 Reichert Meissel Value: ≥28 Acid Value: ≤6 mg potassim hidroxcide per 1 gm ghee Peroxidase Value: ≤10ml/kg Mositure: ≤0.05%
4	Pasturized Milk	3.0% Fat; 8.0% SNF	0 Coliform Count Negative Phosphatase Test
5	Evaporated Milk	7.8% Fat, 25.9% TS	
6	Evaporated Skimmed Milk	20% TS	
7	Sweetened Condensed Milk	8.0% Fat, 31.0% TS and 40% Sugar	
8	Skimmed Sweetened Condensed Milk	26.0% TS; 40% Sugar, <0.5% Fat	
9	Partly Skimmed Sweetened Condensed Milk	28% TS, 40% Sugar, Fat 3.0-9.0%	
10	Butter	80.0% Fat, SNF <2%, Water: <18%	0 Coliform Count Negative Phosphatase Test
11	Cream	18% Fat	0 Coliform Count Negative Phosphatase Test
12	Curd	Fat and SNF as per Buffalo milk, If curd made from cow milk or skimmed milk, the total solid should be accordingly	0 Coliform Count Negative Phosphatase Test
13	Infant Milk Food	Mositure: ≤4.5% Milk Fat: ≥18.0% Milk Protein: ≥12.0% Acid Insoluble ash: ≤0.1% Vitamin A: 350μ /100g Vitamin D: 180IU/100g etc.	Bacterial Count: <40000/g Coliform: Nil/0.1g
14	Infant Food	Mositure: ≤4.5% Milk Fat: ≥18.5% Milk Protein: ≥10.0% Total Ash: ≤8.5%	Bacterial Count: <40000/g Coliform: Nil/0.1g

15	Whole Milk Powder	Mositure: ≤5.0% Milk Fat: ≥26.0% Milk Protein: ≥34.0% Acidity: <1.2%	Arsenic: <0.1mg/kg Lead: <0.2 mg/kg Cadmium:0.1mg/kg Micotoxin:<10mg/kg Radiation:300 Bikeral/kg
16	Skimmed Milk Powder	Mositure: ≤5.0% Milk Fat: ≥1.5% Milk Protein: ≥34.0% Acidity: <1.5%	Arsenic: <0.1mg/kg Lead: <0.2 mg/kg Cadmium:0.1mg/kg Micotoxin:<10mg/kg Radiation:300 Bikeral/kg
17	Paneer/ Chhena	Moisture: <70% Fat: >50 (DM basis)	

Table 25: Specification of referred standards for raw milk in Nepal

Parameter	**Name of the standards**	**Values**
Fat	PFA	Minimum 4.5% (for mixed milk)
SNF	PFA	Minimum 8.5% (for mixed milk)
Acidity	DDC	Maximum 0.2%
TPC	DDC	Not exceeding 200,000 Very good From 200,001 to 1,000,000 Good From 1,000,001 to 5,000,000 Fair Over 5,000,000 Poor
MBRT	DDC	5 hours and above Very good From 3 to 4.5 hours Good From 1 to 2.5 hours Fair 0.5 hours and less Poor

Department of Food Technology and Quality Control (DFTQC) is the regulatory body for quality control of food products and ingredients in the country. The department has full responsibility and authority for maintaining quality of dairy products.

The DFTQC monitoring on the quality of processed dairy products available in the market revealed that we have not been able to maitain the quality standard in milk and milk products though recently the quality standards of milk products particularly ice cream and cheese and paneer have been found to be improved over the past years.

Table 26: Percentage of sub standard and contaminated milk and milk products during 2062-2065

Products	Percentage of tested samples that failed quality standards		
	FY 2062/63	FY 2063/64	FY 2064/65
Fluid milk	29.4	41.9	28.6

Ice cream	78.9	33.3	0.0
Cheese	27.3	0.0	0.0
Paneer	88.8	0.0	-
SMP	56.5	28.6	0.0
Others	0.0	27.7	10.0

Source: Bhattarai (2066)

A study carried out in the eastern terai region of Nepal revealed that the mean TBC at farm (9.03 x 105) was nine fold of international standard (1 x 105), and mean TBC at plant (104.71 x 105) reached 104 folds the international standard warranting the need for adopting hyegenic milk production practices both at farm and plant level (Dahal et al, 2010)

The farm sanitation and milking hygiene is the prime factors for maintaining quality of milk produced in the farm. External contaminations are strained at the farm level. Milk is collected at collection centre of MPCs from individual producer farmers. If the collection center is far, the producers keep the evening milk and mix with next day morning milk and bring to collection centre in the morning. Farmers' brought milk is tested for fat and SNF content. Occasionally, if the person at collection centre doubt about the spoilage of milk, the COB and alcohol test is performed. The collected milk from the producers is brought to the chilling centres and transported to state owned DDC or private dairies as per the contract. The individuals brought milk are never subjected to antibiotic residues test, but sometimes examined for microbiological quality (eg. Total plate count). NDDB, CLDP (DLS) and other NGOs have supported milk producers cooperative and some commercial dairy farmers by providing chilling vats of various capacities. State owned DDC and some large scale private dairies have also provided chilling vats in their collection centres.

The dairy processing plants are occasionally inspected by authority for ensuring adoption of code of practices (CoP) made for dairy processors, violation in which is prosecutable. Frequent violation of CoP by dairy processing industries may loose goodwill and thus the market for their products.

NDDB (2001) conducted a market survey study on quality of milk and milk products at various point of it value chain, and have found discrepancy in quality standards.

Training on hygienic milk production practices to the farmers and good practices for dairy entrepreneurs have been provided by NDDB, CLDP/DLS and NARC. This is the regular and continuous programme of government institutions related with livestock development in the country. Some NGOs working in these fields have also initiated to work in hygienic milk production aspects.

4.2 Quality Control in Traditional Dairy Sectors

There are practically no organized marketing centres for traditional milk products in Nepal. The marketing channel is unorganized and without any rules and regulations. There may be some rules and regulations, but they are not applied. The assurance of the quality of traditional dairy products thus totally depends on the personal and business ethics of the producers. There is a general lack of literature, data on production and marketing and standard specifications for production and quality control. That limits the opportunities that are available to explore, modernise and expand the production and marketing of these products. Some of these products are very fragile and delicate to process and handle, their preparation requires a great deal of manual skills. The overall standards of hygiene and manual handling need to be improved.

The method of preparation of dairy products by the traditional methods needs to be studied and well documented on a scientific basis. The technological parameters, the biochemical changes and the keeping quality of these products should be further researched, with a view to developing the unit processes required for the large scale manufacture of these products.

The marketing channel for ghee is more or less organized. The role of different categories of personnel involved in ghee marketing is well defined already. There is however no control of quality of ghee. Similarly, with other traditional milk products. Khoa, chhana, paneer, shekurm and butter have no quality control. The lack of any guarantee from the government of the quality of traditional products is the reason for a lower price of the products. In the traditional way, curd (dahi) is sold in an open earthenware pot. If this method of package is used to transport dahi over long distances then all kinds of atmospheric contamination may occur. Khoa and soft cheese are often left in a shop in open containers thereby attracting a lot of flies. Traditional milk products are prepared under unhygienic conditions. Cleaning and washing of equipment and milking animals are seldom done. Hygienic conditions are poor in most of the stages involved, from milk production to the sale of final products.

In order to improve the quality of traditional milk products the following suggestions may be considered:-

1. Training for hygienic milk production should be given to farmers at farm gate level.
2. Training on milk quality control aspects should be provided to the milk handler at collection centre.
3. Dairy Technical Support Services should be provided.
4. Marketing of traditional milk products should be channelised through identified institutions and premium price for quality products need to be imposed.
5. A locally-relevant research and development plan with special attention to appropriate technology is needed.

6. Ghee grading, and specifications, should be fixed by establishing ghee refinery factories and laboratories to raise quality to export standards to third countries.

4.3 Poor quality control limiting the development of the dairy industry

Dairy development is essentially a process of collecting raw material and after adding value by processing, selling it to consumers at reasonable rates. The demand for milk and milk products in the country is increasing partly due to increase in population and partly due to change in feeding habits associated with improvement in income status. The country has experienced transition into commercial dairy production from the subsistence system and dairy animal farming and processing industries are emerging particularly in the peri urban areas. The few years back 'Milk Holiday' situation has been totally reverted.

Compromise in quality in both inputs (breeds, feeds, veterinary medicines and vaccine, services) and outputs (milk and milk products) can seriously hamper the dairy sector development in the country. Poor quality inputs including services leads to poor performance of the animals and thus economic loss to farmers that leaves no option to the farmers except leaving the dairy animal farming and milk production profession. This might cascade series of implication in the booming dairy processing industries. On the other hand, the processing industries can only survive if they get quality raw milk which is very essential for further processing. Thus it is very essential that the producers be trained for hygienic milk production (from healthy animals in healthy environment), milk handlers at collection point and transportation for proper handling and processors at processing industries. Quality control at each point is of equal importance that can sustain long term development of dairy sector in the country. So far, dairy entrepreneurs also have not been fully trained on quality and product diversification aspects. They should be also made aware regarding good manufacturing practices.

4.4 Factors that discourage producing quality milk

Lack of incentive and motivation might be one of the single most important factors that discourage farmers from producing quality milk. Though it is the matter of ethics also in part of producers, sometimes farmers might be compelled to produce milk in unhygienic way due to simply lack of water. Ignorance, lack of proper training and skill might also lead to compromise in the quality milk production. It is possible that farmers are unaware about the implication of antibiotic residues in the milk and they are selling milk from the animals during the antibiotic treatment period. Some farmers are concerned only about the visible external contamination. Most of the dairy farmers in the country perceive that the milk price is not conducive enough to produce hygienic milk.

In one study by Animal Health Training Centre (AHTC) located in Kaksi, they found that farmers are not practicing the method of clean milk production at farm because majority of the farmers are not aware about it and some of them are not following it because they

are not getting any extra bonus for it and hygienic quality is not incorporated in the present milk payment system of the country. Other farmers are not applying it because of not using even simple milk testing procedures (COB test, alcohol test and acidity test) to control the quality of milk at collection level. Although the farmers' practices are the most important entry points of bacterial contamination in the milk chain of the country, lack of chilling facilities in every collection centres, only one time (mostly morning) collection of milk, long way transportation of milk in ordinary vehicles, unhygienic handling during processing and distribution of processed products in ordinary vehicles were found important to flourish the bacterial contamination in the milk and milk products.

It was also found from their study that training and awareness programme to farmers for clean milk production is the most important encouraging factor for clean milk production. Bonus and penalty in milk payment on the basis of hygienic quality of the milk collected in the collection centres is found to be the second and third encouraging factors for the production of clean milk respectively. Moreover, it was identified from the study that technical advices, easy availability of veterinary services, credit facilities for the farmers and favorable government policy in the sector are some other encouraging factors for clean milk production at farm level.

Training and awareness programme for farmers, introduction of hygienic quality in milk payment system including bonus first and later on penalty, regular testing of milk by using simple tests to control the quality of milk at the collection level, provision to provide some facilities to the farmers for clean milk production and preparation of favorable government policy in dairy sector by increasing farmers' participation is recommended to produce clean milk at farm level.

CHAPTER 5 THE POLICY ISSUES IN DAIRY SECTOR

A policy is generally defined as a deliberate action by a government or public authority to alter a naturally occurring condition or a condition shaped by past actions to optimize or maximize common good or welfare of citizens in general or a specific targeted part of the economy or segment of the population. A policy targeted to a specific segment of the economy or population to achieve certain goal may indirectly affect other segment(s) of the economy or population with positive or negative consequences, so the net outcome of any policy action may be larger or smaller than the immediate or direct outcomes.

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

An assessment of stakeholder priorities generates a series of policy objectives. These are specific statements detailing the desired accomplishments or outcomes of a development plan. Whereas the goal of a dairy development plan might be to "contribute to national economic development by commercially, qualitatively and competitively developing the dairy sector for employment generation and poverty reduction with the participation of government, cooperatives and private sector", the development objectives would be more specific.

Specific examples of development objectives for the dairy sector could include: reduction of imports; increasing on-farm productivity and ensuring food and nutritional safety; raising on-farm incomes; reducing post-harvest losses and improving quality standards; and ensuring fair prices for quality milk products. This contrasts to more vaguely worded goal statements, such as enhanced food security, sustainable development and poverty alleviation.

5.1 Institutions involved in dairy sector:

Various institutions are involved in dairy sector development in Nepal for production, processing, marketing and policy formulation. These include:

1. **The Dairy Cooperatives:**

The dairy cooperatives, though established during seventies, became more effective only after December 1981, when Dairy Development Corporation (DDC) initiated the milk producers oriented program by encouraging the farmers to form their own Milk Producers' Associations (MPAs) along the lines of cooperative principles. The MPAs operated under the by-laws prepared by DDC. The MPAs had no formal legal status and they operated as single purpose primary cooperatives with milk trade and support to milk production as their main activities. In order to enable the MPAs with the formal legal identity and to make them more autonomous, DDC took initiation to convert these MPAs into Milk Producers' Cooperative Society (MPCS) in February 1989. For this, it encouraged and facilitated to register these MPAs in the Cooperative Office of Government of Nepal (GoN). The recent statistics indicate that about 1,603 MPCSs are registered in 53 districts of the country. The Cooperative Act, 1992, governs these MPCS. Like the MPAs, majority of MPCSs also operate as single purpose primary cooperatives. The main function of these MPCSs is to collect milk from the farmers (both the members as well as non-members), test it for quality, transport it for selling to the nearest milk chilling centers/milk processing plants of DDC and/or private dairies; receive payment for the milk from them; and distribute the payment to the individual milk supplier farmers. Apart from milk collection business, some of the MPCSs have also started the operation of milk chilling vats; and milk processing for producing various dairy products and supply of feeds and veterinary medicines and vaccines at marginal profit basis but cheaper than the commercial suppliers, initiation of saving and credit program and beginning of animal insurance scheme for the cooperative members. Thus, the dairy cooperatives have ventured on various programs related to dairy development in the country, however, these programs have not been implemented in an organized and institutional manner and dependent upon the individual capacity and initiation of the particular cooperative.

The dairy cooperatives in Nepal have adopted a three-tier system; of which the MPCSs are the first-tier primary level cooperatives. In the second tier, the district level District Milk Producers' Cooperative Unions (DMPCUs), composed of district level MPCSs and registered under Cooperative Act as district level bodies. Presently, there are 36 DMPCUs in different districts (mainly in Terai and mid-hills) and their main objectives are to deliver programs designed to support the increased production and processing of milk and milk products and to contribute to the financial and social up-liftment of the rural milk producers. The third tier, is the Central Dairy Cooperative Association Limited Nepal (CDCAN) composed of the MPCSs and DMPCUs and registered as the central-level cooperative body of the milk cooperatives. Established in 1993, CDCAN is a national level tertiary organization of all the milk producers' cooperatives at primary and secondary levels. The main role of CDCAN is to bring increased economic benefits to milk producers and to contribute to make the country self-reliant in clean and high-quality milk and milk products. It also implements policy advocacy activities at the central level to represent the interest of member organizations. Currently, 36 DMPCUs and 1,329 MPCS are affiliated to CDCAN.

2. The Department/Ministry of Cooperatives and Poverty Alleviation (DoC/MoCPA):

DoC is a regulatory body to regulate all the cooperatives from primary to federation level operating in the country. The DoC has three main functions: registration of cooperatives, making recommendations for improvement of cooperatives, and dissolve the cooperatives which fail to operate for two consecutive years or acts against its objectives. Additionally, the DoC is also responsible to monitor the cooperatives to assess their performance. Accordingly, the DoC is also responsible to register and monitor the MPCS, DMPCUs and central level dairy cooperative association. The most recent development in this sector has been the creation of Ministry of Cooperatives and Poverty Alleviation by separating the Department of Cooperatives from the Ministry of Agriculture and Cooperatives, with the aim of strengthening the cooperative movement for poverty alleviation.

3. Dairy Industry Associations:

The milk processing industries have organized themselves under two associations namely Nepal Dairy Association (NDA) and Dairy Industry Association. The Nepal Dairy Association has members like Sitaram Dairy, Anmol Dairy and other local dairies; while Dairy Industry Association (DIA) members include Kathmandu Dairy, Bhaktapur Dairy, Nepal Dairy, Sujal Dairy, Sainju Dairy and Chitwan Dairy. These associations are involved in lobbying the concerns and problems of dairy sector to the policy makers and other concerned institutions and authorities.

4. Department of Livestock Services (DLS):

Department of Livestock Services aims to contribute to poverty reduction and improving the living standard of the people in the country through sustainable livestock development. DLS strives to develop livestock sector by commercialization of the enterprise and to develop it as an income generating sustainable enterprise. The department has implemented various programs/projects on dairy development with the objective of poverty reduction amongst rural poor. The national network of district livestock service offices, service centres and sub-service centres has provided the department of livestock services an environment and opportunity to contribute for dairy sector development in an organized, institutional and across the whole country according to the potentials and possibilities of a particular location. DLS has also maintained the breeding and production farm for buffaloes and National Livestock Breeding Centre at Pokhara for production and processing of semen for artificial insemination.

5. **Nepal Agriculture Research Council (NARC)**:

Nepal agriculture Research Council (NARC), the apex organization for conducting agriculture (including dairy) research in the country, has been involved in dairy sector research through development of suitable technologies for improving dairy animal productivity and improving the efficiency of the sector for better competitiveness in the market. The major areas of research has been the dairy breeding, dairy health, dairy nutrition, forage production and dairy management. NARC has specific divisions like Animal health, Animal breeding, Animal nutrition, Forage and Pasture to contribute to the sector but also The Bovine Research program, all of which are involved in dairy

sector research synergistically. The flow of developed technologies to the clients is through the channels of government line agencies, non government organizations (NGOs), and development projects.

6. **NGO/INGOs and Development Projects**:

Various NGO/INGOs and development projects have been involved with dairy sector development in various regions particularly in the more accessible parts of the country. These organizations have been involved in organization and capacity development of the farming communities, introduction of technologies and inputs in the system and development and support of marketing structure and system. Four development projects namely first livestock development project, second livestock development project, third livestock development project and community livestock development project have been involved with dairy development programs. Some INGOs like Practical Action has implemented a specific dairy project MASF (Market Access for Small holder Farmers) in four districts (Chitwan, Tanahun, Dhading and Gorkha) of the country for improving dairy animal productivity and milk marketing system. Similarly, FAO and USDA has supported specific projects for genetic improvement of dairy animals through performance recording, selection of best bull mothers and use of high quality semen on the selected animals for the production of best bulls, which could be bought to the National Livestock Breeding Centre for production and use of semen of selected bulls to be used in national artificial insemination (AI) program. This approach has been undertaken for cattle and more recently for buffaloes. It is expected that with this approach, a sustained and self dependent system of cattle and buffalo breeding could be initiated in the country.

7. Department of Food Technology and Quality Control (DFTQC):

Department of Food Technology and Quality Control has been mandated with quality control of dairy products, research and development of food processing and nutrition support programs. DFTQC is the sole governmental agency for implementing Food Act and Feed Act for the enhancement of quality and safety of food and feed in the country. DFTQC strives to maintain safety and quality of food and feed products in the country by implementing the provisions made in food and feed act, promote entrepreneurship by developing and disseminating appropriate technologies, and improve the nutritional status of people through food-based approaches.

8. National Cooperative Development Board (NCDB):

National Cooperative Development Board was constituted under the NCDB Act, 1992. The Board has been constituted to promote and develop cooperatives. Its EC (executive Council) is composed of members representing government, private sector and professionals under the chairmanship of Minister/state minister of Agriculture. The NCDB is also responsible for mobilizing funds, entering into joint venture agreements, extending technical support and coordinating the functions of non-government organization involved in cooperative activities.

9. Dairy Development Corporation (DDC):

Dairy Development Corporation is the major institution in the public sector involved in processing of milk and milk products including cheese. This organization was created during 1969 under the Corporation Act of 1964. The major objectives are to: provide a guaranteed market for milk to the rural farmers with fair price; supply pasteurized milk and milk products to urban consumers; develop organized milk collection system to meet increasing demand for pasteurized milk and milk products, and develop an organized marketing system for milk and milk products in urban areas. A Board of Directors appointed by the government governs the DDC. The General Manager or the Executive Chairperson is also appointed by the Government. DDC operates six milk supply schemes (MSS) and a Milk Products Production and Supply Scheme (MPPSS) in the country. DDC's milk collection network exists in 31 districts of the country through 55 milk chilling centers (MCCs) and about 800 MPCSs. The current processing capacity stands about 60,000 MT of milk, 3200 MT of various dairy products and about 200 MT of cheese primarily from Nak and Chauries.

10. The Private Sector Dairy Industries:

The private sector started its involvement in the dairy-processing sector from late 1970s with very small-scale operations in Kathmandu. Today, there are many private dairies (including cooperatives) of various size both within and outside the Kathmandu valley. Prominent among the private dairies with modern milk processing facilities are Chitwan Dairy in Chitwan, Sujal Dairy in Pokhara Valley, Nepal Dairy and Sitaram Dairy in Kathmandu and various other small scale dairies and numerous cottage type dairies in different parts of the country. These dairies produce pasteurized milk and other dairy products such as yoghurt, ice-cream, butter, ghee and different milk products. Similarly, the private entrepreneurs have also involved in producing cheese in the mid and high mountain regions from cow and *nak* milk. According to the available information, altogether, 250 dairies of varying scale are operating in the country. These private dairy entrepreneurs have established associations called Nepal Dairy Association (NDA) and Dairy Industry Association (DIA) involving small, medium, and large scale dairy industries scattered throughout the country.

11. The market chain (retailers and whole sellers):

The market chain for selling the dairy milk and milk products has been facilitated by the network of retailers and whole sellers scattered in major towns and cities of the country. Most of the dairy industries (public/private) sell their products through these market outlets to the consumers. These market outlets get their commission on the volume of the sale they sell to the consumers. In addition to the private sellers, DDC also has few DDC sale centres of its own in some of the town centres of the country, where DDC products are sold directly to the consumers.

12. **National Dairy Development Board** (**NDDB**):

National Dairy Development Board (NDDB) was established in 1992, in similar lines with NDDB India, with the major functions and responsibility of formulating and recommending policies and plans for dairy development in Nepal and strengthen the dairy sector by bringing coordination between private and public sector. NDDB is an apex autonomous institution and the policy body for holistic dairy sector development of the country.

The major objectives of the Board are:

- to assist GoN in formulating national level dairy development policies and plans;
- to promote dairy industries in the country;
- to find the solutions to the problems in dairy development and dairy health;
- to maintain coordination between the public and private dairy industries;
- to carry out high level studies and research on dairy development, and
- to make arrangements for fodder and pasture resources.

The functions of NDDB include:

- policy formulation and recommendation on import of goods necessary for production and promotion of milk and milk products as well as animal feeds,
- implementation of the approved policies;
- formulation and recommendation of milk pricing policy to the government;
- recommend the government for promotion of dairy processors and consumers;
- promotion of cooperative sector dairies; registration of dairy industries;
- management and mobilization of national and foreign grant and loan for dairy industries;
- technical assistance for setting-up, improving, promoting and safeguarding dairy industries;
- review, monitoring and evaluation of dairy development programs, and
- carry out other necessary activities for dairy industries.

NDDB is composed of an executive committee (EC) composed of 14 members, which is Chaired by Minister of Agriculture and Cooperatives (MoAC). The Secretary of MoAD is the Vice-Chairperson and the ED is the member-secretary. The members include representatives of farmers (4), private dairy entrepreneurs (3), General Manager of the Dairy Development Corporation (1), Representative of Federation of the Nepalese Chamber of Commerce and Industries (1), Director General of Department of Livestock Services (1), and Joint Secretary of the Ministry of Finance (1). The Executive Director (ED) appointed by the minister of agriculture with cabinet approval, heads the secretariat of the board.

5.2 THE POLICY ENVIRONMENT

Agriculture Perspective Plan (APP):

The Agriculture Perspective Plan (APP); a 20 year vision document (1995-2015) for agriculture development in the country, has given first priority to dairy sector development with high priority to dairy animals (dairy buffaloes). Buffalo has been prioritized for milk production because of its importance in supplying both milk and meat. Livestock products including milk and milk products have been considered as demand driven commodities, which will be greatly influenced by income elasticity and population growth. Livestock sector is considered as one of the key sector to contribute for poverty alleviation and employment generation, particularly for women.

The broader policy framework for livestock component in APP include enhancement of the private sector with realization that livestock sector is a private sector and livestock policy should be guided by this realization; and public sector should be only complementary to support the private sector. Elimination of all subsidies in livestock processing and marketing is duly emphasized to provide free entry for the private sector. It underlines the privatization of public institutions or their existence as self-sustaining free-units. To help to develop a competitive private sector, the APP stresses to set grades and standards, establish marketing information systems, improve veterinary services, and scrutinize imports of products like SMP. Expansion of roads and electric power, improvement in extension services with focus on women, and expansion of credit facilities are some other major policy guidelines of APP.

National Agriculture Policy

National Agriculture Policy, 2061 is the guiding policy for agriculture sector. It aims to improve living standard through sustainable agriculture development by transforming subsistence agriculture system to commercial and competitive. In order to contribute for food security and poverty reduction through commercial and competitive agriculture system the policy intends to increase agriculture production and productivity, make agriculture competitive with regional and global market by developing bases for commercial and competitive agriculture system, and conserve and utilize natural resources, environment and bio-diversity.

Development of appropriate agriculture technology; development of agriculture resource centers; participatory and competitive agriculture research and development by involving private and non-government sectors; collaboration, transfer of technology and specialists with international organizations related to agriculture research and development; regular monitoring of agriculture inputs for its guaranteed supply; farmers' training for capacity enhancement at local level; priority to produce such agriculture products which have comparative advantage; increase in women's involvement in agriculture programs etc. are some of the major policy guidelines to increase agriculture production and productivity. Similarly, development of large production pockets and mobilization of such facilities as technical services, agriculture roads, rural electrification, irrigation,

agriculture credit, markets arrangement in these pockets with an integrated approach; expansion of livestock insurance system; priority to cooperative-based agricultural industries; institutional development of cooperatives and development of these cooperatives as local delivery point for providing required inputs and channeling farmers' produce to markets are some other major policies to make the agriculture sector commercial and competitive.

Dairy Development Policy (DDP):

The major thrust of dairy policy is to increase milk production and productivity in the rural areas; minimize import of milk and milk products by product diversification; increase the export of quality milk products and supply adequate amount of hygienic milk and milk products to the consumers. Dairy Development Policy, 2064 (2008), has been approved by the government, and is the guiding policy document for overall development of the dairy sector in the country. This policy document was prepared in accordance with the spirit of Agriculture Perspective Plan (APP, 1995-2015); National Agriculture Policy, 2061; National Milk Marketing and Strategy Study, 2001; and Agriculture Business Promotion Policy, 2063. Being based on these documents, all aspects relating to dairy development have been incorporated in the policy. The long-term vision of the policy is to contribute to national economic development by developing the dairy sector for employment generation and poverty reduction with the participation of government, cooperative and private sector and extending the programs to produce good quality milk and dairy products easily available to the consumers. The policy aims for increasing milk production and productivity; extending milk collection, transport logistics and processing industries; substituting import and promoting export of the dairy products with quality improvement and regulation; production and easier availability of milk and dairy products to the consumers.

The major features of the policy include:

- ***Increasing milk production and productivity*:**

  Includes development of dairy business for poverty reduction, development of resource centers for increasing production of improved breed of animals, preservation, conservation and promotion of improved as well as productive local breed of animals; expansion of effective animal health care and disease control services; arrangement of feeds and fodder; mobilization of cooperatives/groups for providing and extending livestock insurance services; easy and convenient credit to the farmers for purchase of milking animals; development of appropriate animal feed, forage production technology for increasing milk production in the lean season; group-based collateral-free low-interest loan and technical services particularly to the women, *dalit* and other disadvantaged groups; prioritization of highly milk production potential districts and expansion of milk chilling centers.

- ***Extending milk collection, transportation and processing industries*:**

Which includes arrangements for providing concession in the tariff of electricity used for milk chilling centers and dairy industries established in the cooperative sector; arrangements for providing concession in the custom duty for NDDB sanctioned dairy machines and equipment; priority to the movement of dairy vehicles as essential service; encourage establishment of internal/external joint venture dairy industries that produce value-added dairy products including powder milk and baby food which will contribute for import substitution and export promotion; convenient credit facility and technical support to the dairy industries particularly for the Yak cheese; support for cooperative/private sector for capacity development for producing cow milk cheese; establishment of dairy institute/training center for developing necessary technical manpower for the dairy industries; capacity enhancement of technical as well as management personnel involved in dairy sector; research and development of appropriate technology for milk production, processing and product diversification; tax exemption on the expenses made for dairy research and development along with appropriate incentives by cooperative and private sector; implementation of necessary programs for goat milk production and producing cheese and other dairy products from goat milk.

- ***Substituting import and developing milk and dairy products as exportable commodities*:**

  Which includes free market policy for pricing of milk and milk products; collection and analysis of information on price, demand and supply of milk and dairy products through regular monitoring and study; exemption of income tax for a certain period to the dairy industries for a specified locations that use fully local milk for producing milk and dairy products; convenient custom duty in the import of printed packaging materials; and removing bi-lateral and regional tariff and non-tariff barriers for promoting export of milk.

- ***Making milk and dairy products easily available to the consumers through quality improvement and regulation*:**

  Which includes consumer targeted public awareness programs for promoting consumption of more milk and dairy products; regular quality monitoring of the marketed milk and dairy product; consumers' awareness about storage methods, consumption duration, consumption methods of these products; review and update of quality control of milk and dairy products; preparation and implementation of appropriate packing standard of milk and dairy products; implementation of code of practice for milk collection and processing at the milk chilling centers and dairy processing factories; and strengthening of laboratories at different levels for supporting the production and marketing of quality milk and dairy products.

- ***Strengthening institutional arrangements*:**

  Includes development of NDDB as a strong organization having institutional representation of farmers and dairy entrepreneurs to formulate policy for the development of dairy sector and prepare related development plan, monitoring and regulation; enhancement of NDDB's capacity for planning, investment, monitoring, regulation,

research and development on the dairy sector; registration of government, cooperative and private dairies at NDDB; establishment of dairy fund through service charge on milk per liter sold by the dairy industries for financing in overall development and expansion of dairy sector; strengthening dairy statistics and information management system; and support for enhancing technical and managerial capacity of milk producer cooperatives.

- ***Implementation and monitoring arrangements*:**

  This policy includes NDDB and other related institutions to be make them responsible for implementing the policy and prepare necessary working procedure for taking initiative to make necessary amendment on existing legal provision for implementing the policy.

Agriculture Business Promotion Policy

In line with the National Agriculture Policy, the Agriculture Business Promotion Policy 2063 also intends to support market-oriented and competitive agriculture production, contribute to internal market and export promotion by developing agro-industries, and help poverty reduction through commercialization of agriculture. This policy also guarantees for an integrated approach to provide such facilities as agriculture inputs, technology and technical services, agriculture roads, rural electrification, irrigation, agriculture credit, insurance, markets, information system, appropriate mechanization of agriculture, and processing facilities with joint efforts of government, non-government, private and cooperatives sectors. Development of e-commerce, concession on interest of agriculture credit, encouragement to direct foreign investment, special programs for establishment of agro-industries by disadvantaged groups, women and *dalits*, 25 per cent concession on electricity charge for chilling vats and 75 per cent concession on import duty of machine and equipment to be used for agro-enterprises for 10 years, group loan, collateral of projects for loans, human resource development, capacity development of training institutes, free market price etc. are the major features of this policy.

Industrial Policy

The Industry Policy, 2049, stresses for the development of private sector. It intends to privatize the government sector industries and assures for creation of environment for competitive free market price of the products produced by the private sector industries. The main objectives of this policy is to increase industrial production and productivity to contribute to national economy, emphasize local raw material based and export oriented industries, reduce unemployment and under-employment in agriculture sector by employment-oriented industries, and adoption of appropriate industrialization policy for balanced development of all sectors of the country. The policy has categorized integrated dairy industries including livestock farming as national priority industries.

The main features of this policy is the development of industries through fair and competitive environment; support industries through custom duties; promotion of such industries that use national labor, skill and resources and are of national importance; speeding-up the growth of national economy through export of industrial production;

emphasis on the development of small, cottage and agro-based industries particularly for creating employment opportunities in the rural areas; emphasis to attract foreign investment and transfer of modern technologies and efficient management. The policy has various provisions relating to facilities including concession on excise duties and income taxes and prioritized availability of infrastructural support such as government land/land within industrial districts, water and electricity, telecommunication etc. Moreover, the policy also includes one-door service delivery to the industries, emphasis on import substituting industries, encouragement to industrial investment in less developed areas, gradual transfer of government owned industries to the private sector, securing cottage and small industries only to the Nepalese citizens etc.

NARC Vision 2011-2030 (Proposed)

The vision of the Nepal Agricultural Research Council (NARC) is to tap institutional, human, and financial resources from the government and a wider spectrum of stakeholders—civil society, research centers, donors, and ultimately the private sector—to move the system from agricultural research and development to agricultural research for development. Future research priorities will be based on creating and scaling up technologies that contribute to food security, poverty reduction, value addition, export promotion, environmental sustainability and cost effectiveness. In order to deliver those desired results NARC research areas are rationalized into five broad based thematic areas of intervention.

The vision focuses on reducing poverty through the effective and efficient use of scientific knowledge to increase sustainable agriculture productivity and related natural resources. The major agricultural research areas include field crops, horticulture, livestock, fisheries, on-farm water management, agro-forestry, related natural resources issues, socio-economic aspects of the farming systems, post-harvest operations, gender issues, and, above all, policy research. Considering the agro-ecological diversity, socio-economic situation and research and development actors, NARC will emphasize the development of region-specific agricultural research programs. It will prioritize a participatory systems-based research approach that incorporates multiple disciplines and address multiple commodities. Environmental sustainability, inclusiveness, growth promotion, and income generation will be the distinguishing features of all research undertakings, besides their explicit positive contribution to poverty alleviation and food security. Indigenous knowledge, traditional practices and local resources—including soil, water, genetic material, and skills—will be used in research and technology development in sustainable way. Due consideration will be made in creating and adjusting the technologies to exploit benefits arising and counter any negative effect brought out by climate change.

NARC will also promote commercial agriculture by generating post-harvest technologies that create value added products from cereal crops, cash crops, vegetables and fruits, livestock, poultry and fisheries; and their downstream processing opportunities. By the same token, it will also give attention to the problems and needs of clients in the input

industries and service providers such as, farm machinery, irrigation equipment, agro-chemicals and animal feed.

NARC will shift to the role of promoter, facilitator, regulator, and implementer of efficient modern agricultural technology in partnership with stakeholders. It will draw on research results from neighboring countries, the Consultative Group for International Agricultural Research, and relevant international institutions to the extent possible, but it must enhance Nepal's own capacity to adapt and modify technologies to best meet its farmers' requirements. In addition to its role of technology generation and policy analysis, NARC will contribute to establishing a national agricultural research system that provides a favorable environment for a broad and pluralistic participation and resource co-ordination amongst all potential service providers and beneficiaries.

In the dairy sector, NARC will undertake research studies on genetic improvement, health nutrition and forage management of dairy animals for improving production and productivity of these animals in a sustainable manner. In addition, NARC will also be involved in research for developing value added milk products.

Tariff, Trade and Domestic Support Policy:

Since, 1990 Nepal's economic policy has been based on economic liberalization, including financial deregulation, trade liberalization, and fiscal reforms. In the area of trade liberalization, elimination of quantitative restrictions and import licenses as well as reduction and rationalization of tariffs have been the major aspects. As a result, the peak tariff rate has been reduced from over 400 percent in the 1980s to 80 percent in 1999.

The agricultural trading regime in Nepal is very liberal. Only a few products falling under the negative list are barred from being traded. Agricultural trade is characterized by a very low duty structure. Only a few products attract customs duties of over 15 percent. Most of the countries have higher duties on agricultural products than Nepal. Besides, Nepal does not impose any kind of trade restrictive measures such as QRs, and provide trade distorting subsidies though the cost of productions in the country are comparatively higher. Nepal has reduced its agricultural tariff to 42 percent from 51 percent in 2006. Most subsidies in agriculture had been scrapped by mid 2000, due to which, Nepalese farmers lack competitiveness than the farmers of its neighbors who are supported by subsidies and other support services throughout the product value chain system and even for export. This is very challenging to Nepal, all of which makes the Nepalese farmers less competitive than the neighboring farmers. Apart from the lack of competitiveness, Nepal's market for agricultural exports is very concentrated. India is Nepal's main agro-trade partner accounting for over 80 percent of total agricultural trade. Almost 80 percent of all agricultural imports into Nepal are made from India. Likewise, over 85 percent of Nepal's agro-exports are directed to India.

Dairy sector is the most distorted and highly regulated enterprise and government interventions play significant role in formulating world dairy policies and trade flows and despite WTO agreement, dairy sector policies still remain highly protective in most of the

countries. The import tariff, large export subsidies and domestic support are still the part of dairy policy around the world. Dairy sector in South Asia has developed in a closed economy environment, which has now been changed due to commitment made to WTO and domestic macro economic reforms. In the move towards globalization, the improvement in dairy sector is likely to be threatened by the distortions (high domestic support and export subsidies) in the world market. Thus the country should have an effective market intelligence system to monitor development in the world market in price, subsidy levels, demand and supply situation and link import tariff to world prices (variable tariff within bound rates of duties) and make delivery of inputs and services more effective and efficient to improve productivity of animals which will help to compete in the world production environment. It will also be important to improve SPS and TBT related issue to be able to compete in the world market.

Under the WTO arrangement, Nepal does not have any Tariff rate quotas (TRQ) commitments, and does not have access to the Special safeguard (SSG), the most important instrument for managing imports is applied tariffs, within the limit set by Nepal's WTO bound rates. A WTO member is no longer allowed to limit trade through import bans or quantitative restrictions, or other similar measures, except under such specified situations as safeguards, food safety and adverse balance of payment situation. The only border instrument permitted is "ordinary" customs tariff, which includes *ad valorem* and specific duties.

In the case of Nepal, the provision prohibiting all non-tariff measures applies. As a Least Developed Country (LDC), however, Nepal would not be required to reduce bound tariffs once the transition phase of the WTO accession process is completed, but applied rates cannot exceed the bound duties. Nepal does not have access to the SSG while there was no need for opening TRQs, which Nepal did not. There is a provision in the WTO rules called "initial negotiating rights" (INR). In Nepal's tariff Schedule, some countries have been designated as INR holders for some products. This means that, in future, if Nepal wants to revise bound tariffs upwards, this must be first negotiated with the INR holder.

Tariffs on dairy products (generally 15%) are mostly higher than on fresh milk (10%), but not by much. Among the dairy products, the highest level of tariff protection is for ice cream, which is regarded as a luxury item. The WTO bound rates on milk and milk products range from 40 to 50% although with some exceptions, which means that the bound tariffs are around 3 to 5 times higher than tariffs applied in recent years. Thus, besides some protection for processed products, there is a considerable scope for raising applied rates when needed.

Nepal imports more than 60% of agricultural products from India, most if not all of this duty-free within the framework of the Nepal-India Trade Treaty. At the same time, the long and porous border with India and the relative sizes of the two economies means that commodity prices in Nepal are strongly influenced by prices in India. In addition, Nepal also gives rebates on customs duties to other countries with bilateral agreements. Due to this situation, the relevancy of the Most Favored Nation (MFN) applied tariffs in influencing trade and in determining the level of protection to import competing sectors

in Nepal need to be assessed. Because, for over 60% of the total agricultural products imported by Nepal, the MFN tariffs play relatively small role in influencing the level of protection to import competing sectors. In the case of products that India produces and can export to Nepal, it is unlikely that imports will take place from third countries as long as the world market price plus the MFN applied tariff exceed the price in India plus transaction costs involved in exporting the goods to Nepal, which is the more likely scenario. In addition to the free trade arrangement with India for primary agricultural products, Nepal also grants rebates and concessions on duties on industrial products. Thus, goods produced in and imported from India are granted a rebate in the chargeable *ad valorem* rate of customs duty by 20% up to the tariff of 40%, and by 10% rebate on tariffs above 40%. In practice, since the MFN rates on processed agricultural products hardly exceed 40%, the applicable rebate in most cases is 20% (some taxes are imposed on these products as agriculture development and security fees). On goods imported from the Tibet Autonomous Region of China, and goods produced in and shipped from SAARC countries other than India, the applicable rebate is 10% on the chargeable customs duty. In addition, a 5% rebate is granted to goods produced in and imported from countries enjoying MFN treatment provided that the Letter of Credit is opened there and invoices and other documents are prepared in the country receiving the MFN treatment from where the shipment is made. Nepal has such bilateral relations with 17 countries. These rebates are given for showing special trade relations, and in India's case in the context of the Protocol to Article V of the Nepal-India Trade Treaty.

Although Nepal benefits considerably from duty free access to the Indian market, one implication of the above situation is that it will be very difficult for Nepal to protect its agricultural sector by way of tariff. Even if there were no free trade with India, the open, porous border imposes a binding constraint on the level of market or farm price that can prevail in Nepal, which is the Indian price plus transaction cost in exporting to Nepal. This constraint will most likely continue to be binding even if trade with India is on a MFN basis, although the transaction cost of exporting to Nepal without paying the duty (which makes it a smuggling cost) would be higher now. The main issue is that MFN tariffs beyond certain levels (which will differ by commodity) will continue to have limited role in influencing relative prices in Nepal. Notwithstanding this limitation, it is important that Nepal maintains higher bound tariffs so that it can match India's applied rates if and when trade with India takes place on a MFN basis. Otherwise, given India's relatively higher bound rates, India's applied tariffs could be higher than Nepal's, which would not be in the interest of Nepal's agricultural sector. Thus, the WTO bound tariffs are of strategic significance for Nepal even though they do not seem to be of relevance currently for day-to-day trade policy.

The Financial Act 1996 empowers the Government to apply and modify import tariffs. For setting tariffs, Nepal uses Harmonized System classification code 2002. Applied tariffs are generally low on agricultural products for several reasons. The Nepalese market is fairly open to Indian products for reasons such as proximity, porous border and bilateral agreement. As the border is open and porous, enforcement of high tariff is difficult as it encourages smuggling except where it is easier to detect the smuggled goods, like vehicles. Nepal applies fairly low tariffs on imports from third countries also,

as one objective is to diversify trade. Many domestic industries depend heavily on imported raw materials whose tariffs have to be kept low and the political economy reasons for maintaining low prices in the domestic market in view of the high incidence of poverty. For these reasons, higher tariffs do not necessarily yield higher revenue. In fact, lower tariffs at times have been associated with increased customs revenue. In the coming years also, it is very unlikely that the situation would change markedly. Therefore applied tariffs in Nepal most probably will continue to be on the lower side, more or less similar to the rates seen for recent years.

Under the WTO arrangement, the Agreement on Agriculture states that Industrial states must reduce tariffs by 36 percent over six years, while developing countries have to do so by 24 percent over 10 years and Least developed countries do not need to cut their tariffs. Similarly, aggregate producer subsidies are to be cut by 20 percent by industrialized countries over six years, and by 13.3 percent by developing countries over 10 years, but not by least developed countries. Regarding the export subsidies, developed countries must reduce by 36 percent the value of their direct export subsidies and by 21 percent the quantity of subsidized exports over six years. The cuts for developing countries are set at two -thirds this level over 10 years. No cuts need to be made by least developed countries. In general, tariff bindings on dairy products in the post-WTO period remain very high and hinder market access. The global average tariff for dairy is about 85 percent. In OECD countries, simple average tariff protection is about 116 percent. In South Asian countries, the bound tariff rate for dairy products (SMP, Butter and Cheese) is 200 percent in Bangladesh, 100 percent in Pakistan, 50% in Sri Lanka and 40-60% in India, while it is 42% in Nepal. In many countries, there is a considerable gap between tariff bound in WTO schedule and tariff actually imposed on imports. This tariff is called 'watery tariff policy' which provides some flexibility to the concerned country to raise tariff within the constraint of bound rate.

The domestic support commitment has been found to be least binding in the WTO arrangement. In most of the developed countries, the share of dairy sector to total support to agriculture sector is about 16 percent in OECD countries and milk is the most protected commodities. Milk receives high level of protection in EU countries, USA and Japan which is given as producer subsidy to the producers. This subsidy rate varies between 9% in New Zealand, 18% in Australia to 80% in Japan, and 48% in EU countries, 58% in Canada, 55% in USA, 78% in Switzerland, 75% in Norway and 62% in OECD countries.

Similarly, export subsidy is provided to the exporters of dairy products and its share is one of the highest in post WTO era. Global expenditure for export subsidy for dairy products accounted for 34% of all export subsidy expenditure in which share of EU countries accounted for 89% of the global expenditure.

5.3 Policy Gaps and anomalies

Among the above policies, the Dairy Development Policy is the most relevant policy relating to the development of dairy sector in the country. The policy is very

comprehensive and encompasses all the major aspects of dairy development. It has major provisions for increasing milk production and productivity in rural areas, making production of milk and dairy products commercial and competitive, dairy product diversification based on the potentiality of internal and external markets for import substitution and export promotion, easy availability of good quality milk and dairy products to the consumers, free market price of milk and dairy products, expansion of dairy processing plants, capacity enhancement of dairy cooperatives and other dairies, various facilities for dairy development, creation of dairy fund, and involvement of all related institution in its implementation. The policy has given important responsibilities to NDDB for its implementation and monitoring. It has directed NDDB to prepare working procedures for its implementation and take initiatives to make required changes in the present legal provision. Accordingly, the policy could only be implemented after the approval of working procedure prepared by NDDB from the MoAD, which was submitted to the ministry since long but has not yet been approved nor has NDDB taken any initiative to get it through. Thus, despite the approval of the dairy policy by the government since last two years, it has not come in to effect. This has remained as the major constraint in policy implementation. Similarly, NDDB is yet to take initiatives for making required amendment of the existing legal provisions.

As per the Act, the activities that NDDB is responsible are vague. Some of its objectives are duplicated with other organizations. For example, objectives like solving the problems of livestock development and animal health and promotion of fodder and pasture are the duplicated program with DLS. Despite the importance given to NDDB from the policy perspective, it could not be implemented because of the weak financial and technical position of NDDB. This is one of the differences that NDDB has with the NDDB, India, which has been supported by the fund from Government of India and successive funding for more than 30 years from the World Bank and EU. From the policy perspective, Government of India has supported NDDB India as an apex institution and it has played a pivotal role in aiding the district cooperative unions in the project formulation and implementation stages all over the country. The Government of India has designated NDDB as the canalizing agency for all dairy imports into the country. NDDB, India at present, is in a sound financial position to run its programs independently and without external support, while the NDDB Nepal is dependent basically on government contribution, which is insufficient to run the programs. Under the present Act, NDDB has an autonomous status and is permitted to make its own staffing rules and fix its own salary levels. However, due to GoN contribution in salary, government rules and regulations practically remain in force, which did not allow any kind of additional allowances and incentives, except prescribed by the GoN. There is no clear vision about creating alternative financial resources for running the Board; and no alternative arrangement has been made to generate additional financial resources for the board. Consequently, the Board is lacking competent technical manpower which is a major constraint for implementing the mandate given by NDDB act and Dairy Development Policy.

Moreover, the board has not given particular thrust to its objectives, one of which, is the collection and management of national database on dairy sector. Availability of accurate

data is important for formulation of any policy or program, which has been lacking so far in dairy sector as well. This situation was clearly reflected by the fact that, the problem of milk holiday, which has consumed so much time and energy of the planners some four years ago has now been reversed to milk deficit situation of about 400,000 litres of fluid milk per day by the establishment of two milk processing plants in the private sector. This figure is also debated and not agreed by all further emphasizing the need for actual data collection and its management for developing the appropriate policies. It clearly reflects the poor strategy on data collection and management and lack of policy to deal with the development of the industry. There is no system of data acquisition and management in the dairy sector, which is essential for policy formulation and planning of the development programs. It is also evident that figures on import and export of dairy commodities need to be obtained from the customs office, where the items are all grouped together. Thus the accurate data on each item is difficult to obtain, which will be essential to analyze the real situation of dairy sector and to recommend for holistic dairy sector development in the country.

The Dairy Development Policy, has not given due recognition and roles to the private sector dairy industries for their promotion. For example: the electricity tariff concession, which has been recommended for the cooperative sector industries has not been considered for private sector dairies. This disparity was also reflected as the private sector industries were not provided with specific roles for the promotion of dairy sector, while the DDC has been given with the mandate of extension of dairy business and quality dairy product diversification. It is well recognized that in the free market economy, the public sector institutions have failed to compete in the market and collapsed gradually. Hence, the policy environment should be to encourage and flourish of private sector dairies and gradual withdrawl of public sector from the dairy business, which will provide level ground for all industries. Instead, the public sector institutions should get involved with regulatory and quality control aspect of the industries, which will make them competitive for business within and outside of the country.

The MPCSs have become one of the major actors in the dairy sector by being a strong channel between the rural milk producers and the milk processing industries. However, majority of the MPCSs are found to be operating in a condition of disarray. The available information shows that the MPCSs have not been able to generate enough capital bases for providing real support to their member milk producers except being an agent between the milk producers and the milk processing industries. Presently, the dairy cooperatives in Nepal are playing a limited role of collection and selling of raw milk to either DDC or private dairies. Neither the DoC nor other related institutions have taken any initiation to regularly monitor the performance of the MPCSs and suggest measures to make them more professional and commercially oriented. Similarly, NCDB has not been effective in promoting and providing technical support for MPCSs except for providing some occasional financial support to CDCAN when requested.

DDC is engaged in commercial activities of collecting milk from rural areas, processing it to milk and milk products and distributing them to urban consumers. It is also the leading agency of fixing the price of milk and milk products. The main problem facing

DDC is the shortage of good quality raw milk whereas demand for its milk and milk products in the urban areas is increasing. In an effort to fulfilling the increasing demand for milk and milk products, DDC has expanded its milk collection network in distant rural areas. However, DDC is not engaged in executing neither milk production programs by providing technical or financial supports to the rural milk producers nor milk quality improvement programs in its milk shed areas except some newly introduced program in some pockets, which was implemented as Gai-Mai Programme, in which a milking cow was given to women household in a subsidized rate on installment basis in the selected milk production pockets of DDC. In some areas, DDC has provided AI and feed transport cost to the dairy farmers as an support incentive. Similarly, the private dairies are also involved only in collection, processing and marketing of milk and milk products without any support program for the producer farmers, which is not in line of AMUL pattern of dairy development as aimed during its inception phase.

NDDB has been given the mandate for overall dairy development in the country, however, it has not been able to achieve its objective due to some major problems regarding composition of its EC, financial constraints and weak staff position. As the Minister of MoAD is the chairperson of the EC, difficulties have been experienced to conduct the EC meetings due to the frequent changes of Government/Ministers resulting in difficulties to give continuity of NDDB's activities. Secondly, the Board is financially constrained. The government contribution to the Board is very limited to implement the program of the board. Finally, a weak staff position of the NDDB has constrained the effective implementation of the program. In order to be in a position to assume the responsibilities according to its mandate, NDDB needs adequate staff with professional technical background and be able to retain the staff with required incentives, which has not become possible due to the government regulations, except allowed by the government. Consequently, the Board is lacking competent technical manpower and it is technically weak to deliver its duties effectively.

NDDB is also mandated by the Act to formulate and recommend pricing policy to the government, which is in contrast of the Dairy Development Policy, which advocates for free market policy to fix the price of milk and milk products. But in practice, being the leading government institution, the DDC is the main actor in fixing the raw milk price, which is being followed by the private dairies as well. Price of milk has remained a sensitive issue among the producer farmers and the buyers (i.e. DDC and the private dairies) due to which marketing of milk has occasionally been constrained. The milk producers seek to overcome this problem through their collective action to be assured of secure market is their real need. The DDC’s raw milk pricing is mainly based on the negotiations with the rural milk producers. The same system
applies for pricing of raw milk by the private dairies. However, the private dairies pay some additional price so as to remain in competition for milk collection. Although the private dairies also follow the same price for the processed milk as fixed by DDC, DDC and private dairies set their own price for other milk products. Thus, the pricing of milk and milk products is characterized by conflicting Act and Policy; absence of an established pricing mechanism in terms of basis of pricing and pricing intervals; and involvement of many actors, but without any clarity on their roles.

Although all the institutions involved in dairy sector have the mandate for the production of good quality milk and milk products, there has been little attempt to improve the quality of milk and milk products. In fact, very little attention has been given for improving the quality of milk and regulate the quality standards on milk and milk products. There has been no program for good agricultural practices (GAP) for milk production and maintaining the quality standards in the processing industries according to the good manufacturing practices (GMP). This program should start from the farm itself as milk produced from a healthy animal would contain very little bacterial population and it gets contaminated during subsequent handling processes. One reason for the high bacterial load in raw milk is unhygienic practices in milk production, handling and transport along with the malpractices of adulteration. The other reason is that the milk travels fairly long hours, especially in the hills, before it reaches for processing; either chilling or pasteurizing that checks bacterial growth. In the Terai areas, when the contamination in milk is high, the higher ambient temperature triggers the multiplication of bacterial population. Accepting milk of any standard due to competition among buyers has led milk quality to deteriorate. Since the quality of raw milk is not up to the mark, the resulting processed products are also of not high quality. All these problems necessitate the introduction of quality control in milk and milk products and pricing of milk on quality standards as quality philosophy is considered as the password to the market and maintaining quality, as in other products, is considered as an indispensable attributes of the milk and milk products too.

Most of the dairies have neither laboratory manual nor company standards of milk and milk products. Although there is GoN approved Code of Practice (CoP) for Dairy Industries, it has remained unimplemented by the dairy industries nor the committee constituted for monitoring. The implementation status of the CoP has been active and functioning. Consequently, the quality of milk starts gradually deteriorating from source (farmer level) due to unhygienic animal keeping and milking practices, adulteration of water and other substances, use of inappropriate and contaminated milk vessels and open transportation. In addition, lack of cleanliness, use of contaminated water, absence of strict quality control system and use of uncertain quality packing materials in the dairy industries, and use of dirty milk crates, inappropriate transportation of processed milk and its disorganized selling (such as in footpaths) further deteriorate milk quality. System to take action against the defaulters is another critical issue in maintaining the quality of milk and NDDB should have been more active in enforcing the CoP and regularly monitoring the dairy industries.

5.4 Reforms Required:

The following are the reforms required in the policy sector of Dairy development, which need to be addressed:

1. **Implementation of Dairy Development Policy**:

   The dairy development policy could only be implemented after the approval of working procedure prepared by NDDB by the MoAD. Though, the working procedure was

submitted to the ministry much earlier, it has not yet been approved by the ministry, nor has NDDB taken any initiative to get it through. Thus, the implementation of Dairy development policy is in limbo, despite the approval by the government since last two years. Hence, it should be the first priority of NDDB to get the approval of working procedure of Dairy Development Policy, from the ministry of Agriculture development and implement the policy. There are however, some reforms/modifications required in the policy itself to avoid duplication of efforts between the organizations.

2. **Defining and streamlining the objectives of various organizations involved in dairy sector development and avoid duplication**:

As per the dairy development policy two objectives set for NDDB are to find the solutions to the problems in dairy development and dairy health and make arrangements for fodder and pasture resources. These objectives are the major mandated work of Department of Livestock Services and NARC, who are equipped with qualified human resources, field coverage of the activities through farms/stations and district offices, research and diagnostic laboratories, vaccine production and supply system. Thus NDDB should drop these objectives are concentrate on collection, processing, value addition and marketing of milk and milk products and act as a linkage between the rural producer and urban consumer for wholesome milk and milk products and flow of cash from urban consumers to rural economy.

3. **Promotion of quality standards of milk and milk products**:

In the open market economy and under the WTO arrangement, the quality aspect has been given the important most consideration for national and international business. Milk and milk products are one of the important most items which require high level of attention for maintaining its quality. In the milk food chain, the quality perspective begins with the milking animals at the barn and continues up to the consumers table and quality maintenance becomes the responsibility of many institutions. In this context, the role of NBBD should be from collection centres to the processing industries, as the quality maintenance at the barn and of the animals lies with the DLS/NARC and quality regulation of food items including the dairy products remains with DFTQC.

One of the important mechanisms to regulate quality milk production is to introduce the quality based milk pricing system. As one of the objectives of NDDB is to promote dairy industries in the country, the quality regulation of these industries is important to maintain the quality standards of the processing procedure, so that wholesome products could be delivered to the consumers. Regular quality checkups and certification of milk and milk product processing industries from a certified independent agencies should be mandatory for improving the quality standards of international standards, which will be necessary to remain competitive in the world trade environment. The proposed Dairy development policy has not given required importance to quality maintenance aspect of milk and milk products and these aspects should be

incorporated in the policy and working procedure. The area of demarcation between different organizations responsible for milk production, processing and marketing should clearly be defined for maintenance of quality.

4. **Updated statistics on national and international dairy situation**:

To compete in the WTO environment, it is important that the country should have an effective market intelligence system to monitor development in the world market in price, subsidy levels, demand and supply situation and link import tariff to world prices (variable tariff within bound rates of duties) and make delivery of inputs and services more effective and efficient to improve productivity of animals. However, in our context, we do not have any mechanism or system which is responsible for maintaining and updating the national data on dairy animals, production, marketing and consumption patterns and future needs. These figures are important for the required reforms in the policies and national strategies. NDDB, being mandated as the national body to develop dairy policy, should have the up to date on national and international scenario, so that policy reforms could be suggested to the government according to the changing situation. It is thus important that NDDB should initiate to develop national data bank on dairy sector and update it regularly. It could be initiated through the data from MPCS and later broadened to other areas. It should also have information collection system for the import export of dairy products and have influence on importing these items. In addition, NDDB should be able to gather market information to monitor the market system of major dairy producing countries and particularly the immediate neighbors. A data bank on dairy sector with its regular updating mechanism would be of considerable asset for checking on current situation and carrying out policy reforms if required.

5. **Milk pricing and free market policy**:

NDDB is also mandated by the Act to formulate and recommend pricing policy to the government, though it is being done in practice by DDC. Change in price by DDC also regulates the private dairies and thus nationally. Pricing of milk is in contrast to the Dairy Development Policy, which advocates for free market policy to fix the price of milk and milk products. Although, in the free market economy, pricing of agricultural commodities will be governed by the market, yet almost all countries (especially the developed countries) have adopted some strategic approaches (tariff structure, production incentives, input and export subsidies etc) to protect their national agricultural system including dairies. In a country like Nepal, sandwiched between two giant economies with highly facilitated and supported dairy production and marketing system and almost open porous borders with its southern neighbor, maintaining the dairy industry competitive would be impossible without some measures. Hence, approaches should be taken to improve production efficiency of the animals through input and service support, facilitating the industries to processing and marketing the wholesome milk and milk products and pricing based on authentic studies and data carried out by independent mechanism. The pricing system should be competitive to the international level especially to the immediate neighbors to avoid smuggling of goods and products along the border, which otherwise will compromise all efforts of price regulation. It must also be realized that national dairy industry is comprised basically of small holder producers having one or two milking animals with the family economy almost entirely dependent on milk and dairy product sale. Hence, not only the economic parameters but also the

socioeconomic parameters should need to be taken in to account while developing dairy pricing policy.

6. **Promotion of private sector industries in dairy business**:

The broader policy framework for livestock component in APP include enhancement of the private sector with realization that livestock sector is a private sector and livestock policy should be guided by this realization; and public sector should be only complementary to support the private sector. It is well recognized that in the free market economy, the public sector institutions have failed to compete in the market and collapsed gradually. Hence, the policy environment should be to encourage and flourish of private sector dairies and gradual withdrawl of public sector from the dairy business, which will provide level ground for all industries. Constructively engaging the private sector early in the process through the provision of attractive financial incentives, such as tax rebates and cost-sharing arrangements, is crucial for ensuring the development of the sector. Government should be aware of the private sector's role in addressing many of the problems affecting efficiencies of dairy chains. Supportive private services include targeted extension, animal health, AI services, the facilitation of chain-based financing/credit guarantee schemes, the establishment of traceability and quality assurance services, etc.

7. **Strengthening of existing MPCU and extension of MPCUs in new areas**:

NDDB should strengthen its linkage and coordination with the milk producer's cooperative unions scattered throughout the country to increase their managerial efficiency and manage them on commercial lines and corporatization which will enable the cooperatives to compete efficiently in the open market environment. NDDB should also promote the extension of these cooperative along the new areas with blacktop road, which are as yet not included in the milk collection grids of the processing industries and facilitate the establishment of processing industries in such locations. As the consumer population is mostly concentrated in the Kathmandu valley and the distance of fluid milk transport will be prohibitive, the establishment of milk powder plants in such locations would be more suitable. These industries located in the distant location should get additional incentives and facilities from the government sector for their establishment and operation.

8. Strengthening institutional economic status of NDDB using its autonomy:

NDDB should capitalize its autonomy status to generate additional funding support for the organization from the national and international agencies/donors, which will strengthen its economic and operational capacity in the country. It could be achieved through the development of programs and projects related to dairy development and poverty alleviation. As a mandated institution, it should be easier for NDDB to get the funding support from the international donors, because the dairy animals reared by most of the common mass in the rural area could be used as a vehicle for poverty alleviation of this population. The success of NDDB, India to transfer the urban cash to rural economy has been regarded as a classical example of success by most of the development agencies.

It was however, possible because of the long term support of The World Bank, EU and strong commitment from Indian Government for the success of the program. In Nepal, NDDB lacks initiative to embark on these efforts, which in turn is capitalized by non-government sector. Hence, NDDB should develop programs/projects which could be floated for funding support from the international donors and implement the program for the promotion of dairy sector.

9. **Promotion of National dairy in the WTO context**:

Despite the WTO arrangement, dairy sector is still the protected sector in most of the countries through imposition of high import tariffs, large export subsidies and domestic support to dairy producers. Most of the countries have protected their dairy sector from being the dumping ground of cheap dairy products from abroad, because, dairy sector is not only a production sector but also an employment generation sector. A study in Kenya showed that 1000 liters of milk produced creates 23 self employed full time jobs, 50 permanent full time jobs and 3 full time casual labors in addition to the 77 direct farm jobs and 13 full time jobs in processing industry. With the value addition in the milk and milk products, the multiplicity of the job creation increases. Hence, under the Nepalese situation, the dairy sector also needs some strategic policy support to survive in the WTO environment as the production efficiency of our dairy sector could not compete with the better facilitated dairy production system of developed or neighboring countries. Hence, the strategic policy need to be developed involving the expert on trade, WTO, livestock sector and dairy business to safeguard the national dairy production, which will benefit a large population involved in dairying. As the hill and mountainous terrain with limited infrastructure development limits the support and inputs to farmers making them less competitive to the rest of the world, the production of niche specific commodities with some specific attributes might be more suited to their conditions. As Nepalese dairy production system is still traditional with no exposure to modern antibiotics and chemicals, some specific products like Ghee, Yak cheese, Chhurpi, Paneer could be branded and marketed as specific Himalayan dairy products. These products could further be promoted as organic products if certification system for the products could be obtained, which will provide some leverage to our farmers in the highly competitive international trade.

CHAPTER 6: RECOMMENDED STRATEGIES for MILK MARKETING

6.1 Increasing Production and Productivity and Consumption

The per capita availability and consumption of milk and milk products in the country is far below the recommendation made by WHO/FAO (250 g/day). Further the country is still not self sufficient in producing milk to meet the current demand and is annually importing dairy products worth 1 billion rupees from formal route from around the globe and unaccounted amount from informal channel despite having high livestock population (more than 12 million large ruminants). This has been the effect of extreamly poor animal performance due to poor genetic potential, inadeqtae and improper feeding and health management, inapropriate breeding system and overall poor herd management. This low producivity level of dairy animals is one of the main reasons behind high cost of milk production in the country. Higer cost of production and higher consumers price in one hand and low income level of the majorities of Nepalese on the other is root cause for low level of consuption of dairy products. Properly addressing these primary issues are of immediate concern for developing appropraite milk and milk products marketing strategies in the country. Integrated breeding, feeding and health care management of dairy animals with minimum adverse impact on the environment and human health should be given top priority to increase productivity of dairy animals and milk production in the country. Following actions need to be taken by the concerned stakeholders (NARC, DLS, NDDB, Private dairies and their associations and farmers and their cooperatives):

- Genetic improvement programme for dairy cattle and buffaloes being undertaken in 24 districts jointly by NARC and DLS should be continued and further strengthened.
- There should be massive cross breeding programme for native cattle (except in those Achhami and Lulu cattle which are not recommended by Livestock Breeding Policy) with exotic (Jersey and HF) cattle breeds for increasing the number of high producing dairy animals and milk production in the country.
- Selective breeding among native buffaloes in potential pockets should be initiated as well as upgrading poor performers with exotic Murrah breed be continued.
- Suitable level of exotic blood (Jersey, HF and others) at different agro ecological zone and at different management system need to be recommended for better adaptability and profitablity to the farmers.

- Importation of sexed semen for the time being is recommended to address fluid milk deficiency situation in the country. NDDB can assist through its programme for this activity or public private parternship could be emphasized.
- Feeding standard and strategies for dairy animals should be developed and implemented to reduce cost of production with optimum productivity. Focus should be given to fodder based production system for reducing cost of milk production and making milk more affordable to the consumers.
- Animal Health care system be developed in such a way that smallholder and needy farmers get technical services more easily with affordability. Community/ cooperative animal health model could be initiated in well established cooperatives.
- Disease prevention programme (vaccination) should be strictly implemented with public private partnership.

To increase consumption, mass campaigning, school milk feeding programme, product diversification and market launch, packaging in suttaible and affordable size are some of the strategies that need to be followed on.

6.2 Measures to improve milk quality

Ensuring quality of milk and milk products is of prime importance for safeguarding the health and satisfying the taste of general consumers. Right from producction point to the various points at processing and retailing (dairy value chain), the recommended practices (CoP and GMP) need to be strictly implemented. Rampage use of antibiotics and not adharing to the withhelding period has shown great deal of antibiotic residues in milk. Recent revelaing of adulteration of non cosumable items and poor hyegenic conditions in many dairies and sweet shops have raised great concerned among consumers and that will have far reaching consequences for the well being of the whole dairy sector in the country. The sporadic test of milk samples collecting at farmers premises and also in the collection centres and dairy processing industries has revealed that the bacterial load was many times more than permited. In these context, NDDB in close collaboration with other concerned stakeholders has to initiate for facilitating and regulating the CoP and GMP in dairy value chain.

- Farmers need to be sensitised regularly in adopting CoP and trained for adopting hyegenic milk production at farm level and during delivery.

- Payment should also be based on the bacteriological quality (Bulk Somatic Cell Count) of the milk delivered so that farmers are compelled to adopt hyegenic production practices. Premium prices for quality products also encourages them to strictly adopt such practices.
- Evening milk collection has to be promoted. Farmers use to add sodium bicarbonate as preservative in evening milk so that they can deliver it to chilling/ collection centre next morning. The practice of higher price paid based on TS for milk delivered during evening is good practice, but further chilling facilities have to be strengthened.
- Processing industries must also be regualrly monitored for checking adoption of GMP in the processing plants. Prosecution for defaulters should be in place.

6.3 Reducing Cost of Milk Production

Reducing cost of production through adoption of all possible and available options should be prioritized for the sustenance and flourishing of dairy sector in the country. For most dairy farms the most effective means of lifting profitability is still to raise milk yield per cow in order to raise output and reduce unit costs of production. If yield per cow is increased without raising total fixed costs, fixed costs per litre are reduced and overall profit from the herd can usually be increased without increasing cow numbers. Other strategies include adjusting feeding management, preventing and control measures for economically important diseases and herd health improvement, addressing dairy animal infertility problems for reducing the cost of production from dairy animals.

6.4 Linking Milk to Market

Relatively small faraction (about 15%) of the total milk produced in the country enters in the formal milk market. This has been the effect of poor infrastructure (road network), terrain of the country and scattered production, not evenly distributed processing centres particularly in mid and far west associated with demands for milk and milk products being high in only large cities and past taboos of the farmers in far west. However, by now most of the districts are now linked with road network, attitutdes of farmers and feeding habits of consumers are changing, demand for milk and milk products is increasing with faster rate of urbanization and also due to population and income level increase. Consequently the demand for milk and milk products in the country is not being fulfilled by national production and dairy products worth nearly more than 1 billion rupees is being imported in the country. Absoulte increse in the population of dairy animals in the country wouldn’t be

sustainable thus linking market in the production areas would be necessary for bringing more milk into the formal sector. Programme for increasing productivity in these areas would be necessary such that farmers would be encouraged to sell extra milk in the availbale market. Developing these areas into dairy pocket and exploring possibility of establsihing processing factories that produces products such as SMP, Cheese, Butter etc and bringing them into areas with more demand making transportation more economical.

6.5 Dairy Sector Policy Reform

The Dairy Development Policy with the suggested ammendmend in the previous chapter need to be effectively implemented. Also consideration should be made for overall dairy sector development in the face of federelization of the country in the future. The policy should also bring some sort of protection to national dairy sector and programme should be made for making the sector more competitive so that the sector sustain in the face of global competition. The policy should also addressed the following issues:

- Effective and acceptable means for disposal of unproductive animals particularly cattle (old, diseased with zoonotic significance, infertile etc)
- Making dairy sector as necessary service sector to ensure transportation free from any hassle in all circumstance.
- Role and responsibilities of NDDB and other service providers in federal system
- Measures to protect national dairy industries (production farms to processing industries) in global challenges including Subsidy and Pricing Support.

6.5 Dairy Marketing Research and NDDB

Information is required at all levels in the marketing channel. Before one decides to process and market any dairy product, it is important to know the potential market for each particular product. This is important to enable the processor to know which types and when, where and how much of each product to manufacture and market. It is very crucial because unless goods can be supplied in the right form, place and times, consumers may not be able to buy. This then requires securing and utilising market information.

Marketing information should address the following:

- Area to be covered

- Price information (Price variations, price for premium quality discount price etc.)
- Number and type of consumers (market segmentation)
- Current and future product supply levels
- Type and number of competitors

NDDB should be strongly involved in marketing research. The database should be maintained by NDDB and regularly updated such that proper marketing strategies are developed through analyzing the trends in the market. Coordination with dairy industries (DDC and private), District Milk Producers Cooperative Unions and CDCAN would be essential for gathering these information.

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Annexes

Annex 1: List of Farmers Contacted/ Interviewed

SN	Name of Farmers	Address
1	Bishnu Dhakal	Mukundapur 7, Nawalparasi
2	Padam Dhakal	Mukundapur 6, Nawalparasi
3	Surendra Thakur	Mukundapur 5, Nawalparasi
4	Bed Prakash Dhakal	Mukundapur 6, Nawalparasi
5	Shiva Prasad Kandel	Mukundapur 5, Nawalparasi
6	Tikaram Kharel	Mukundapur 7, Nawalparasi
7	Dadhiram Subedi	Mukundapur 6, Nawalparasi
8	Shalikram Sapkota	Mukundapur 6, Nawalparasi
9	Gokul Subedi	Mukundapur 6, Nawalparasi
10	Dilliram Regmi	Mukundapur 6, Nawalparasi
11	Balkrishna Bhandari	Mukundapur 5, Nawalparasi
12	Haribhakta Neupane	Mukundapur 7, Nawalparasi
13	Ek Raj Regmi	Mukundapur 7, Nawalparasi
14	Chandrakanta Lamichane	Mukundapur 6, Nawalparasi
15	Gopal Shrestha	Mukundapur 5, Nawalparasi
16	Nirmal Neupane	Mukundapur 7, Nawalparasi
17	Hom Nath Kandel	Mukundapur 5, Nawalparasi
18	Chet Narayan Ghimire	Mukundapur 6, Nawalparasi
19	Ghangadhar Sapkota	Mukundapur 7, Nawalparasi
20	Saligram Kandel	Mukundapur 7, Nawalparasi
21	Ghanashyam Regmi	Mukundapur 6, Nawalparasi

1	Bhim Prasad Paudel	Geetanagar 6, Chitwan
2	Yam Nath Sharma	Geetanagar 6, Chitwan
3	Bishnu Timilsina	Patihani 7, Chitwan
4	Purnananda Bhusal	Chainpur 1, Chitwan
5	Devi Prasad Dhungana	Geetanagar 4, Chitwan
6	Rameswor Ghimire	Pithuwa 7, Chitwan
7	Bishnu P Ghimire	Pithuwa 7, Chitwan
8	Chabilal Adhikari	Geetanagar 4, Chitwan
9	Jagat Bahadur Bhandari	Geetanagar 6, Chitwan
10	Bhagirath Timilsina	Geetanagar 6, Chitwan
11	Ganga Timilsina	Geetanagar 6, Chitwan

12	Dayaram Lamichhane	Pithuwa 7, Chitwan
13	Bishnu P Paudel	Ratnanagar 5, Chitwan
14	Tilak Raj Paudel	Ratnanagar 5, Chitwan
15	Loknath Paudel	Ratnanagar 5, Chitwan
16	Meghnath Paudel	Ratnanagar 5, Chitwan
17	Gyanprasad Paudel	Ratananagar 5, Chitwan
18	Chudamani Paudel	Geetanagar 6, Chitwan
19	Dandapani Timilsina	Geetanagar 6, Chitwan
20	Geetaram Timilsina	Geetanagar 6, Chitwan
21	Kaushila Lamichhane	Pithuwa 7, Chitwan

1	Bishal Koirala	Tintolia 13, Morang
2	Prem Prakash Upreti	Biratnagar 14, morang
3	Birat Sharma	Biratnagar 15, Morang
4	Renu Ghimire	Inruwa 3, Sunsari
5	Damodar Koirala	Inruwa 3, Sunsari
6	Sujana Raja Kharel	Kathari, Morang
7	Hem Raj Basnet	Biratnagar, Morang
8	Sundar Khadka	Biratnagar, Morang
9	Binod Adhikari	Biratnagar, Morang
10	Lilu Poudel	Biratnagar, Morang
11	Gyanendra Ghimire	Biratnagar, Morang
12	Bir Bahadur Karki	Biratnagar, Morang
13	Ambar Bahadur Katuwal	Biratnagar, Morang
14	National Cattle	Kathari, Morang
15	Indra Mohan Thakur	Biratnagar, Morang
16	Din Dayal Yadav	Biratnagar, Morang

SN	Name of Farmers	Address
1	Bishnu P Bhandari	Bharatpokhari 3, Kaski
2	Khadka B Baniya	Bharatpokhari 4, Kaski
3	Padam Prasad Adhikari	Lekhnath 1, Kaski
4	Parashuram Poudel	Lekhnath 12, Kaski
5	Prakash Tiwari	Lekhnath 12, Kaski
6	Kamal Bhandari	Lekhnath 12, Kaski
7	Saraju Adhikari	Lekhnath 8, Kaski

8	Chudamani Baral	Lekhnath 12, Kaski
9	Khemnath Bhandari	Lekhnath 8, Kaski
10	Kamal Bastola	Lekhnath 1, Kaski
11	Taranath Gautam	Lekhnath 1, Kaski
12	Ganesh Baniya	Bharatpokhari 2, Kaski
13	Humbahadur Baniya	Bharatpokhari 2, Kaski
14	Ravi Prasad Kandel	Bharatpokharii 3, Kaski
15	Muktinath Acharya	Bharatpokhari 3, Kaski
16	Surya P Adhikari	Bharatpokhari 3, Kaski
17	Madhav Baral	Lekhnath 12, Kaski
18	Ghanshyam Kamar	Lekhnath 12, Kaski
19	Baburam Dhakal	Lekhnath 8, Kaski
20	Meghnath Subedi	Lekhnath 8, Kaski
21	Krishna Subedi	Lekhnath 8, Kaski
22	Biswanath Bhandari	Lekhnath 12, Kaski
23	Khem Narayan Dhakal	Bharatpokhari 2, Kaski
24	Chudamani Paudel	Bharatpokhari 2, Kaski
25	Biseswor Harami	Bharatpokhari 3, Kaski
26	Swatantra Raj Pahadi	Bharatpokhari 3, Kaski
27	Humnath Paudel	Bharatpokhari 3, Kaski
28	Sabitri Adhikari	Bharatpokhari 3, Kaski
29	Chandra Prakash Paudel	Bharatpokhari 3, Kaski
30	Prem Prakash Acharya	Bharatpokhari 3, Kaski

1	Sanu Rana Magar	Matikhel 2, Kathmandu
2	Shiva B Ale Magar	Matikhel 2, Kathmandu
3	Bidhyabasini	Satungal, Kathmandu
4	Pathik Foundation	Satungal 5, Kathmandu
5	Gopi Thapa	Matatirth 1, Kathmandu
6	Chandramani Bhusal	Mahadevsthan 4, Kathmandu
7	Arjun Bajgain	Khumaltar 15, Lalitpur
8	Hari P Acharya	Khumaltar 15, Lalitpur
9	Min Prasad Ghimire	Khumaltar 15, Lalitpur
10	Krishna P Dahal	Khumaltar 15, Lalitpur
11	Kamal P Bajhgain	Khumaltar 15, Lalitpur
12	Bhagbati Ghimire	Khumaltar 15, Lalitpur

13	Mukunda Ghimire	Khumaltar 15, Lalitpur

1	Durga Prasad Neopane	Pragatibazar-1, Devdaha
2	Prakash Aryal	Koluwa-1, Devdaha
3	Giri Prasad Pandey	Gurungtol-1, Devdaha
4	Narayan Poudel	Mitri Tola-2, Devdaha
5	Padam raj Poudel	Mitri Tola-2, Devdaha
6	Durga Dhungana	Mitri Tola-2, Devdaha
7	Min Prasad Dhungana	Mitri Tola-2, Devdaha
8	Sandeep Dhungana	Miteritole-2, Devdaha
9	Jiva Prasad Bhandari	Miteritole-2, Devdaha
10	Umanath Lamichhane	Khireni-2, Devdaha
11	Arjun Chapagain	Pipaldanda-3, Devdaha
12	Krishna Dhungana	Miteritole-3, Devdaha
13	Laxmi Poudel	Pipaldanda-3, Devdaha
14	Shovakhar Acharya	Miteritol-3, Devdaha
15	Pheku Prasad Tharu	Pipaldanda-3, Devdaha
16	Bishnu Gyanwali	Sunkauda-4, Devdaha
17	Shiva Chapagain	Jogikuti-3, Shankarnagar
18	Narayan Chapagain	Jogikuti-3, Shankarnagar
19	Krishna Poudel	Jogikuti-3, Shankarnagar
20	Bhoj Raj Poudel	Jogikuti-3, Shankarnagar
21	Narayan Poudel	Jogikuti-3, Shankarnagar
22	Indra Prasad Poudel	Jogikuti-3, Shankarnagar
23	Resham Baral	Jogikuti-3, Shankarnagar
24	Lal Bahadur Dhungana	Jogikuti-3, Shankarnagar
25	Sabitri Pandey	Shantikunj-3, Shankarnagar
26	Ishwar Chapagain	Janakinagar-3, Shankarnagar
27	Kaladhar Chapagain	Janakinagar-3, Shankarnagar
28	Chitra Kafle	Tapaha-3, Shankarnagar
29	Bhim Prasad Poudel	Janakinagar-3, Shankarnagar
30	Tul Bahadur Rana	Janakinagar 3, Shankarnagar

1	Tikaram Luitel	Illam N.P.-2
2	Ganga Dahal	Illam N.P.-3
3	Sunita Adhikari	Illam N.P.-3
4	Ambika Chauhan	Illam N.P.-3
5	Shiva Gautam	Illam N.P.-3
6	Dhan Bahadur Neupane	Illam N.P.-3

7	Rohini Ghimire	Illam N.P.-3
8	Narendra Bh. Neupane	Illam N.P.-3
9	Indra Bahadur Thapa	Illam N.P.-3
10	Umaram Prasai	Illam N.P.-3
11	Dhan Bahadur Khadka	Barbote-3, Phikkalbazar
12	Geeta Timilsina	Gairigaun-3, Phikkalbazar
13	Muktinath Timilsina	Gairigaun-3, Phikkalbazar
14	Rom Nath Dhungana	Gairigaun-3, Phikkalbazar
15	Tika Parsad Dhungana	Gairigaun-3, Phikkalbazar
16	Mohan Dhungana	Gairigaun-3, Phikkalbazar
17	Dittha Khadka	Barbote-3, Phikkalbazar
18	Ganesh Khadka	Barbote-3, Phikkalbazar
19	Chandra Bahadur Thapa	Barbote-3, Phikkalbazar
20	Kishan Tamang	Barbote, Phikkalbazar

1	Kaisang Tamang	Yarsa-5, Rasuwa
2	Gupti Thing	Ramche-8, Rasuwa
3	Kami Tamang	Chilime-9, Rasuwa
4	Dhubba Tamang	Yarsa-9, Rasuwa
5	Vugung Tamang	Syaphru-3, Rasuwa
6	Lwang Tamang	Dhunche-3, Rasuwa
7	Kyarsyan Tamang	Syaphru-7, Rasuwa
8	Wang Dhingi Tamang	Ramche-3, Rasuwa
9	Pasang Tamang	Ramche-3, Rasuwa
10	Damai Tamang	Chilime-8, Rasuwa
11	Tashi Dhorge Tamag	Chilime-8, Rasuwa
12	Wangdhi Gwalbo Tamag	Syaphru-3, Rasuwa
13	Senam Wangdi Tamang	Chilime-7, Rasuwa
14	Man Bahadur Tharkel	Yarsha-5, Rasuwa
15	Layul Tamang	Yarsa-5, Rasuwa
16	Pasang Dindup Tamag	Syaphru-7, Rasuwa

1	Kamal K C	Narayanpur 6, Dang
2	Mohan Ghimire	Narayanpur 6, Dang
3	Sworgadwari Ashram	Chilahi 9, Dang
4	Shobhakar Bhusal	Lalmatia 7, Dang

5	Durga Thapa	Narayanpur 8, Dang

1	Dipendra Karki	Latikoili-8, Surkhet
2	Chudamani Dhakal	Satakhani, Surkhet
3	Umesh Ku. Paudel	Dasharathpur, Surkhet

Annex 2 Milk Producers Cooperative Visited

SN	Name of MPCs	Address	Last year Milk Collection (lit)
1	Panchyan Dugdha Utpadak Sahakari Sanstha	Pithuwa 7, Chitwan	413985
2	Chanauli Dugdha Utpadak Sahakari Sanstha	Chanauli, Chitwan	319238
3	Annapurna Dugdha Sahakari Sanstha	Geetanagar 6, Chitwan	1160843
4	Janaki Dugdha Utpadak Sahakari Sanstha	Chainpur 1, Chitwan	887415
5	Kamdhenu Dugdha Utpadak Sahakari Sanstha	Chainpur 2, Chitwan	254263
6	Amarapuri Bahuudesiya Sahakari Sanstha	Amarapuri 5, Nawalparasi	480391
7	Mukundasen Dugdha Utpadak Sahakari Sanstha	Mukundapur 4, Nawalparasi	1226859
8	Nawajyoti Dugdha Utpadak Sahakari Sanstha	Mukundapur 5, Nawalparasi	1922060
9	Saraswati Dugdha Sahakari Sanstha	Bhaktapur	191000
10	Machhenarayan Dugdha Sahakari Sanstha	Bhaktapur	184000
11	Lokeswor Dugdha Sahakari Sanstha	Bhaktapur	49275
12	Gaukureswor Dugdha Sahakari Sanstha	Bhaktapur	387000
13	Jageswari Dugdha Sahakari Sanstha	Bhaktapur	360000
14	Bahuudhhesiya Sahakari	Thaibung, Rasuwa	47000

	Sastha(Hamro rasuwa dairy),		
15	Chorgadi Dugda Utpadak Sahakari Sanstha	Bharatpokhari, 3 Kaski	116000
16	Naubise Dugdha Utpadak Sahakari Sanstha	Lekhnath 1, Kaski	255000
17	Harabhara Dugdha Utpadak Sahakari Sanstha	Bharatpokhari, Kaski	108000
18	Jagat Kalya Dugdha Utpadak Sahakari Sanstha	Lekhnath 12, Kaski	100000
19	Bhagabati Dugda Utpadak Sahakari Sanstha	Inaruwa	18000
20	Devdaha Dugda Sahakari Sanstha	Devdaha, Rupandehi	900000
21	Kamdhenu Dughda Bikas Sahakari Sanstha Ltd.	Hasnposa, Sunsari	2028804
22	Aarubote Dugdha Sahakari Sanstha	Phikkal 7, Ilam	97400
23	Suryodaya Janakalayn Dugdha Utpadak Sahakari Sanstha	Phikkal 5, Ilam	53350

Annex 3: Information on Milk Producers' Cooperatives of Kailali district

SN	Name of cooperatives	Address	Estd year	Beneficiery HH	Annaul milk volume (kg)	Annual transaction (Rs)	Other than milk activity-feed/savings/milk products-yes/no
1	New Road Ghoda Ghodi Dugdha Cooperative	Darakh-4	2067.3.19	700	180000 Kg	2000000.00	Yes
2	Kailali Dugdha Bikash Cooperative	Geta-4	2066.2.4	70	108000 Kg	127950.00	Yes
3	Dugdha Bikash Cooperative	Baliya-8	2067.5.18	25	216000 Kg	811954.00	Yes
4	Malika Bikash Cooperative	Baliya-8	2067.5.18	39	NA	11750.00	Yes
5	Shuvalaxmi Dugdha Utpadan Cooperative	Dhangadhi Muncipality-1	2067.5.30	28	NA	00.00	-

6	Shrijanshil Dugdha Utpadan Cooperative	Khailad-5	2067.6.09	27	NA	6146.00	Yes
7	Rara Dugdha UtapadanCooperative	Chauamala-7	2067.8.9	26	NA	295225.00	Yes
8	Laxmi Krish Duggdha Utapadan Cooperative	Chaumala-3	2067.8.17	38	NA	500.00	Yes
9	Mahila krishak Dugdha Utapadan Cooperative	Phulabari-4	2067.8.21	56	36000 Kg	158735.00	Yes
10	Noteshwory Dugdha Utpadan Cooperative	Chaumala-3	2067.8.23	40	NA	500.00	Yes
11	Goladevi Dugdha Utpadan Cooperative	Shreepur-6	2067.9.5	31	NA	00.00	-
12	Naw Durgha Dugdha Utapadan Cooperative	Chaumala-9	2067.9.11	63	NA	00.00	-
13	Rajipur MahilaKrisha Dugdha Utpadan Cooperative	Chaumala-7	2067.9.11	52	90000 Kg	00.00	-
14	Panchawati Dugdha Utpadan Cooperative	Masuriya-8	2067.9.13	52	18000 kg	26331.00	Yes
15	Chandeshwori Dugdha Utpadan cooperative	Shreepur-4	2067.8.19	122	93600 Kg	5480.00	Yes
16	Shaileshwori Dugdha Utpadan Cooperative	Chaumala-8	2067.9.18	30	NA	00.00	-
17	Bhairavha Krisha Dugdha Utpadan Cooperative	Masuriya-4	2067.9.18	31	21600 Kg	20268.00	Yes
18	Kanchan Krisha Dugdha Utpadan Cooperative	Masuriya-7	2067.10.11	26	32400 kg	25706.60	Yes
19	Chaumala Krisha Dugdha UtpadanCooperative	Chaumala-2	2067.10.12	171	NA	00.00	Yes

NA: Not available

Source: District Cooperative Office, Kailali

Annex 4: Information on Milk Producers' Cooperative in Dang District

SN	Name of cooperatives	Address	Estd year	Beneficiery HH	Annaul milk volume (kg)	Annual transaction (Rs)	Other than milk activity- feed/savings/milk products- yes/no
1	Kisan Dugda Uppadak Sahakari Sanstha	Sonpur 8	2062	100	50,000	15,00000	-

2	Bagarkhana Dugda Uppadak Sahakari Sanstha	Satbaria 9	2060	150	54000	1606000	-
3	Udhyamsheel Bahuudesiya Sahakari Sanstha	Chailahi 2	2065	200	72000	2100000	Yes
4	Devgadh Sahakari Sanstha	,,	2069	100	14400	504000	-
5	Kalika Dugda Uppadak Sahakari Sanstha	Gadawa 2	2045	45	12000	505000	-
6	Pashupati Dugda Uppadak Sahakari Sanstha	Gangapara spur 5	2051	52	13000	521000	-
7	Divya Jyoti Dugda Uppadak Sahakari Sanstha	Bijauri	2065	150	72000	2520000	-
8	Manakamana Dugda Uppadak Sahakari Sanstha	Pawannagar	2062	84	140000	3650000	Yes
9	Jaya Laxmi Dugda Uppadak Sahakari Sanstha	Tulsipur 5	2065	200	310250	10858750	

Source, DLSO, Dang (2012)

Annex 5: **Information on Milk Producers' Cooperatives In Surkhet District**

SN	Name of cooperatives	Address	Estd year	Beneficiery HH	Annaul milk volume (kg)	Annual transaction (Rs)	Other than milk activity- feed/savings/milk products- yes/no
01	Himal M. P. C.	Gadhi -4	2065	75	146500	507500	saving
02	Gumichuli " " "	Gumi -2	2063	65	32850	1149750	
03	Karaikhola " " "	Jarbuta-5	2062	414	167900	5876500	Saving
04	Radhakrishna " "	Satakhani-4	2059	112	135050	4726750	"
05	Janasewa " " "	Malarani	2057	67	55400	1662000	"
06	Shreekrishna "	Lekhparajul	2056	45	53200	1596000	
07	Chhabi " " "	Chhinchu-1	2058	57	63700	1911000	
08	Janata milk	Mainatada-1	2054	76	64540	1936200	
09	Bageshwori " "	Sahare-8	2054	82	135050	4051500	"
10	Laxmi " "	Lekhafarsa	2054	56	63200	1896000	
11	Vagawati " " "	Lekhaparajul	2050	53	57925	1737750	
12	Nawaratna " "	Ramghat -5	2050	65	140350	4210500	
13	Pashupati " "	Chhinchu-1	2054	48	49300	1479000	
14	Durgavagawati "	Chhinchu -4	2050	54	67550	2026500	

15	Tolikhola " " "	Chhinchu -2	2050	45	58290	1748700	
16	Ganeshpur " "	Chhinchu-7	2050	55	156950	4708500	"
17	mehelpani " " "	Gadhi	2064	67	146000	4380000	saving
18	Janauchha " " "	Bi na pa	2063	54	160250	4807500	
19	Jivanjyoti " " "	Satakhani	2067	38	47800	1673000	
20	Saraswoti " " "	Chhinchu	2067	42	45300	1359000	
21	Chetansil " " "	Gothikanda	2067	52	116800	3504000	
22	TOTAL				1963905	56947650	

Annex 6: Information on Milk Producers' Cooperative in Dadeldhura districts

SN	Name	Address	Estd	Annual Milk collection (MT)
1	District Milk Producers' Cooperative Union	Baghbazar, Dadeldhura	2059	125
2	Bhailweswor Dugdha Utpadak Sahakari Sanstha	Pokhara, Dadheldhura	2059	50
3	Ugratara Dugdha Utpadak Sahakari Sanstha	Kirtipur, Dadeldhura	2059	95
4	Janachetana Dugdha Utpadak Sahakari Sanstha	Bhatkanda, Dadeldhura	2059	40
5	Sahasraling Dugdha Utpadak Sahakari Sanstha	Tai, Dadeldhura	2062	15

Source: DLSO, Dadeldhura

Annex 7: Dairy Industries Visited

SN	Name of Dairy	Address	Products
1	Panthi Dairy	Pokhara, Kaski	Milk, Curd, Icecream, Cream, Panner, Mozerella, Khuwa
2	Shakti Dairy	Lekhnath, Kaski	Milk, Curd, Ghee, Paneer, Icecream
3	Sujal Dairy	Pokhara, Kaski	Milk, Youghurt, Butter, Paneer, Icecream, SMP, Cream
4	Fistail Dairy	Pokhara, Kaski	Milk, Curd, Icecream, Cream, Butter
5	Asal Dairy	Pokhara, Kaski	Milk, Curd, Ghee, Paneer, Butter
6	Bajhgain Dairy	Lekhnath, Kaski	Milk, Curd, Icecream, Paneer, Ghee
7	Himal Dairy	Gharipatan, Kaski	Milk, Curd, Paneer, Ghee, Butter
8	Rashmi Dairy	Thasikhel, Lalitpur	Curd, Paneer, Ghee, Butter
9	Bhaktapur Dairy	Bhaktapur	Ghee, Butter, Milk
10	Jagadamba Dairy	Bhaktapur	Pasturised milk
11	Tika Dairy	Talchikhel	Milk, Curd, Paneer, Mahi
12	Rajdhani Dairy	Chapagaun	Milk, Curd, Cream, Butter, Ghee, Paneer
13	Prabhat Dairy	Chapagaun	Milk, Paneer, Yoghurt, Cream, Butter
14	Chitwan Milk	Thimura, Chitwan	SMP, Pasturized milk, Butter, Ghee, Ice cream
15	Gyanodaya Dairy Undhyog	Sunwal, Nawalparasi	Ice Cream, Yoghurt, Butter, Ghee
16	BMSS	Morang	Milk, yoghurt, paneer, ghee, butter, icecream, SMP
17	Shivaganga Dairy Udhyoug, Devdaha	Devdaha, Rupandehi	Milk, Curd, Icecream, Ghee, Paneer
18	Dewan Icecream Udhyog	Ilam	Ice cream
19	Apsara Lalipap	Pashupatinagar	Lallipap, cheese
20	Shakti Foods	Lalitpur	Ice cream

Annex 8: Capacities and Operation of Dairy Industries associated with DIA

SN	Name of Dairy Industries	Address	Daily Processing Capacity (ltr)	Current Operation (ltr)	Capacity Utilized (%)
1	Adhunik Dairy Pvt Ltd	Balaju, Kathmandu	10000	8000	80.0
2	Akrikit Dugdha tatha Krishi Udhyoug	Panauti, Carve	15000	8000	53.3
3	Kathmandu Dairy Pvt Ltd	Babarmahal, Kathmandu	5000	5000	100.0
4	Kalika Dairy Pvt Ltd	Bageswori, Bhaktapur	20000	10000	50.0
5	Kharipati Dairy Pvt Ltd	Kharipati, Bhaktapur	20000	10000	50.0
6	Chitwan Milk Ltd	Thimura, Chitwan	150000	50000	33.3
7	Nawaprabhat Dairy	Chapagaun, Lalitpur	5000	4000	80.0
8	Nepal Dairy Pvt Ltd	Lalitpur	15000	8000	53.3
9	Puspa Diary Udhyog	Balaju, Kathmandu	5000	4000	80.0
10	Bhaktapur Dairy Pvt Ltd	Bhaktapur	15000	5000	33.3
11	Modern Dairy Pvt Ltd	Gundu, Kathmandu	15000	5000	33.3
12	Rajdhani Dairy Pvt Ltd	Chapagaun, Lalitpur	10000	6000	60.0
13	Sujal Dairy Pvt Ltd	Pokhara, Kaski	100000	50000	50.0
14	Sainju Dairy Pvt Ltd	Bageswori, Bhaktapur	12000	8000	66.7
15	Jagadumba Dairy Food and Beverage	Bhaktapur	5000	3000	60.0
16	Sanjibani Dairy Udhyog	Katunje, Bhaktapur	5000	4000	80.0
	Average capacity utilization				60.2

Source DIA, 2012