

# **AN ASSESSMENT OF FARMERS' INVOLVEMENT IN HYGIENIC MILK PRODUCTION FOR FORMAL MILK SUPPLY CHAIN OF KASKI DISTRICT OF NEPAL**



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Specialization: Livestock Chain

Tulasi Jang Dahal, September, 2013  
Wageningen  
The Netherlands

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# **An Assessment of Farmers' Involvement in Hygienic Milk Production for Formal Milk Supply Chain of Kaski District of Nepal**

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**Master of Agricultural Production Chain Management**

**Specialization: Livestock Chain**

**Wageningen, the Netherlands, 2013**

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Cover Photo: A view of milk collection procedure in milk collection center of Bharatpokhari VDC, Kaski District of Nepal. Photo by: Tulasi Jang Dahal, 2013

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## List of Abbreviations

AAP	Agriculture Perspective Plan
AGDP	Agriculture Gross Domestic Production
AHTCS	Animal Health Training and Consultancy Service
BQ	Black Quarter
CALPI	Capitalization of Livestock Program Experiences in India
CBC	Central Bureau of Statistics
COB	Clot and Boiling Test
DCMPU	District Milk Producers' Cooperative Union
DDC	Dairy Development Corporation
DFTQC	Department of Food Technology and Quality Control
DLS	Department of Livestock Service
DLSO	District Livestock Service Office
EEC	European Economic Community
FAO	Food and Agriculture Organization
FDCMPU	Federation of District Cooperative Milk Producers' Union
FDCMPU	Federation of District Cooperative Milk producers' Union
FMD	Food and Mouth Disease
GCMMF	Gujarat Cooperative Milk Marketing Federation Ltd India
GDP	Gross Domestic Production
INGO	Internal Non-Government Organization
JT	Junior Technician
JTA	Junior Technician Assistant
MoAD	Ministry of Agriculture Development
MPCS	Milk Producers' Cooperative Society
NDDB	National Dairy Development Board
NDDB/I	National Dairy Development Board of India
NGO	Non-Government Organization
NPC	National Planning Commission
NRS	Nepalese Rupees
OF	Operational Flood
SDC	Sujal Dairy Company
SNF	Solid Not Fat
SWOT	Strenght Weakness Opportunity Threat
UNDP	United Nations Development Program
VAHW	Village Animal Health Worker
VDC	Village Development Committee
WFP	World Food Program
WTO	World Trade Organization

## ABSTRACT

In Nepal, the quality of milk and milk products has been a very critical issue since last several years. But the effort for the improvement has not been enough so far. The quality of milk starts from the farm level but in fact awareness of dairy farmers about the hygienic milk production is poor in the district. Due to the unhygienic milk supply in the chain, almost every year, there is quality related scandals of the milk and milk products. Because of these reasons, this research was conducted to identify the real situation of the dairy farmers and increase the involvement of farmers in hygienic milk production in the Kaski district of Nepal. To obtain the objectives of this research, a survey with dairy farmers, discussion with milk producers' cooperatives Society (MPCS) and two case studies with dairy processors was carried out. The survey was conducted on 30 respondents from three milk collection centers of three different VDC of Kaski district.

The findings of the survey show that dairy farmers are not applying basic hygienic practices in their farm while producing milk. No provision of extra bonus system for hygienic milk, not any compulsory rules regulations for hygienic milk production are main causes for not adopting hygienic practices at the farm level. The result also shows that some farmers have not sufficient knowledge about the hygienic milk production and its effects on human health. Many farmers and collection centers are not applying the simple milk testing systems like CoB, Alcohol and acidity tests which are very cheap, easy to perform and useful to control bacterial contamination in the milk in the collection centers. The existing practices of farmers are one of the most possible sources of contamination in milk. Besides this, insufficient chilling facility in the collection centers, milk transportation from the long distance, manual handling of milk from producer level to processing level, using ordinary vehicles for milk and milk product transportation, insufficient electricity facility for cold chain maintain were found.

The research study identified that, cooperative involvement for the hygienic milk production with its different tasks including input supplying, milk collection and marketing of milk and milk product appeared more competitive among dairy industries in India.

The study also found that extra bonus system for hygienic milk, increasing the milk price at least in a small amount every year, training and awareness program for dairy farmers, accessibility of credit and technical services and adaptation of the milk testing system are important motivation factors for hygienic milk production in the Kaski district.

Finally, the provision of bonus system for high quality milk, training and awareness program for farmers on the basis of needs assessment, access to technical services and credit in soft interest rate and strictly follows milk testing system at the collection centers are recommended for the hygienic milk production in the district.

## CHAPTER 1: INTRODUCTION

This report is written on the research title “An assessment of farmers’ involvement on hygienic milk production for formal milk supply chain of Kaski District of Nepal”. The reports cover a brief research background, its objective, review of different literatures, the findings of the survey and case studies. In addition, it also covers discussion on the basis of the findings, conclusion and recommendation for the implementation of hygienic milk production at farm level in the Kaski district of Nepal.

### 1.1 Research background and justification

Agriculture is the main source of national economy of Nepal. It has contributed about 33 % to the Gross Domestic Production (GDP) (MoAD, 2010). Livestock farming is one of the important components of the agriculture. The livestock sectors contribute 6% to the total GDP through different products like milk, meat, eggs, wool and leather (NDDB, 2010). Among these different livestock products, milk has the largest shares of 39% among the livestock GDP. The dairy sector in the country is in the increasing trend and the growth will reach to 5.5% from the current 2.9 % by 2015 (APP, 1995). Now it is increasing at 3.6% (MoAD, 2012). Although the production of the milk is in the increasing trend, the dairy processing companies are facing around 250 to 300 thousand liters raw milk deficit in a day and so, it has to be imported from India. The dairy companies have been importing only 70 thousand liters of fresh milk daily from India (Parakhi, 2012). So there is still 180 – 230 thousand liters milk is deficit in the country.

After the admission of Nepal with World Trade Organization (WTO) in 2005 and increasing the awareness level of urban consumers on quality products, the demand of high quality product in the market is also in the increasing trend. In this condition, if the quality of milk and milk products of Nepal is unable to meet the standard criteria demanded by the consumers, there is a high risk to decrease the market of Nepali dairy products. So, the quality of milk and milk product is an important concern in Nepal.

The quality and hygienic practices of milk begin from the farm; the farmers' involvement in the production of hygienic milk at the farm level is almost negligible in the country. There is no provision of pricing system on the basis of the quality of milk. Due to the high production cost and low price of milk, numbers of dairy farmers are adopting alternative business options yearly instead of continuing dairy farming (DLSO annual report, 2011).

Besides this, there are also numbers of problems from farmer level to consumer level in handling of milk, collection in the collection centers, chilling of milk, transportation and processing of milk and milk product. All these factors affect the quality of milk and milk product. To increase the quality of milk and milk product in the chain, there should be maintained standard hygienic practices in every step in the chain. Existing milk handling practices of the farmers are the main entry points of contamination in the milk. The dairy farmers are not applying basic hygienic practices during the milking and after milking. The raw milk is stored in unhygienic condition in their farm and transported to the collection centers in unhygienic manners which affect its quality (FAO, 2010).

Different studies conducted on the quality of milk and milk products of Nepal shows that many products did not meet the minimum compositional and microbiological quality standards laid out by the Food Act (Acharya BH, 2009). If milk is collected from the healthy dairy animal, it is almost free from pathogenic microorganisms. So, the implementation of the hygienic practices of the milking time is a critical factor in the contamination of milk at the farm level (FAO, 2010). That's why the researcher is motivated to know how the farmers' participation can be increased in hygienic milk production at the farm level.

## **1.2 Problem statement**

The dairy sector of Nepal is dominated by the small scale farmers. Most of the farmers are not adopting basic hygienic and management practices and rearing their animals under the poor management condition in the farm. There are many problems in hygienic milk production at farm level in handling, stocking and transporting to the collection centers. Almost every year, there has been a scandal spreading related to the quality of milk and milk product in the country. In order to improve the quality of milk in the formal milk supply chain there is a need to increase the involvement of small scale farmers in hygienic milk production.

## **1.3 Research objective**

To increase the farmers' involvement in hygienic milk production in order to get better milk price at farm level and supplying higher milk quality in the chain.

## **1.4 Research questions**

### **1.4.1 Main Research Questions**

1. What are the current features of the milk supply chain in the district?
2. What are the existing milk production practices and involvement of farmers in hygienic milk production ?

### **1.4.2 Sub questions**

- 1.1 What are the roles of actors and supporters in the milk value chain?
- 1.2 What are the quality control mechanisms in the chain?
- 1.3 What are the volumes, selling price, payment system and value share in the milk chain?
- 2.1 What is the level of awareness of producers in hygienic milk production and storage?
- 2.2 What are activities performing before delivering the milk to the collection center?
- 2.3 What are the roles of chain actors for producing more hygienic milk in farmers' level?
- 2.4 What are the constraint factors for hygienic milk production in the district?

## **1.5 Scope of the study**

Since long time, the milk and milk quality of Nepal is considered as an essential concern but the facts that milk and its products are not meeting the quality standards determined by the National Dairy Development Board (NDDB, 2011) of Nepal. The farmers involvement and production practices are the very important factor for the quality of the final product. Therefore, the research will introduce some facts to the production of hygienic milk at farm level by considering the factors of farmer involvement.

The outcome of the research will be useful to increase the involvement of farmer for hygienic milk at farm level. In addition this, the recommendations of this research will be useful for the formulation of development activities and also useful to prepare the training guideline for different dairy related programs for the development organizations and government side too.

## 1.6 Research Methods

The research was conducted in three different VDCs of the Kaski district. To collect the data and information about hygienic milk production practices, a survey and two case studies were conducted.

### 1.6.1 Survey

The survey was conducted on 30 respondents of three different milk collection centers. The survey is quick and cost effective method for the data collection. It is also useful to receive direct comments from respondents and researcher can observe many related issues during the question answering process. During the survey, the respondents thought that I was coming from the government side and they were expressing all the problems which they are facing in the dairy sectors. But after a short introduction, they were cleared and give the factual answers. I have learnt an important lesson from this survey that before conducting the survey, the respondents should have an idea about the planning of the survey so that they will prepare themselves as responsible respondents. Hence, this will help to get more real data during the survey.

### 1.6.2 Case studies

Two case studies of dairy processors were also carried out during the field work of the thesis. The processors were selected based on selection criteria as described in the in chapter 4 of this thesis report. During the interviewing with representatives of processors were not open about the quality management aspects of the company because they don't want to expose their weakness to outside of the company. The data provided by the processors should be verified before presenting it because they exaggerate the information if that is a positive concern for the company. The presented information in the case studies, collected by the processors is verified as much as possible.

## 1.7 Limitations of the study

Although the thesis report is prepared on the basis of field survey with farmers and case studies with two dairy processors there were some limitations as well;

- ❖ The time duration for research was short. It was conducted within a certain time (3 months).
- ❖ The data were collected only from 30 farmers in 3 milk collection centers of 3 VDC of Kaski district.
- ❖ The research was based on the information provided by the respondents which mainly focused on the existing practices of the farmers while producing the milk and delivering it to the collection centers. So, the research does not cover other management aspects of dairy farming.
- ❖ The data were collected from a limited geographical area of the districts.

## 1.8 Organization of research

This report is organized on the basis of guideline given in the module book. It has six chapters. The first chapter describes about the research context and justification, problem statement, research objective, research questions and scope of the study. The second chapter deals with literature review especially focus hygienic milk production practices and milk supply chain in Nepal and India. The third chapter describes about the methodologies of the research which includes site selection, method of data collection and data analysis and presentation. The fourth chapter deals with the findings of the research. The findings are presented in charts and table for easy interpretation of findings. The findings of two case studies are also described in this chapter. The fifth chapter is about the discussion on the basis of research findings and desk study. The last chapter deals about the conclusion and recommendation on the basis of discussion and also describes about the implementation of the recommendations of the research.

## CHAPTER 2: RELATED LITERATURE REVIEW

This chapter focuses on general background information about the country including milk supply chain with concentrated on the concept of hygienic milk production at farm level on the basis of different concepts which are already published in different reports, article, books and internet sites.

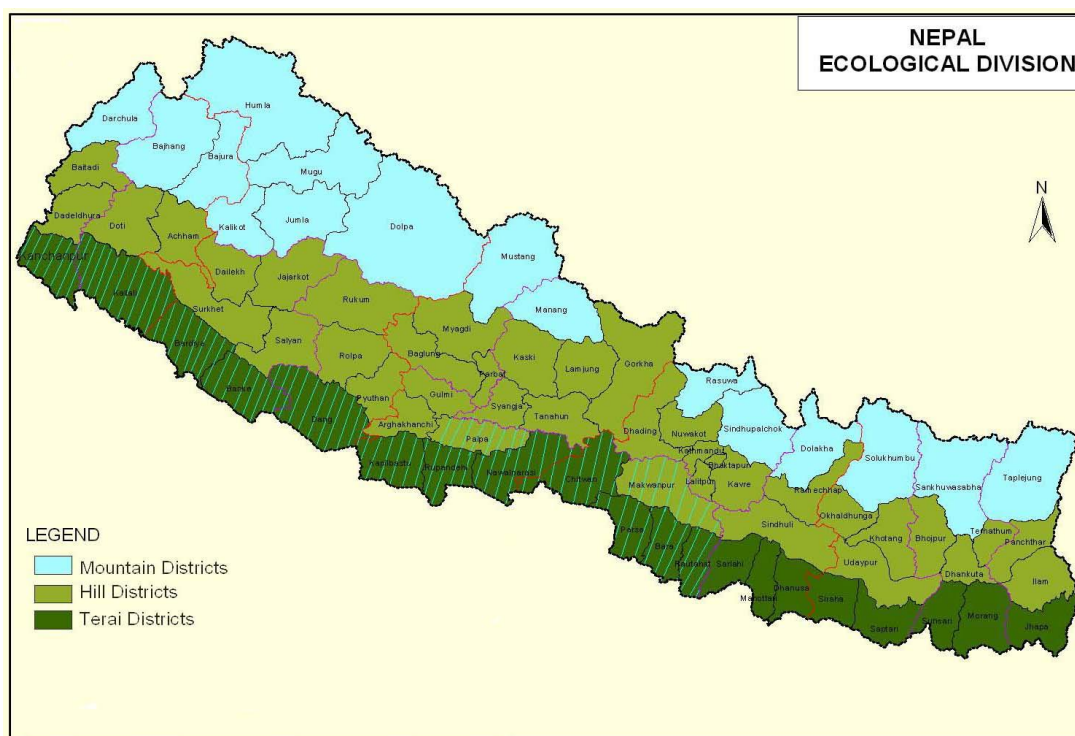
### 2.1 Background information

#### 2.1.1 Country overview

Nepal is a developing and small landlocked country and it has a population of about 26 million people (CBS 2012). The country is situated in the south Asian region bordering with two large and populated countries of Asia-India and China. The country is separated into 5 development regions, 14 zones and 75 districts. Furthermore, each district has Village Development Committees (VDC) and Municipalities. There are altogether 3915 VDCs and 58 Municipalities in the country (CBS 2012).

Besides this, based on the Agro-ecological features Nepal is also divided into three different regions. These three features are Mountain in the north, Hills in the middle and Terai (plain area) in the south which is parallel spreading from the east to west part of the country (CBS, 2012). The southern part of the country is almost Terai (plain area) covered by the 23.1% of the land. Similarly, 41.7% of the land is covered by hills which lie in the middle part of the country. The northern part is almost high mountain covered 35.2% of the land. The cultivated land holding by the different regions is about 52.9% in plain, 40.3% in Hills and 6.8% of land is located in a mountainous region (CBS, 2012) (figure: 1). The total area of the country is 147,181 square km and more than 80% population still live in rural areas of the country. (UNDP, 2012).

**Ecological division of Nepal**



**Figure: 1 Ecological division of Nepal**

Source: Adopted by author from WWF, Nepal 2012



### 2.1.2 Overview of livestock in the country

Nepal is a low developed country and nearly 25% of its population is living below the poverty line (UNDP, 2012). Livestock plays an important role in the national economy and it is an important source of nutritive food like meat, milk and eggs. It is also a source of income and employment of rural people by selling its products. The livestock sector contributes 29 % to the AGDP and 6% to the GDP of the country (CBS, 2012).

Although the dairy farming of the country is dominated by small and medium scale farmers, the average growth of milk production is about 3.6 percent per year (Statistical Information on Nepalese Agriculture, 2012). But the cost of production is generally 10-20 % higher than the other country like India and China (Kshatri, 2010). The milk production system in Nepal is divided into the flush season and lean season, because of feed availability and seasonal breeding pattern of buffaloes. In the lean season (March to August) milk production is 35% lower than the flush season because there is not sufficient green grass and fodder in this season. But in the flush season (September to February) the milk production is high compared to the lean season because the green grass and fodder is sufficient in this season and generally the buffaloes give birth in September and going to dry in February (Pradhan et al, 2005). Currently, the milk production is around 1600 thousand metric ton in flush season and around 1100 thousand metric tons is in lean season (Figure: 3).

The cattle and buffalos are kept as a main livestock in Nepal and buffaloes are the major dairy animals in term of milk production in the country.

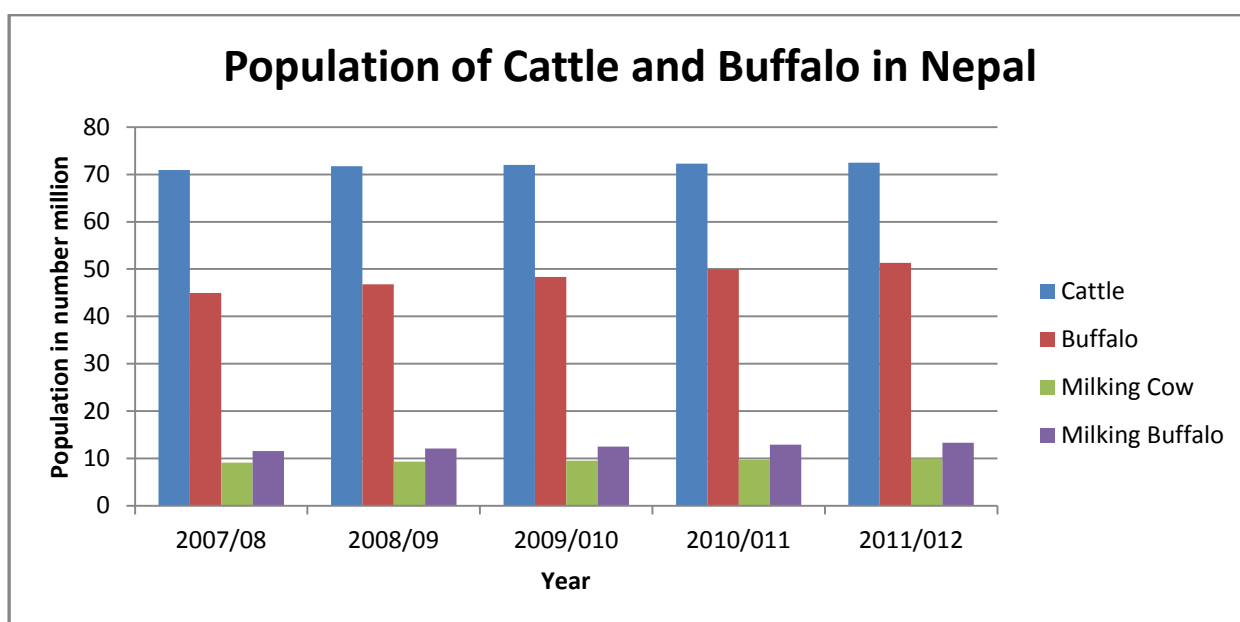


Figure: 2 Population of cattle and buffaloes in Nepal  
Source: Adapted by author from MoAD, 2012

The bar diagram shows that the total population of cattle is higher than the buffaloes but milk production of buffaloes is higher than milk production of cattle but the production trend is increasing in both cattle and buffalo.

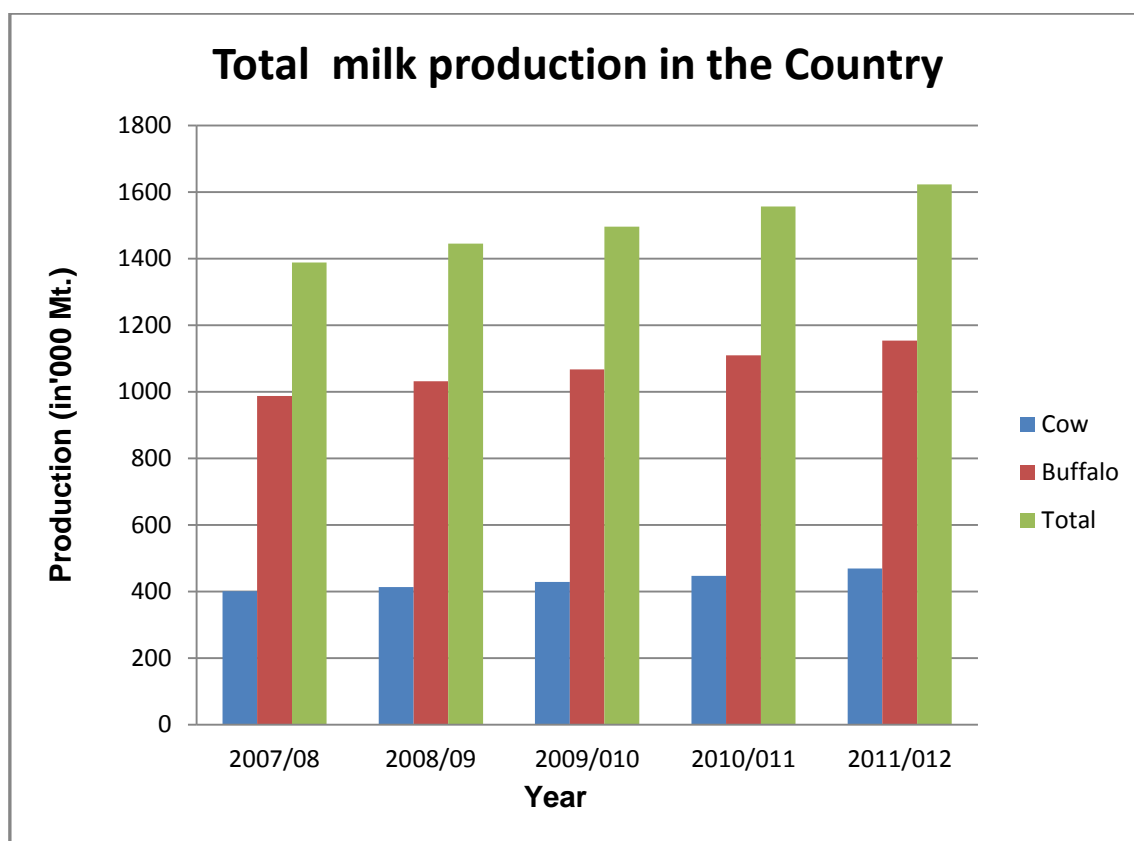


Figure: 3 total milk production in the country  
Source: Adapted by author from MoAD, 2012

Above bar diagram show that, the production of milk is in increasing trend and buffaloes are the main source of milk production in the country.

### 2.1.3 District profile and dairy sector of the Kaski district

Among the 75 districts of the country, Kaski is one of the hilly districts and situated in the western development region. Pokhara is the administrative headquarter of the district and it is also popular in the tourism because of its natural beauty. Agriculture is the main profession of the people in the district and around 71% of people are depending on agriculture and livestock (DLSO, 2011). There are 43 Village Development Committee (VDC) and 2 Municipalities in the district. The total population was 492,098 in 2011 and total numbers of households were 125,673 in the district (CBS, 2011). Out of total households 51789 (61%) are the farming households in the Kaski district (DLSO, 2011).

The capital city of Kaski, Pokhara is the main center for marketing of livestock products. Most of farmers surrounding VDC of the city are depending on dairy farming because they have a big market opportunity in the Pokhara. The farmers have 1-5 large animals for milk production in the hill area but because of transportation facility in the plain area, some farmers are keeping 5 -10 buffaloes or cows for milking purpose. Besides this, farmers also keep pigs, poultry, sheep and goat for meat purpose and they also involve in the agricultural farming for domestic consumption.

In other districts of the country also the same scenario like Kaski exists. Farmers are keeping buffaloes and cows for the milk production. The data given below makes clear that around 80% of milk is produced by buffaloes in the total milk production of the district.



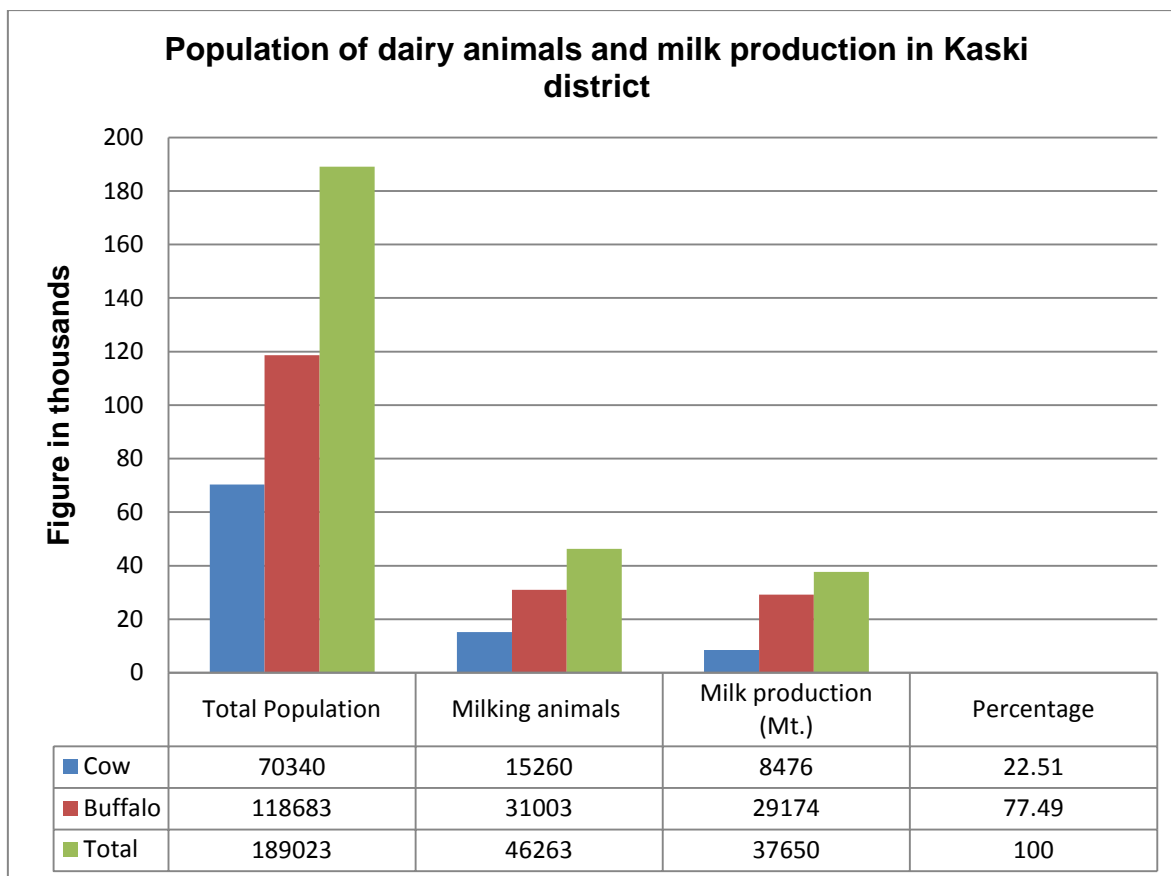


Figure: 4 Population of dairy animals and milk production in Kaski district  
Source: Adapted by author from MoAD, 2012

The data show that, the population of milking animals seems very low compared to the total population because the management practices of dairy animals is not appropriate in the districts. On the other hand, the cow is a holy animal in Nepal, so farmers have to keep them and are not allowed to kill them.

## 2.2 Concept of hygienic milk and its importance

The general definition of 'Hygienic Milk' is "milk secreted from the healthy animals, which is collected by the clean milking persons in a clean container and free from physical elements like dust, hay, manure. It has a normal composition, low bacteria count ( less than 1000 colony-forming units of total bacteria per milliliter ) and natural flavor in taste" (FAO, 2006).

As we know milk is a highly perishable but highly nutritious food for all age groups of human beings (FAO, 2006). It is also a good medium for bacteria growth. If the milking animal is suffering from contagious diseases like tuberculosis, brucellosis, leptospirosis, there is a high chance to transfer those diseases to human beings from the raw milk (FAO 2006). To prevent these risks for human health there is need of sincere care while producing the milk at the farm level. Production of hygienic milk is also an important factor to keep the quality of raw milk and in producing the quality milk products during the processing time. (NDDB annual report, 2009).

### 2.2.1 Milk quality

In Nepal, the quality of milk and milk products are a critical issue in the chain. Almost every year, there has been a scandal spreading related to milk and milk product in the country (DFTQC, 2011). If the animals are free from diseases and farmers strictly apply basic hygienic practices in their farm, there will be less chance for bacterial contamination in the milk. But insufficient knowledge on hygienic practices, lack of chilling facility of milk in the collection centers, improper and unhygienic utensils used in milk handling, insufficient facility of the milk testing system in the collection centers increases the possibilities of contamination of milk in the context of Nepal (NDDB, 2009)

Besides this, collected milk in the collection centers should travel long distance to reach the processing company without maintaining the cold chain. This condition is another favorable environment for the growth of bacteria in the milk. Some part of the country especially in the tarai region there is a high chance for the multiplication of bacteria in the milk due to the high temperature. (Pradhan, 2005)

Moreover, some adulteration practices like mixing sodium bicarbonate for reducing the acidity level, starch, sugar and urea for increasing SNF and water for increasing the volume of milk that occur in the milk chain which also declines the quality of milk (NDDB, 2009).

Recently, the sample of milk and milk products from DDC and others 14 private dairy companies had collected in Kathmandu valley (capital city of the country) and tested in the central food laboratory showed that more than 90% samples were found positive for coliform bacteria. According to the department, the coliform count found in DDC's product was 0-100 per milliliter and up to 2400 per milliliter in some private dairy company (DFTQC, 2013). But the code of practice for the dairy industry in Nepal is pasteurized milk and milk products should be free from coliform bacteria (NDDB, 2005). This fact shows that the quality standard of milk and milk products is very poor condition in Nepal.

### 2.2.2 Quality control of milk

Milk quality control is important to ensure that products are safe and healthy, application of approved standards and regulation concerning in the milk and milk products. Different tests are designed and applied to ensure the milk products meet accepted standards for chemical composition, purity, level of bacteria and other micro-organisms. The quality control is related to the milk testing system and its payment system. That's why this testing and payment system can control the quality of milk in the chain (A. Tessema, 2009).

## 2.3 Contamination source of milk

For hygienic production of milk, the producer should be aware about the source of contamination and its prevention methods. At the producer level, there are many possible sources of contamination of milk (FAO, 2006). Some important source of contamination and their prevention measures are described below.

### 2.3.1 Dairy animals and Shed

Unhealthy milking animals are the one of the most important source of contamination in the milk. If the dairy animal is suffering from the unseen diseases like sub-clinical mastitis, brucellosis, tuberculosis etc., there is a high chance for contamination of milk. That's why the proper management system and good health condition of animals is the primary step to prevent the contamination at farm level. The farmers should always be aware about the health condition of the milking animal. Before the milking the animals should be cleaned. If it is not possible every day, the udder and teat should be always clean and dried before milking the animals (FAO, 2006)

In the animal's shed, there are many risky elements for the contamination of milk. The shed should be cleaned with disinfectant. Before milking, the shed should be free from the urine, feces, feed and forage residues because these are high risk factors in the case of hand milking (FAO, 2010). The floor space for animals should be provided as per recommended by animal welfare organization and there should be a good facility of safe and clean water for drinking and washing purpose.

### 2.3.2 Handling practices of milk and milking man

Because of the hand milking practice in Nepal, personal hygiene of milker is an important factor of hygienic milk production. The milker should be free from infectious diseases, cold and cough. If the person is in the unhealthy condition during the milking time, there is high possibility of contamination in milk (Sharma and basnkota, 2007). Before the milking time, the milking person should wear clean clothes or apron; wash the hands with soap and water. These activities are very essential tasks for the hygienic milk production. The Sub -clinical mastitis should always be tested from the first strips of the milk and discards it if the result is found to be positive. After milking, the milk should deliver to the collection centers as fast as possible. If milk is not delivered immediately to the collection centers, it should be kept under the cold condition as much as possible (Reginal Agriculture Research Station, 2010).

### 2.3.3 Equipment and Transportation of milk

The equipment which is used in the milking processes is another probable source of contamination of milk at the farm level. The equipment should be easily cleanable and resistant from the disinfectant. After the milking, all equipment should be cleaned and disinfected with suitable disinfectant and should be stored in a clean environment. Before using the equipment it should be cleaned with clean water (Fias Co farm, 2012).

After milking the milk should be cooled down up to 4 to 6 degree centigrade (FAO, 2010). If there is no chilling facility, the milk should be kept under the cooling condition as much as possible or should be delivered to the collection centers quickly. If both conditions are not feasible, a preservative lactoperoxidase can be added to extend its shelf life for 7/8 hours. This method is easy and cheap for farmers in developing countries (Bennett et al, 2000).

## 2.4 Milk supply chain in Nepal

### 2.4.1 A short history of dairy development in Nepal

In Nepal, Dairy development activities started in 1952 as a Dairy Development Section under the Department of Agriculture (FAO, 2010). In 1969, the Dairy Development Corporation (DDC) was established. Before the establishment of the National Dairy Development Board (NDDDB), DDC had carried out all dairy development activities in a wider area. National Dairy Development Board (NDDDB) established in 1992, now it is an apex level policy-making body for dairy development in Nepal and Dairy Development Corporation (DDC) is a fully government owned corporation limited.

After 1992, the DDC is totally focusing on the production of different milk product in the country. To supply the milk and milk products to consumers, DDC has established different four milk supply chain in the different part of the country. These schemes were involved in the collection, processing and marketing of the products. But among the four schemes the Pokhara milk supply chain scheme was privatized in 2005 according to the privatization policy of government. In 1981, the DDC also introduced a concept of milk producers' Association for the development and increase the farmers' participation in dairy sectors. Later these associations were transformed into Milk Producers' Cooperatives (MPCs). Now 888 milk cooperatives in 33 districts are actively working on the collection of milk (DDC, 2011).

### 2.4.2 Milk production in Nepal

In the year of 2011/012, the total milk production of the country was 1622 thousand metric tons. As mentioned earlier, the buffaloes are main milking animals in the country and its contribution is about 78% followed by the cow, is about 22% in the total milk production (calculated from MoAD, 2010). Most of the farmers prefer to keep buffaloes as a milking animal because (i) milk production and the fat content is higher than local cows (ii) high salvage value because some caste groups eat buffalo meat (ii) well perform in local feed and poor quality roughages and (iv) high disease resistant capacity (Regional Agriculture Research Station, 2010)

### 2.4.3 Collection and chilling system of milk

In the village level, many small scale farmers are involved in the production of milk. Generally, the raw milk is collected by Milk Producer Cooperatives Society (MPCS) in village level. The milk collection is done twice a day (evening and morning) in the flush season and once a day (morning) in the lean season. If the collection center is far, the farmers kept their evening milk in the home and on the next day they mix it with the morning milk and take to the collection center. There are about 888 MPCS in 33 districts of the country (DDC, 2011). Because of lack of road access, the cooperative practices are not extensively applied in the mountains and some hilly districts. The MPCS plays an important for milk production, collection and supply to the milk processing company. Some cooperatives are also providing the training and conducting the awareness programs to farmers for improvement and hygienic production of milk. (DDC, annual report, 2011). In some collection centers, the middlemen and traders are also involved in collection of milk from the farmers and its delivery to chilling centers or sometimes directly deliver to the processing plant (DDC annual report, 2011)

There are numbers of chilling center in the country established by the DDC, private dairy company and cooperatives. In total around 800 thousand liters chilling capacity of milk per day in the whole country (NDDDB, 2011). But these numbers are not sufficient for chilling the total collection in MPCS in rural areas. Some cooperatives near the processing company immediately deliver to the company after the collection (NDDDB, 2011).

#### 2.4.4 Transportation

Early in the morning, the farmers bring their milk by themselves to the collection centers in small aluminium cans (Picture:16 Annex-IV ). Some farmers are still carrying on the plastic bucket. After collecting in collection center, milk is chilled in the chilling vats until not delivered to the processing plant. If collection center have not chilling facility, collected milk is transported to chilling centers or processing company in 40 liters aluminium cans. Many collection centers are established in the remote areas so there is not a good road access for the milk transportation by appropriate vehicles. Mostly collection centers are used tractors, jeep and porters for the transportation of milk to the chilling center or processing company (NDDDB, 2006). But in plane area, some private dairy company and DDC transport milk by milk tanker. Still some dairy companies are transporting the milk in plastic tanks without cold chain maintain of milk. (DDC annual report, 2011)

#### 2.4.5 Processing

Nepal is still in the initial stages of dairy technology even in the processing of the milk (FAO, 2010). Currently, the total processing capacity of the country is about 1230 thousand liters per day and about 66% of the total capacity is in the private sector (H. Rajbhandary and L. Sherchad, 2011). Due to the shortage of milk in the country, the processing companies are not producing according to their capacity. Although the DDC has the lower processing capacity compared to the private sector, the total processing share of DDC is about 54% because of the organized milk collection channel (Joshi et al, 2011).

The demand of pasteurized milk is very high in the country and about 80% of the processed milk is sold as pasteurized milk (NDDDB, 2010). Only a small amount of milk is used to process other dairy products like yoghurt, butter, ghee, ice cream. So the product diversification of the dairy products is very limited (NDDDB, 2010). DDC and private dairies have been selling the same kind of products like standardized milk (3% fat and 8% SNF), yoghurt, ghee, cheese and ice cream since the last several years (Joshi et al, 2011).

#### 2.4.6 Marketing

Due to the insufficient transportation facilities in remote areas of the country, there is difficult to collect the milk from the farmers. The small scale farmers are involved in production for both formal and informal marketing channels. In the formal marketing, they are selling through MPCs which is acting as a mediator between farmers and processing plant. In the informal sector, they are selling directly to the consumers like tea shop, restaurant and sweet shop or sell their milk through the middlemen (FAO, 2010)

The middlemen are actively involved in the raw milk collection from the farmers and transport it to the MPCs and processing plant. Sometimes, the middlemen, transported milk to the sweet shops, restaurants and tea shops. This trend is going more in the surrounding area of the major city because middlemen can deliver in a short time and can sell on high price by convincing the consumer as pure milk not adding water (FAO, 2010).

The dairy processors are major marketing channels of the milk and dairy product. Because they are acting as a bridge between collection centers and consumers. The marketing channel of milk and milk products for DDC and private dairies is almost similar. They are formulated MPCs at the village level for the collection of milk from the farmers. Most of the dairy companies have their own booths or appointed dealers in the city areas to sell the dairy products. Moreover, they also channelize the products to the retail shops through the dealers. At the present time there is increasing popularity of supermarkets in the major city of the country, so the processors also started to market their products through these sales outlets (FAO, 2010).

The main product is pasteurized milk packed on the plastic sachet. It is marketed through the booths or sells centers once a day in the early in the morning. This processed milk is available only once a day from the booths and sales centers. In some highly populated areas of the city, the retail stores buy bulk of packet milk from dealers and store in refrigerator for sale throughout the day. But consumers should pay one or two rupees extra price for the refrigerated milk.

Milk Chain Map of Kaski District of Nepal

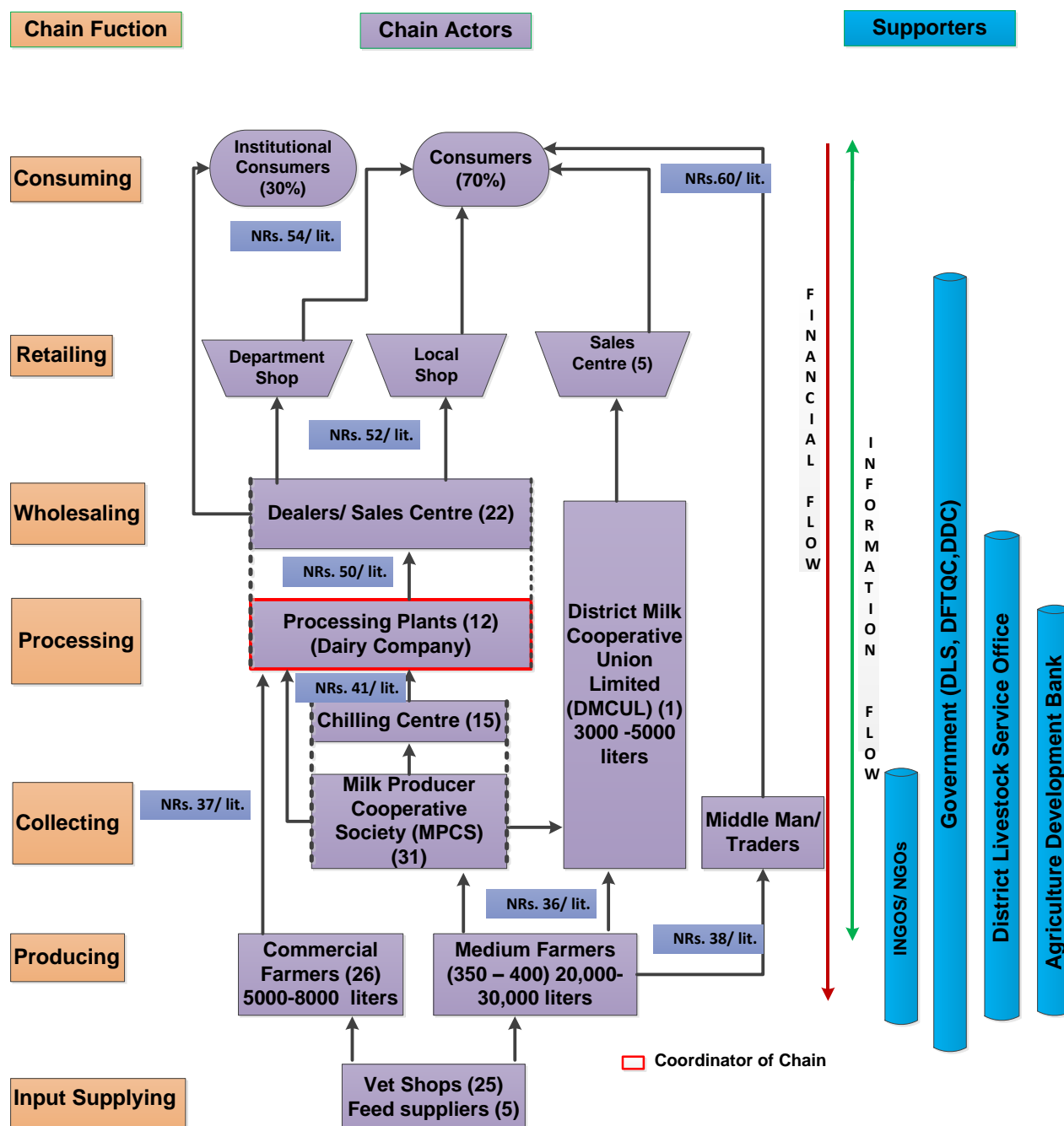


Figure: 5 Milk Chain Map of the Kaski District of Nepal

Source: Modified by author from NDDB Nepal



## 2.5 Role of chain actors, supporters and factors in quality milk production

### 2.5.1 Actors in the chain

#### ***Farmers***

The quality of the milk starts from the producer level. There are contamination possibilities at different steps of chain from producer level to the consumer level. At the producer level, may contaminate during hand milking, stocking, and transportation to the processing plant. At processor level, this chance is high during the processing and storage of the products. Although all steps are very critical in the chain for quality of milk, the prevention of contamination at the producer level is important because it may affect the quality control in next stage (FAO, 2010). To apply milk hygienic practices from the farmers, they should have minimum basic knowledge about hygienic practices and they should be motivated for the hygienic milk production.

But in fact, many dairy farmers are not applying above mentioned practices in their farm while producing the milk. Therefore, farmers are important actors in the production of quality milk in the chain.

#### ***Collection center /middlemen***

The main function of collection centers is to collect the milk from the farmers in village areas. They are also responsible to determine the quality of milk by performing different milk testing methods. In some areas of the country, the middlemen are also involved in the milk collection at village level. So the collection centers and middlemen have an important role to play in the quality control of the milk. Because of insufficient awareness about the personal hygiene, Unhygienic handling, insufficient milk testing equipment in the collection centers, lack of chilling facility in milk collection centers contributes low quality of milk in the chain.

#### ***Processing plant***

For the quality product, milk handling and application of hygienic practices of the employers in the processing company is other important points. Poor personal hygiene of workers, care less about sanitation of equipment and utensils and poor storage of the final products are contributing to the low quality of milk and dairy product. Because in the context of Nepal, still there is not any compulsory rules for quality of the dairy product at factory level (NDDB, 2008).

#### ***Dealers and retail centers***

Dealers and retailers are final chain actors before consuming the products. After delivering to the dealers and retailers, milk should be stored under the recommended temperature (4-6<sup>0</sup> celsius) otherwise there is a high possibility to increase the bacteria in the milk. But, due to the power cutoff (load shedding) there is difficult to maintain the cold chain in Nepal. Besides this, most of the sales center and retailers have not followed the instructions of storage which is stated on the cover of the products. Therefore, the dealers and retailers are also responsible to maintain the quality of milk and milk product ( T. Joshi et al, 2011).

#### ***Consumers***

The consumers are the final user of the products. The consumer should keep the milk in the refrigerator or boil it immediately after purchasing. If they are not maintained in cold chain there is a chance to increase the bacteria in the milk and deteriorate the quality of milk. Therefore, the consumer awareness is also important for the quality of milk (H. Rajbhandary and L. Sherchad, 2011)

### 2.5.2 Value share of different actors in the chain

The value share is an important factor for analysis of the economic contribution of different actors in the chain and it also gives a clear idea about the profit margin between different actors.

In the milk value chain of the Kaski district, the farm gate price of milk is Rs 36 per liter and the final consumer price is Rs 54 per liter. Although the processing company provided Rs 40 to 41 per liter of milk, the collection center (cooperatives) deducted 10 to 12% management cost. After processing, the milk is sold at the price of Rs 50 to the dealers. The dealers sell at Rs 53 per liter to the retailers and consumers paid Rs 54 per liter of milk. There are two types of milk in the market one is pasteurized milk having 3% fat content and 8% SNF and next one is whole milk having 5% fat and 8% SNF. The price of whole milk is 2-3 rupees per liter higher than the pasteurized milk.

This calculation is based on pasteurized milk.

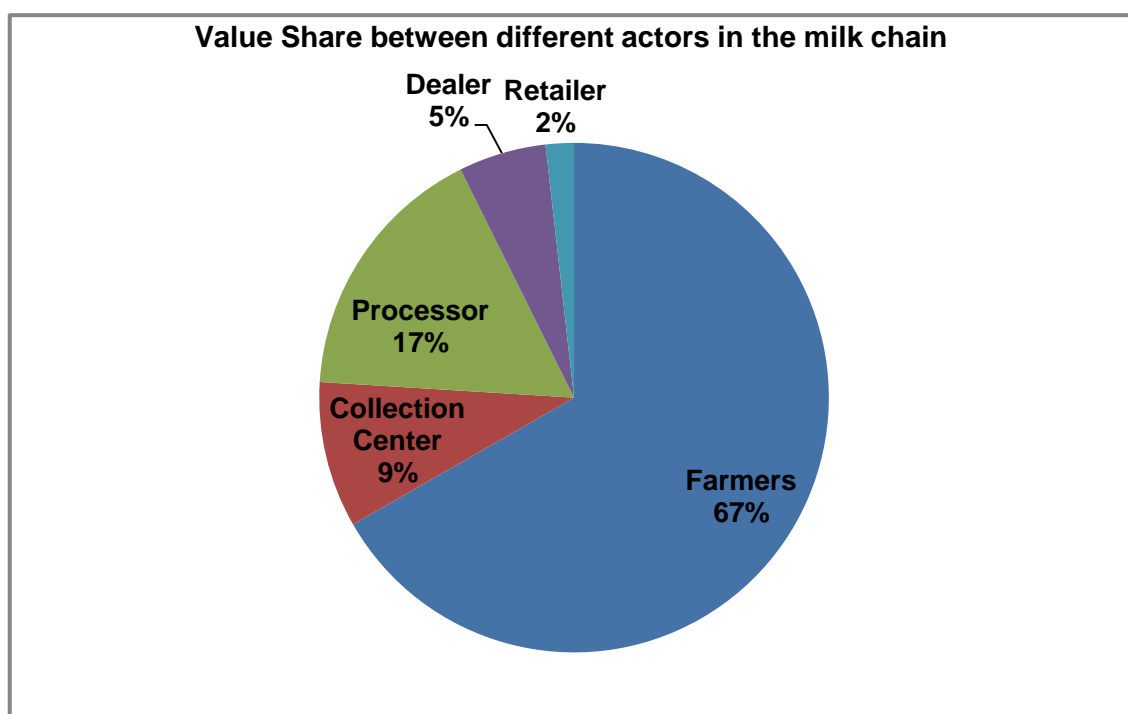


Figure: 6 value share between different actors in milk chain

Above mentioned pie chart shows that farmers have 67% value share in the chain but due to the high production cost they are not benefited from the dairy farming. The production cost of milk is around Rs 33 per liter in the flush season and around Rs 39 per liter in the lean season (Rajbhandari H. and Shrechand L. 2011)



### 2.5.3 Supporters in the chain

#### ***National Dairy Development Board (NDDB)***

The National Dairy Development Board established in 1992 under the ministry of agriculture. The main functions of NDDB are to formulate overall policies and recommend plans to government for the dairy development. So the NDDB can enforce the quality control mechanism in the country (NDDB annual report, 2011).

#### ***Department of Food Technology and Quality Control (DFTQC)***

In Nepal, DFTQC is central level authority for the quality control of food products. Under the DFTQC, the food quality division is responsible to control the milk and milk quality of the country. There are some fixed mandatory standards for milk and milk products and monitors the quality (DFTQC, 2008). To determine minimum requirements of milk and milk products in the market, the department can perform regular monitoring and analyses. But DFTQC is not performing in regular interval.

#### ***Dairy Development Corporation (DDC)***

DDC was established in 1969. Before the establishment of NDDB in Nepal, The DDC was involved in the policy formulation and implementation of the dairy sector. But now it is one of the public sector dairy institution in the country and involving in the collection, processing and marketing of the milk and dairy products. So the DDC is indirectly involved in quality control of milk because DDC has organized milk collection and marketing systems in the country. But a few years ago privatization policy was passed by the government and now DDC is on the way of privatization (DDC, 2011)

#### ***Department of Livestock Service (DLS)***

DLS was established in 1993 under the Ministry of Agriculture of the Government of Nepal. The objectives of DLS in the dairy sector are to assist to the farmers for increasing the production of milk and quality improvement. Besides this, the DLS is helping for marketing of livestock products, encouraging for livestock based industries and developing human resources in the sector. Therefore, DLS has a vital role in the quality control of milk chain in the country (DLS, 2013).

### 2.5.4 Factors in the chain

#### ***Political***

The impact of national politics is in the overall development activities of the country. The dairy sector is not exceptional on the impacts of political situation for the effects of milk quality. There needs a stable government for the development of the dairy sector. If the government is stable then they can formulate the different policies and implemented it. But in Nepal, due to the unstable political situation, the government cannot perform their roles since last 8 years. Formulated policies and implementation practices are not favor of the farmers. Due to the unstable government, policies are formulated to be one government and implementation by another government is a big problem in Nepal. Moreover, different political parties are organized general strikes (Nepal Banda) block the road which causes trouble in the transportation of milk from the collection centers to the processing plant. Sometime huge amount of milk is destroyed due to the general strikes (Shrestha et. al, 2011).

## ***Economic***

The economic factor is important for the production and demands of quality milk its products. If the income level of consumers is increasing, they can pay a high price for the quality products and processors also can produce according to their demand. The present scenario of Nepal is high income and conscious consumers are increasing in the urban areas. The per capita income of the people is \$ 742 in 2012 and it is increasing 3% as compared to the previous year (UNDP, 2012). Therefore, the demand of high quality milk and milk products are increasing in urban areas of the country.

## ***Environmental***

The environment is also an important factor for the quality of milk. Clean environment in animals shed, collection center, chilling centers and processing plant is essentials for the high quality of milk. But in Nepal the sanitation practices in every step in the chain is very poor even in milking time of dairy animals.

## **2.6 Role of Government in the dairy sector**

The milk pricing system of the government is a main problem for dairy development of Nepal (FAO, 2010). The NDDB of Nepal determined the price of milk for the farmers and consumers. Although there is a provision to participate the representative of farmers, processor and consumer, the government can influence in the price fixing system,. A few years ago the price of milk in the lean and the flush season was different and farmers got slightly higher price in the lean season. But now the price of raw milk is same in the both seasons (NDDB, 2009).

In 2003, the government of Nepal already decided that privatization of public cooperative to reduce the subsidies of government and create a healthy and competitive environment. Agriculture Prespective Plan (APP) also focuses on the same way. According to the plan, DDC Pokhara has already been privatized in 2005. But due to the unstable government this policy is not followed anymore. If this privatization policy is implemented in the dairy sector, there will be fair competition between private sectors.

In Agriculture Perspective Plan (a 20 year plan designed in 1995 and implemented since 1996), the livestock sector strategy has emphasized in major three sectors on meat and milk production, animal nutrition, health and marketing. Within livestock, dairy is the first priority and buffalo is the priority animal. For milk production, buffalo has first priority because of its importance in both milk and meat purpose (APP, 1995)

Under the APP, livestock products have been considered as demand driven because these products will be greatly influenced to increase per capita income contributor to poverty alleviation and employment.

According to the thirteenth three year plan (2013-2016), free market policy will be adopted for a quality base pricing system of milk and milk products for national and international market. The quality determine on the basis of compositional standard and hygiene of milk. The government also supports to increase the productivity of animal, animal insurance system, collateral free loan for farmers; cooperative training will be expanded in the regional level (NPC, 2012).

## 2.7 Milk price

The pricing system of milk is also an important factor for the motivation of quality milk production. In the context of Nepal, the production cost is high and the price of milk does not cover the production cost. As the result more farmers are diverted to the other business (personal communication with farmers). For the attraction of this sector, there should be an attractive price of milk. There is a huge price difference between farmers and consumers. Due to on hand payment and high price of milk compared to the collection center, some farmers are adopting a middleman for the marketing of the milk (Sharma and baskota, 2007) which led to low supplying in the formal chain.

The reasonable price of milk and incentive scheme is an encouraging factor for farmers in the production of quality milk at the farm level (Kolekar D. V. and Meena H. R., 2012).

## 2.8 Milk supply chain and hygienic practices in India

India is bordering country of Nepal. There are many similarities in dairy sector between Nepal and India. The farming system, cooperative concept, production system, animal breeds, religion and consumption behavior are some example of similarities in the dairy sectors. Besides this, the geographical situation is almost matched in Nepal so that the Indian dairy farming practices are reliable to compare the dairy sectors of Nepal.

### ***Production***

Among the various agricultural activities, the milk production is the one of the major activities in the Indian agricultural sector. The total contribution of the livestock sector to the national gross domestic product (GDP) was 3.6 % in 2010-011 (NDDB/India, 2012).

From the milk production point of view, India is the highest milk producer in the world with an estimated total production of 121 Million MT during the year 2011-012 (Kumar, 2012). During the late 1960s, the government of India initiated a policy in the dairy sector to achieve self-sustain in milk production. Before the start the changed policy named 'Operation flood' the milk production of the country was about 20-22 million MT. This figure shows that, the milk production in the India has increased by more than six times within 50 years of the period. The increasing ratio of milk production is about 4.5% per annum (Kumar A. et al, 2011).

### ***Collection and Transportation***

Milk collection systems in the many developing countries are same. Milk is collected from both formal (organized) and an informal (unorganized) sector. India has also the same situation in the milk collection system. The formal milk supply milk supply is organized after the Operational Flood program. In the formal sector dairy cooperatives, government milk schemes and private processors are involved in the collection and processing of milk. Among them, the dairy cooperatives are larger in terms of market share (Squicciarri M et.al, 2009). The cooperatives are also involved in input supplying and providing the technical services for the farmers (NDDB India, 2012). A general pricing system of milk is on the basis of SNF, fat content and volume of milk. But some cooperatives have already introduced the incentive system for the highest quality of milk (NDDB India, 2012).

Most of the farmers bring their milk in covered steel cans in the collection centers. After collecting in the collection centers, milk is chilled to 4 degrees centigrade and sent it to processing company for further processing of milk in cold chain mentioned milk tanker (CALPI, 2008).

## **Processing and Marketing**

There are three sectors government, private dairies and cooperatives are involved in the processing of milk in India. Approximately 55% of the milk produced is consumed by the producer household and only 44% of milk is sold for the cooperatives. The cooperatives have large shares (49%) in term of processing and marketing the milk and milk products. Similarly the private sectors processes 45% and only 6% of milk is processed by the government sector (The dairy sector of India: a country study, 2006).

For the marketing of the milk and milk product, there is an organized very big market network in the formal sector. The dairy companies are using the different chain for marketing. Some cooperative sales only pouch milk in the country. Some city areas of the country, the standardized milk, buffalo milk, double toned milk is sold by automatic vending machine (Indian dairy product, 2012).

### **2.9 Milk production strategy and Operation Flood program in India**

In the late 1960s, the India has implemented Operational flood program in different phases. This program was started with the support of the World food Program (WFP) and assistance from the European Economic Community (EEC). This program has been one of the largest and most successful rural employment schemes in the world. When the first phase of OF program was started, people of the country were entrusted about the implementation of its task. The chair of NDDDB Anand pattern developed a three layer tire structure. The structure was Dairy Co-operative Societies at village level, District Co-operative Milk Producers' Union (DCMPU) at the district level and Federation of District Co-operative Milk Producers' Union (FDCMPU) at the state level. Different tasks and responsibilities were also provided them (Kumar, 1997). The main task of cooperatives was to collect milk from the farmers and supplying the inputs to the farmers.

At the end of OF III, coverage of the milk sheds grew to 170, DCS organized to increase average milk collection became 11 million liters a day and the processing capacity to 19.4 million liters a day (Singh, 2002).

### **2.10 Milk testing and quality control in developing countries**

#### **Introduction**

The milk testing systems and payment system of the milk is different in various developing countries. Many developing countries use only compositional quality (usually fat and SNF) with the combination of mil volume for the payment of milk. (J. Draaiyer et. al FAO, 2002). In most of the developing countries the system of quality control in the milk chain is not well organized. Due to the high demand of high quality milk and milk product in the international market, developing countries are also compelled to adapt the hygienic quality for the milk payment in combination with compositional quality.

#### **Milk testing**

Different milk testing methods which can be easily carried out during the reception time of milk in the collection center. Among them, some very simple milk testing procedures that are suitable for small-scale farmers and small collection centers in developing countries are given below.

#### **Organoleptic test**

This is a very common and simple test generally performed in all milk collection centers. It does not need any tools and chemicals for testing and it is also a cheapest and quickest method. But this method is not very reliable for generalize of the quality of milk. If there are any doubts arise in the organoleptic test, other tests can be done for the assurance of the hygienic quality of the milk.

### ***Density meter or lactometer test***

The lactometer along with the fat content test is valuable to identify the addition of water in the milk. At 15 degree Celsius, the normal density of the milk ranges from 1.028 to 1.033 g/ml whereas water has a density is higher, and then the milk might have been skimmed. If the results of the fat content test are low and the density is low, then water might have been added to the milk (Draaijer, 2002).

### ***Clot-on-Boiling (COB) test***

The COB test is also very simple, easy, quick and cheap test. If the milk is sour or abnormal like colostrum or mastitis milk, that milk will not pass this test. For this test, put 5 ml of milk in a test tube and boiling it up to 4 minutes and examine the test tube and reject the milk if you see the milk clotting. But this test is not much sensitive to slightly sour milk (Draaijer, 2002).

### ***Alcohol test***

The different strength ethanol alcohol is used for this test. Generally 68% ethanol alcohol is used to test the abnormality of the milk like colostrum, mastitis milk. This test can perform by mixing equal (2 ml) volume of milk and alcohol. If the milk contains more than 0.21% acid, it will coagulate (Draaijer, 2002).

### ***Acidity test***

This test is slightly complicated compare to previous tests. This test measures the lactic acid in the milk. If the acidity is higher than 0.19% then the milk quality is poor and cannot be processed it (Draaijer, 2002). If the acidity is lower than normal level (0.10%) then the milk is poor in bacterial quality.

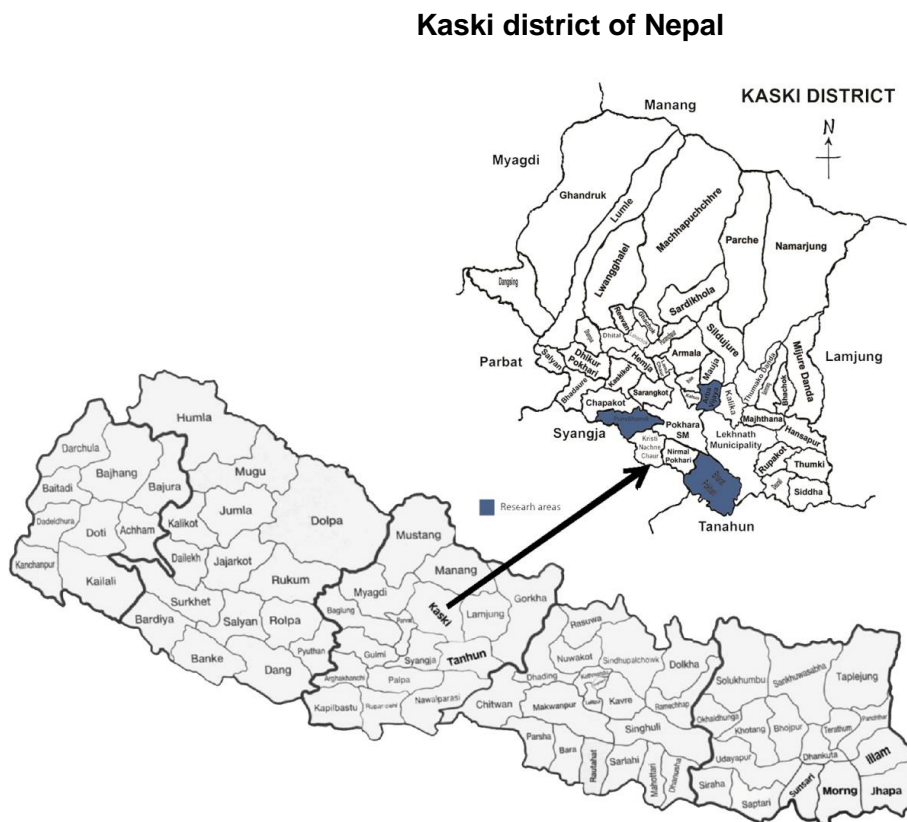
## CHAPTER 3: RESEARCH METHODOLOGY

This chapter presents the selection of study areas, selection of cases for case studies and the respondents for the survey. Furthermore, this chapter also deals with methods of data tabulation and its analysis. The research approach was both quantitative and qualitative based on the empirical data. The primary data was collected from the survey and case and secondary data was gathered from the study of different literatures, documents and the internet sites.

### 3.1 Selection of site

Because of a short duration of time for the research work, the study area was already allocated in the research title and the objective of the research. Selection of the study area was not the only time duration but the other following points taking to the selection.

- Kaski is a hilly district which is situated in the western development region of the country. Pokhara is the capital of the district as well as the western development region. The district is almost situated in the central part of the country. That's why the situation can represent at least the hilly districts of the country.
- The milk processors are collecting milk from the other neighboring district so that the survey and case study were effective to collect the information about hygienic practices during the milk transportation.
- Pokhara is a natural beautiful city which is worldwide famous for the tourism. The demand of high quality milk and milk product of the city is higher than the other districts and the city. So the case studies were effective to gather the information about the quality control and hygienic practices for the production.



**Figure: 7 Research Site of the district**

Source: adopted by author form DLSO, Kaski 2011



### 3.2 Survey

For the survey, a structured mostly closed type questionnaire (ANNEX I) was used to gather about the hygienic milk production system. Before conducting the survey, the questionnaires were translated to the Nepali language and the researcher facilitated to fill-up procedure of the questionnaires during the survey time.

The survey was conducted on 30 randomly selected farmers from 3 MPCS of 3 different village development committee of the district. The MPCS were selected from the different part of the district. During the survey, short discussions with farmers were organized to get the general views of the farmers who are not involved in the survey. This discussion has helped to increase the confirmation of the data collected from the survey.

### 3.3 Selection of the respondents

All the respondents were the members of the MPCS who came with milk in the collection centers were selected for survey. The staffs of MPCS were asked for the selection of the farmers on the following criteria.

- It is planned to select the respondents who are always selling milk in the milk collection centers.
- It is planned to select the respondents who are involved in the milking process.
- The number of respondents from one MPCS should be ten.
- The respondents should be literate, curious and willing to give accurate information.

### 3.4 Case studies

In the case studies, two staffs from each processor were selected for the interview. The processors for case study were chosen with discussion by an experienced person of the dairy sector on the basis of following criteria.

- One should be represent from large dairy processors and one from the small dairy processor in terms of the production capacity and product diversification.
- One should collect milk from Kaski district and one should be collect from other districts. The expectation was to obtain the cold chain management during the transportation of milk.

The Sujal Dairy Company was selected from large dairy processor of private sector in the district. The SDC has produced different dairy products except pasteurized milk. The Lovkush dairy company was selected from the small dairy processor. The company has produced limited milk product and collected the raw milk from other districts of the country.

The case studies were taken with two managers from SDC and two officers from the Lovkush dairy processor on the basis of semi-structured questionnaire (ANNEX-II). The information collected by the processors was cross-checked during surveys in the field.

### 3.5 Fieldwork and data collection

The field work was carried out within a specified period of 3 weeks (16th July to 9th August). The questionnaires were prepared before going to field work but some changes were made after its pre- test. The visit of the dairy farm and survey of the farmers was organized on the same day, generally morning time was used to visit farmers for the survey and day time was used to visit to the dairy processing company.

### 3.6 Data tabulation and analysis

The collected data was tabulated in the Microsoft excel sheet. The figures (Pie chart and bar chart) and tables were prepared for the explanation of the data. The respondents were divided into two groups on the basis of selling more and less than 10 liters of milk per day. The analysis which is more related in the hygienic practices are presented in two groups, but the related to management aspects are presented in a single group. In addition, response of every respondent was taken important because a small amount of contaminated milk is sufficient to defect in the bulk.



## CHAPTER 4: RESEARCH FINDINGS

This chapter presents the major findings of the survey and case studies collected in the research area during the field visit to Nepal. To make an easy interpretation of the results the major findings of the survey are figured out in charts and tabulated. In addition, the major points of the interpretation are highlighted. The findings of the two case studies of the dairy processing company are also described in this chapter.

### 4.1 Survey

It was planned to collect data from 30 selected farmers in three different Village Development Committee (VDC) of the Kaski district. Another planned criterion for the survey was only 10 respondents selected from each VDC. But during sampling time, the number was slightly changed and the data were collected from 14 farmers from one VDC, 6 and 10 from other two VDC. The collected data are divided into two categories based on the amount of milk sell per day by the farmers because researcher wants to compare the differences of hygienic practices between small scale farmers (selling <10 liters) and medium scale farmers (selling >10 liters). According to this category, 13 farmers who are selling less than 10 liters of milk and 17 farmers who are selling more than 10 liters of milk to the collection center in a day are selected.

The findings of important question that are more related to the hygienic practices are presented on the basis of the two groups. The question number 4 activities performed by the farmers while producing milk, question number 5 use of milk from mastitis suffering animals, question number 6, use of milk produced from treated animals by drugs, question number 12 difficulties for the hygienic milk production and question number 14 farmer level test before delivering the milk to collection centers are described on the basis of two groups

Rest of all questions that are related to the management aspects are presented in a single group.

#### 4.1.1 Milk sells to the dairy company by the farmers and price of milk

This result is related to question number 2 and question number 3 on the survey questionnaires of dairy farmers. The Safal dairy company and Gaurishankar dairy company of the district have started the price of the milk on the basis of the quality of milk including fat, SNF and its volume. But during the time of the survey, the farmers supplying the milk to Salfal dairy could not be found. Out of 30 respondents, only 5 (17%) number of farmers are selling their milk to the quality based pricing system. Remaining 83% of farmers are selling on the basis of Solid Not Fat (SNF) and fat content of the milk (figure: 8).

The price of milk is found almost same in the three collection centers. Some respondents were not interested to give an accurate price because the price is depending upon the SNF and fat content of the milk. In an average the milk price is found NRs. 36 to NRs. 38 per liters of milk.

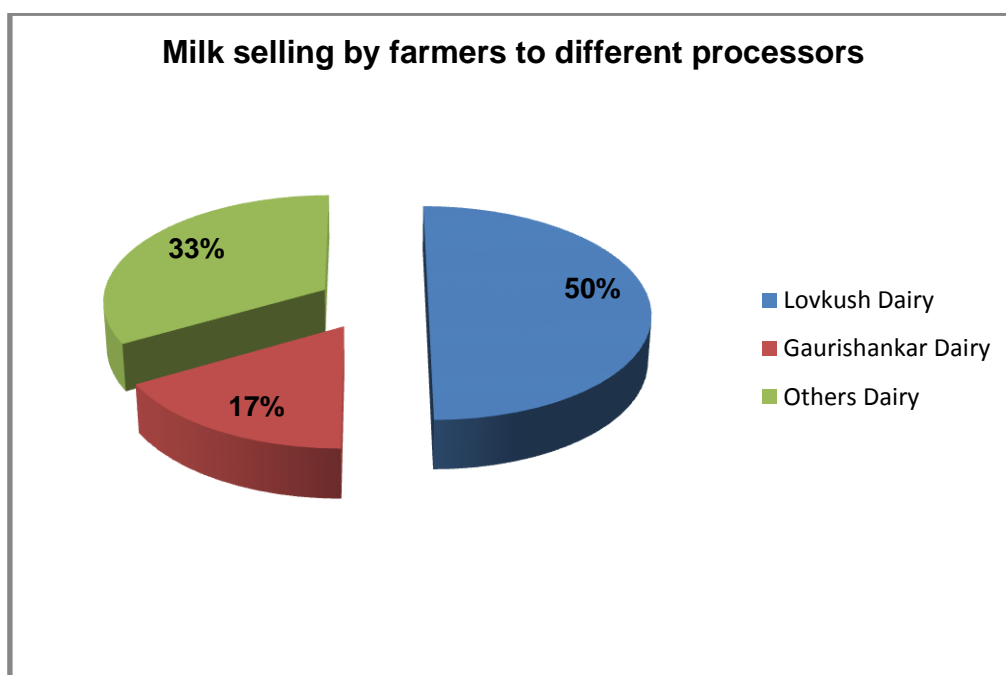


Figure: 8 Milk selling by farmers to different processors

#### 4.1.2 Performed activities by farmers while producing milk

This is related to the question number 4 of the survey questionnaire. Some basic and important activities for hygienic practices are performed by the farmers on their farm during producing the milk. The survey result shows that there is not a big difference in performing activities between two groups (selling less than 10 liters and more than 10 liters). Most of the farmers performed sanitation of shed, cleaning of animals and its udder, hand washing before milking and delivered milk as fast as possible to the collection centers (Table 1).

Table: 1 Performed activities by farmers while producing milk

S.N.	Performed activities	Less than 10 liters			More than 10 liters		
		Yes	No	Percentage	Yes	No	Percentage
1	I always clean the shed of animal	10	3	77	16	1	94
2	I always clean the animal	10	3	77	15	2	88
3	I always clean the udder and teat with clean water before milking	12	1	92	17	0	100
4	I always make the udder dried after washing by using clean clothes	8	5	62	11	6	65
5	I always clean my hands with soap and water	11	2	85	16	1	94
6	I always wear the clean clothes or apron during the milking of animals	3	10	23	12	5	71
7	I have never milked if I am suffering from any disease, cough, cold or any other diseases	5	8	62	3	14	82
8	I always use clean utensils (aluminium/Stainless steel) for milking	9	4	69	15	2	88
9	I always used to clean utensils with detergent after milking	9	4	69	15	2	88
10	I always put the milk in cool condition as much as possible	9	4	69	15	2	88
11	I always deliver the milk as fast as possible time to collection centers as possible	10	3	77	14	3	82

Above data shows that 62% of the farmers who are selling <10 liters of milk per day and 65 % of farmers who are selling >10 liters of milk per day are applying the practice of drying the udder and teat of milking animals after cleaning with water. Cleaning of milking utensils before and after milking with detergent and keeping the milk in cool condition condition as much as possible is done by 69% of farmers selling <10 liters and 88% of farmers selling >10 liters per day. Only 23% of the respondents selling <10 liters milk are positive to wear the clean clothes or apron during milking time, but 71% of farmers selling > 10 liters are positive about it. In general, farmers who are selling <10 liters are less aware about the hygienic practices compared to the farmers who are selling > 10 liters milk per day. But above mentioned activities are very important for the production of hygienic milk at farm level. Everyone farmers should strictly follow these activities for hygienic milk production because a small amount of contaminated milk is sufficient for contamination of bulk of milk in the collection center.

#### 4.1.3 Use of milk produced from the unhealthy animals

The result is related to the question number 5 of the survey questionnaire. Many farmers are destroying milk which is produced from the mastitis suffering animals (Figure 9). But, some respondents from selling <10 liters are not taking care about it and selling to the collection centers. In this case there is a high possibility of contamination of milk in the collection center.

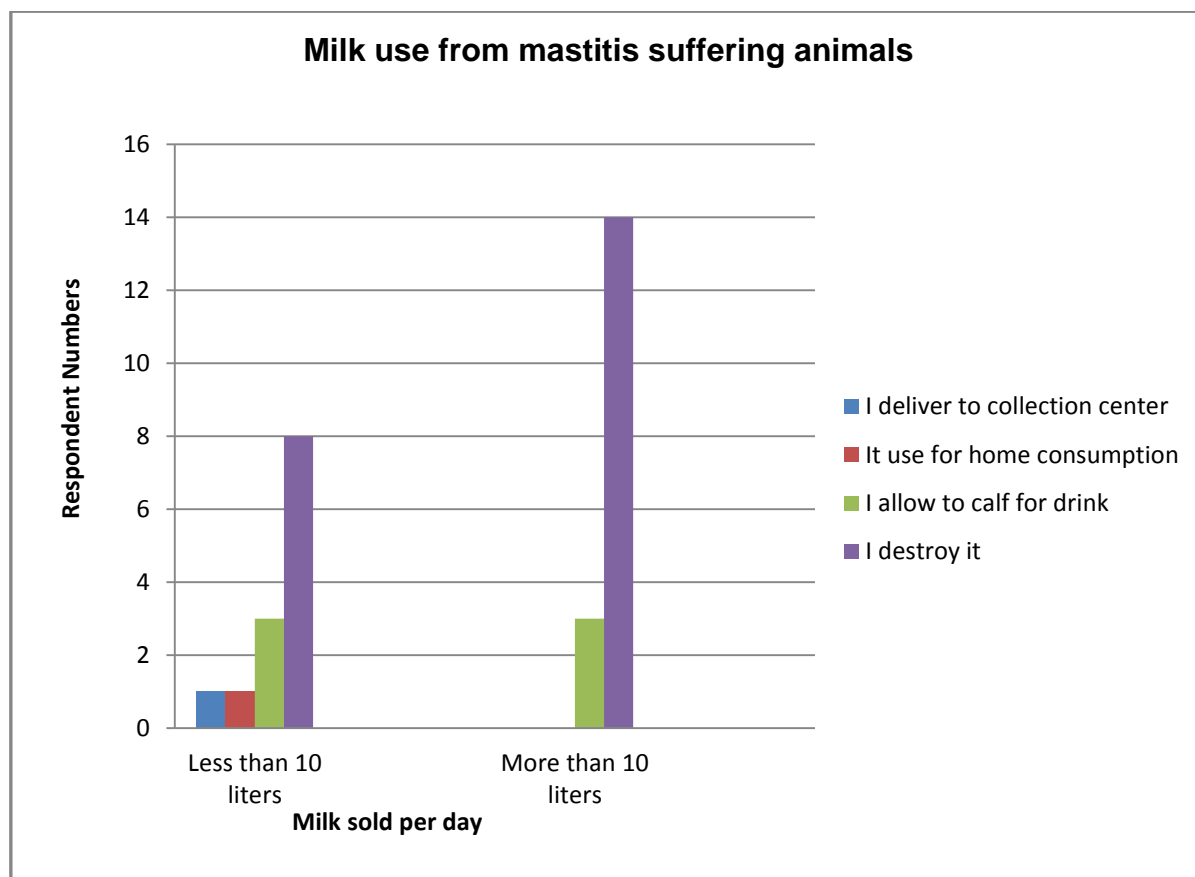


Figure: 9 Milk use of mastitis suffering animals

It is not possible to test the result for significant differences, because the number of cases was too low so the test was not reliable.

#### 4.1.4 Use of milk from animals treated with antibiotics and medicines

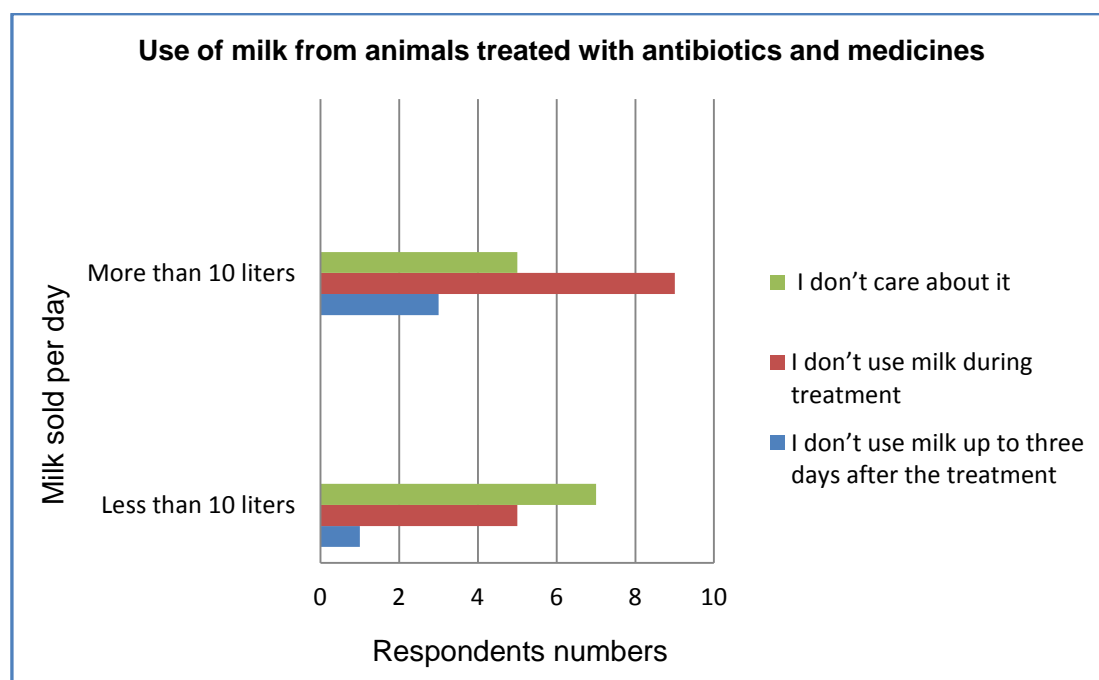


Figure: 10 Use of milk from animals treated with antibiotics and medicines

The result is related to the question number 6 of the survey questionnaire. 53% of farmers who are selling >10 liters of milk and 38% of farmers who are selling <10 liters of milk are not using milk from the treated animals. But, 54% of the respondents from selling <10 liters and 29% of respondents from selling >10 liters of milk per day don't care about the use of milk from the animals treated with antibiotics and other medicine (Figure:10). The milk is not appropriate for human consumption if the milk is collected from animals treated with antibiotic and other medicine because all medicine has certain withdrawal period.

#### 4.1.5 Quality control, testing and payment system of milk

The result is related to question number 7. Out of 30 respondents, 19 (63%) answered that all three activities are performed by the employer in the collection center. But, 6 (20%) respondents are aware only about measure the volume of milk and (5) 16% of respondents are aware about seeing the quality of milk from the collection center (table: 2).

**Table: 2 Activities carried out in the milk collection centers**

S.N.	Activities	No. of respondents
1	Measurement of volume only	5
2	Fat content test only	0
3	Quality test by seeing only	6
4	All of above	19

Table: 3 Quality control mechanism of milk in the collection center

S.N.	Test performed	No. of respondents	Percentage
1	Test for bacterial contamination	3	10%
2	Organoleptic test	17	57%
3	Clot and Boiling (COB) test	8	26%
4	Non	2	7%

The result is related to question number 8 of the survey questionnaires. The result shows that organoleptic test is common in the milk collection centers. This is very simple and fast test as well. The clot and boiling test (COB) is done only for suspected milk (table: 3).

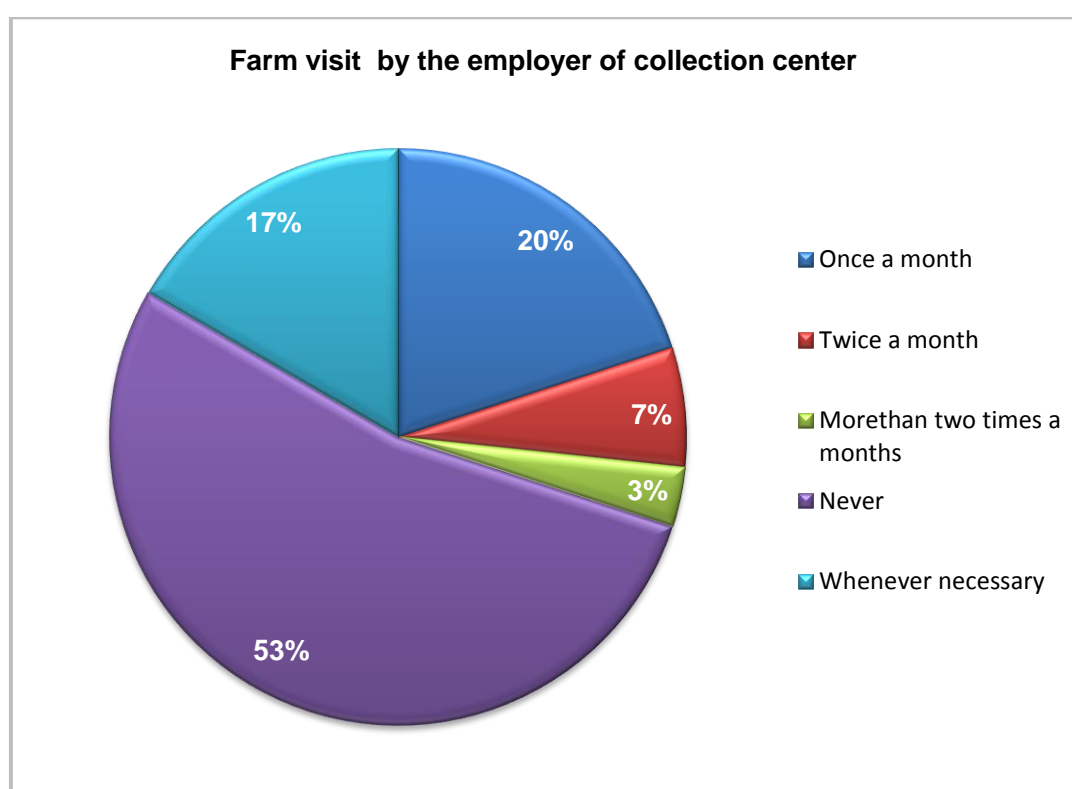


Figure: 11 Farm visit by the employer of collection center

The result is related to question number 9 of the survey questionnaire. The result shows there is not sufficient visit conducted by the employer of the collection centers. Because 53% of respondents answered that the farm is not visited to check the hygienic condition of the farm during the month. But some farms are visited by the employer of collection centers. A regular farm visit from the concerned authorities should be done to monitor and supervision of the hygienic practices during the milk production at farm level.

Table: 4 Farmer level test before delivering the milk in the collection center

S.N.	Performed activities	Farmers selling less than 10 liters		Farmers selling more than 10 liters	
		Positive respondent numbers	Percentage	Positive respondent numbers	Percentage
1	Organoleptic test (see, smell, taste)	6	46	3	18
2	Clot on boiling (COB) test	2	15	7	41
3	Non	5	38	7	41

The result is related to the question number 14 of the survey questionnaires. The above data shows that 41% of the farmers who are selling >10 liters of milk and 38% of farmers who are selling <10 liters milk per day delivered their milk without performing any test. At the farm level, the simple test is needed to measure the quality of milk. Although Organoleptic and COB test is very easy and simple for farmers, the majority of the farmers was found not applying it before delivering milk in the collection center (Table 4).

Table: 5 Milk clotting problem at farm level

S.N.	Number of spoilage due to clotting of milk	Number of respondents	Percentage
1	Only one time a month	5	17%
2	Two times a month	4	13%
3	More than two times	2	7%
4	Never	19	63%

The result is related to the question number 10 of the survey questionnaire. The result shows that the majority of respondents did not face the clotting problem in their farm. But, 17% of the respondents were faced the problem one time a month, 13% of the respondents were faced two times a month and only 7% of respondents were faced the problem of milk clotting more than two times a month in the summer time.

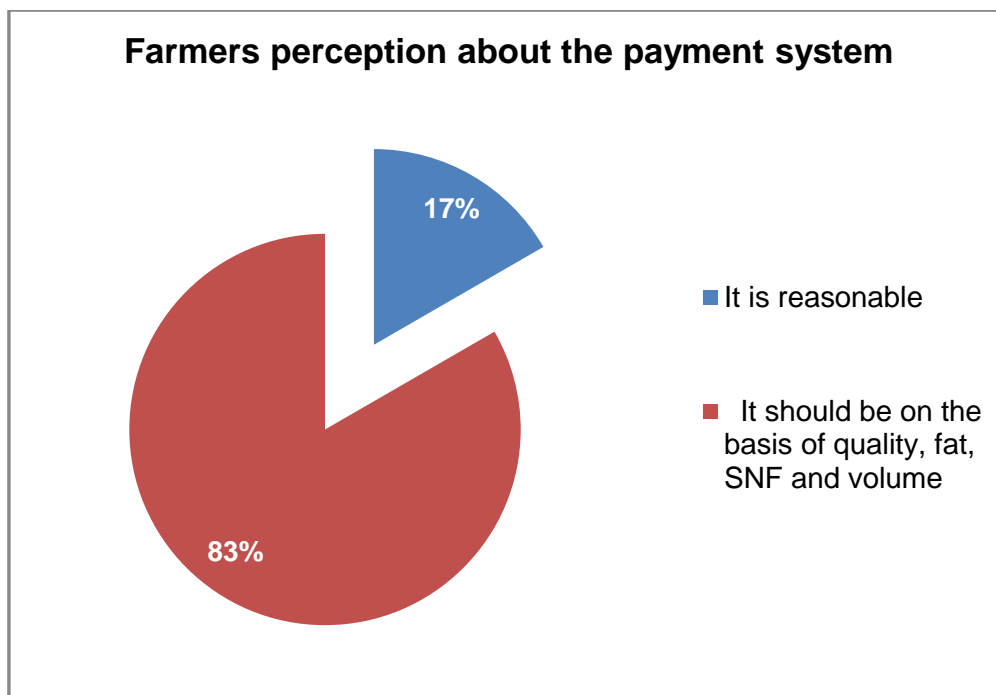


Figure: 12 Farmers perception about the payment system

The result is based on the question number 16 of the survey questionnaires. The majority of the farmers were against the present payment system based on fat and SNF content of the milk in combination with volume. They wanted to add hygienic quality in a milk payment system of the district.

#### 4.1.6 Unhygienic milk and its effect on human health

The result is related to question number 11 of the survey questionnaires. The result shows that 80% of the farmers were aware about the effect of unhygienic milk on human health. They know that consumption of unhygienic milk can cause disease in human beings. 17% of the farmers have not any idea about the effect of unhygienic milk.

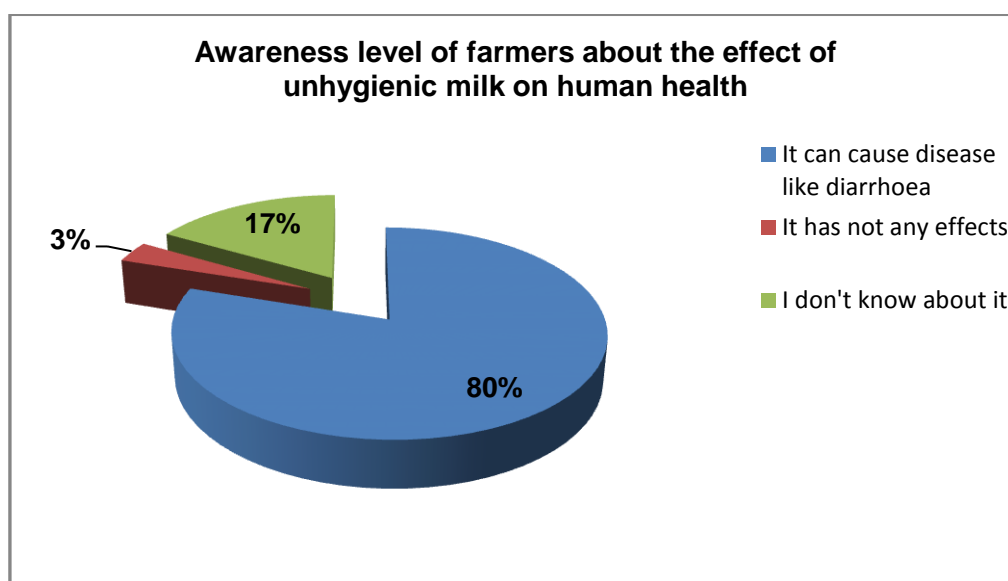


Figure: 13 Awareness level about the effect of unhygienic milk on human health



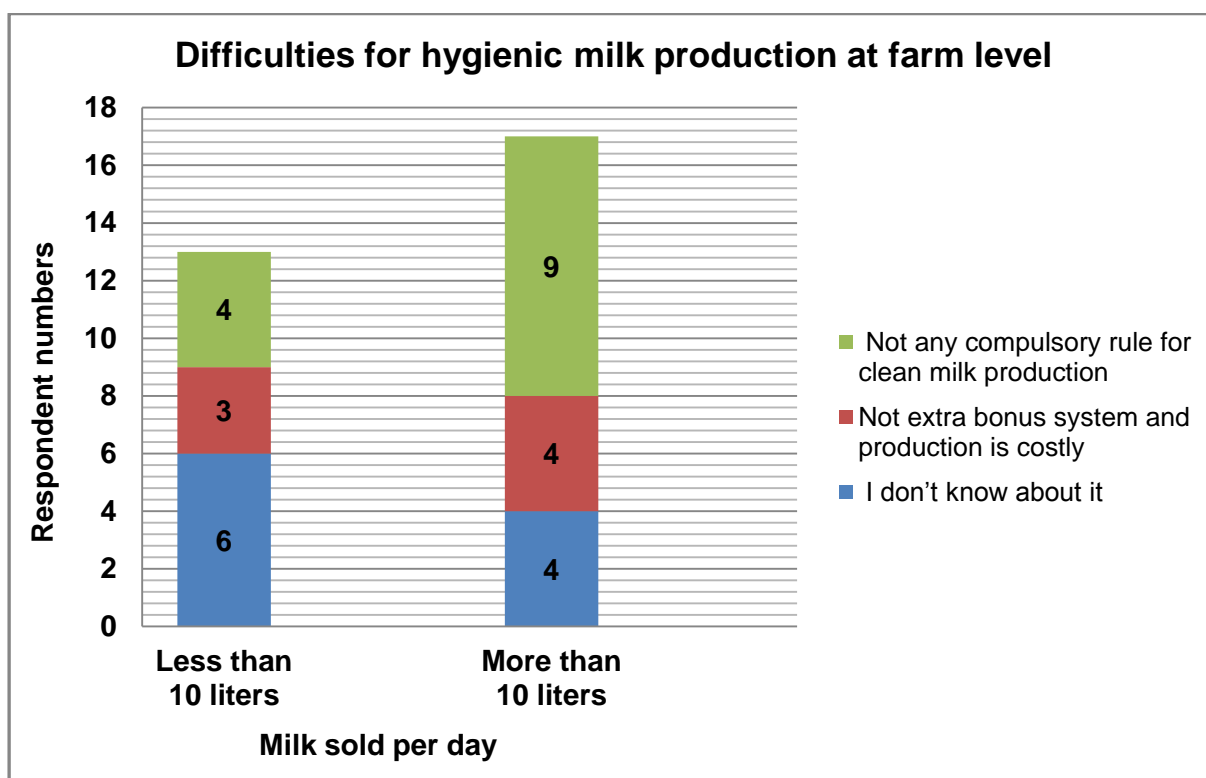


Figure: 14 Difficulties for hygienic milk production at farm level

The result is related to the question number 12 of the survey questionnaires. The result shows that, 44% of farmers were not produced hygienic milk because there is not any compulsory rule for hygienic milk production. Similarly, 23% of farmers were not motivated because there is no provision of the bonus system. 33% of farmers don't know about the hygienic production.

Table: 6 Willingness of hygienic milk production at farm premise

S.N.	Test performed	No. of respondents	Percentage
1	I will produce on hygienic way	17	57
2	I don't produce	0	
3	I am already producing on hygienic way	13	43

The result is related to the question number 13 of survey questionnaires. Above data show that 43% of the surveyed farmers are producing the milk in the hygienic way. 57% of the farmers are willing for the production of hygienic milk if there is system of bonus for good quality milk and penalty for bad quality milk.

#### 4.1.7 Expectation of farmers from concerned authorities

The individual expectations of the farmer were also collected during the survey (question number 17). Major expectations of the farmers from the milk collection center, the dairy processing company, the government sector and the non - government sector are as follows.

- Milk price should increase on the basis of cost of production
- Availability of veterinary service for treatment and prevention of diseases
- Training of farmers for animal management and hygienic milk production
- Availability of credit facilities at low interest rate
- There should be a provision of award or prize for best farmers within a particular area at least one time a year
- Availability of veterinary medicines at reasonable price
- More participation of farmers in policy making body of the dairy sector
- There should be a system of animal insurance

#### 4.2. Case studies

##### 4.2.1. Milk Supply chain of Sujal Dairy Company, Kaski

###### **Introduction**

The Sujal Dairy Company (SDC) is a private dairy company which was established in 2005. The SDC has been involving in collection, processing and distribution of milk in Kaski district since its establishment. The Sujal Dairy Company is the name of former Pokhara Milk Supply Scheme of Dairy Development Corporation (DDC) after it has been privatized.

During the field work, two managers of Sujal Dairy Company were interviewed on the basis of semi- structured questionnaire. The managers were one from production department and one from the marketing department. The survey was carried out for getting detailed information and knowledge about the milk production, supply chain and the quality control mechanism of the company. The following section describes the detail information.

###### **Production**

Total milk production in the district is low which cannot meet the demand of growing consumer of the district. Total milk demand in the city areas of the district is about 60- 65 thousand liters per day and the whole production of the district is 100 thousand liters per day in flush season. But after the home consumption, only around 41 thousand liters milk is collected in the processing company. Still there is about 19 – 24 thousand liters milk deficit per day. Almost throughout a year the deficit amount of milk is imported from the other districts. In the lean season milk is also imported from the India. The farming trend and the milk production ratio of the farmer is similar to the other part of the country. Most of the farmers are rearing 1-5 milking animals and producing 5-10 liters milk per day. Most of the farmers prefer a buffalo for milking animals as described above. But buffaloes are the seasonal breeder so the production of milk depends upon the seasons.

The production capacity of the plant is 100 thousand liters per day. But due the shortage of milk, currently the plant is processing about 50 thousand liters of milk per day in flush season and about 35 thousand liters milk per day in the lean season. The company has collected around 24-26 thousands liters milk per day from the Kaski district. The remaining amount of milk is imported from the other districts of Nepal. During the lean season, mixing of the skimmed milk powder in the milk is common practices. The skimmed milk powder is also imported from the India

## ***Collection***

In the district, there are more than 70 numbers of village level milk producer farmers' groups who are involved in the production and collection of milk. These groups are formulated in the different places of the district. In some part of the district there is also involvement of middlemen for the collection of milk from farmers. The company is collecting milk from different 9 collection centers of the districts. In the collection center, the appointed staffs from the cooperatives are involved in the milk collection. The main duty of the staff is to measure the volume of milk and test the fat and SNF of the milk. After the collection, milk is transported to the processing plant. Generally the milk is collected once in the morning at 7-8 AM. The evening milk is used for home consumption and surplus amount kept in cold condition as much as possible. Next morning the farmers mix the evening milk with the morning milk and bring it to the collection center.

## ***Transportation***

All farmers bring their milk themselves to a collection center in small aluminum cans or in plastic buckets. Most of collection centers have a chilling facility in the district. If the collection centers have not chilling facility, the milk is transported to the chilling center in aluminum cans. The capacity of the cans is 40 liters and same size and color of cans are used in every collection centers in Nepal. The collection centers and chilling center are used 40 liters aluminum cans for the transportation of milk to the processing plant and jeep or tractors are used for the transportation of milk. In some cases porters are also used for the transportation if the road condition is not good. The time taken to bring the milk from the collection or chilling center to the processing plant is about 5 hours but technically the milk should be cooled up to 4 degree centigrade within 4 hours of milking (Dairy Farm Energy Management Guide, 2004). In addition, the exposure of milk in sunlight during the hot season of the year declines the quality of the milk during transportation.

## ***Milk testing and payment system***

Most of collection centers are tested for fat and solid not fat during the collecting time in the collection centers. Fat content test and SNF test are compulsory done in the collection center because the milk price is determined on the basis of fat content and solid not fat (SNF) content of the milk with its volume. Normally, the processing company pays an average Nepalese rupee 41 per liter of the milk to cooperative and cooperative takes around 12% as cost of management. Therefore, the farmers receive only about 36-37 per liter of milk and the selling price of the standardized milk in the market is 52 per liter and whole milk (5% fat and 8% SNF) is Rs. 54 per liter. The Sujal dairy pays a slightly higher price (Rs.1) than the other dairy for the good quality of milk to the farmers.

After receiving the milk in the processing plant, again the fat and solid not fat test is done for price determination and for deciding to accept or refuse the milk. Clot on Boiling (COB) test and organoleptic test are common in the milk collection center but the COB test is done only suspected milk. In the processing level, the milk is tested by using COB test and Alcohol test. After completing all the tests at the processing plant, the milk is cooled up to 4-5 degree centigrade before further processing.

## ***Processing***

In this processing plant, the milk is pasteurized in 80 degree centigrade for 30 seconds. The pasteurizer machine also cools the milk after pasteurization. Then after it standard into two categories that are 3% fat and 8% SNF for normal pasteurized milk and 5% fat and 8% SNF for whole milk. The price of whole milk is 2-3 rupees higher than standardized milk. Then the milk is automatically packed in plastic pouches of half liters. In addition this, the SDC is producing ghee, butter, panner, yoghurt (Dahi) and ice cream. But the main product of this processing plant is milk, yoghurt and ghee.

### Quality control

Due to the unhygienic practices followed at the farm level during the producing of milk, the processing company unable to receive the standard quality milk. Besides this, there are other reasons which led to decrease the quality of milk. Long distance transportation of milk before it chilling, not maintain the required temperature during the transportation and the absence of an organized quality control mechanism in the milk supply chain of the district.

### Marketing

The major product of the company is standardized (3% fat and 8% SNF) pasteurized milk and yoghurt which is marketed through the six authorized dealers and more than 70 retail shops located in different places of Pokhara city (Kaski district). The milk and yoghurt are distributed early in the morning from 2:30 to 5:30 AM. The milk is transported to the dealers and sales centers in non-refrigerated ordinary vehicles so that the cold chain is broken while transporting the milk during distribution.

**Milk supply chain of Sujal Dairy Company**

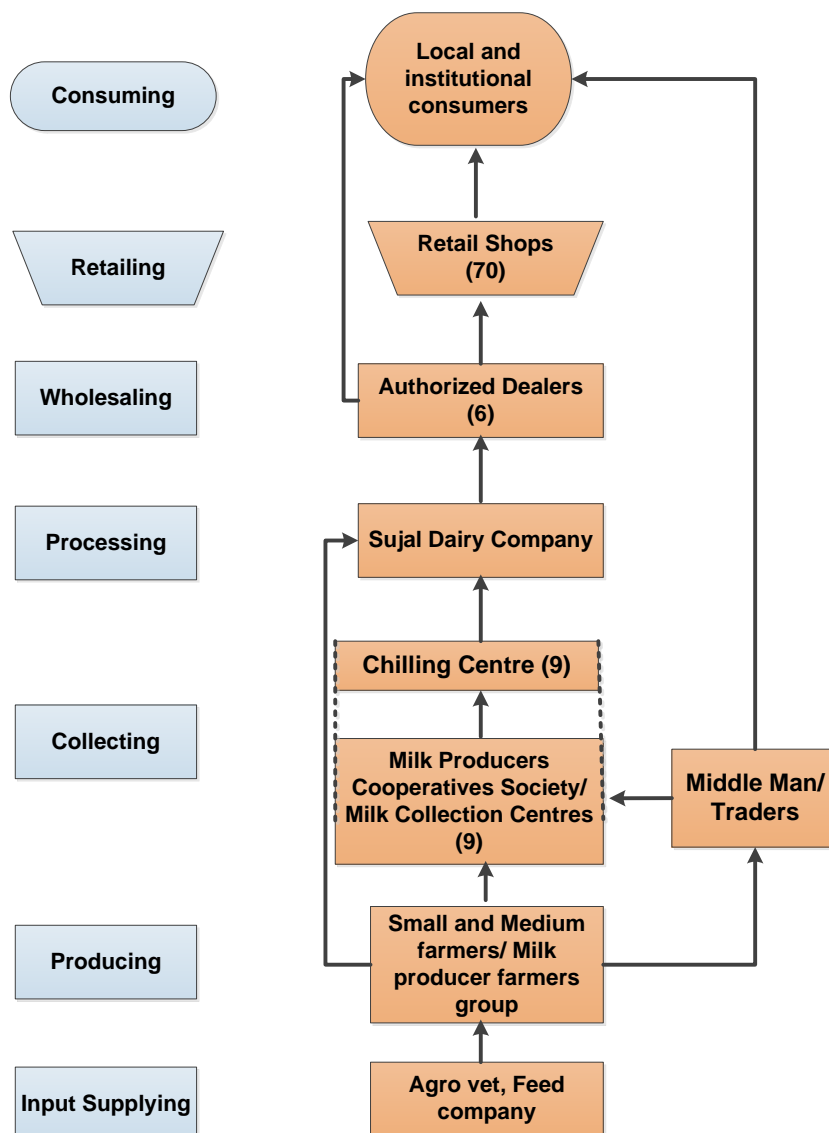


Figure: 15 Milk supply chain of Sujal Dairy Company

### ***Major limitations in the milk supply chain***

The managers (interviewee) were focusing on different constraints factor of the milk supply chain. Due to the poor government policy in the dairy sector, the price of milk is not reasonable at the producer level because the cost of production is very high compared to the milk price.

The Dairy Development Corporation (DDC) is responsible to determine the price of milk in the country. DDC only can decide after the meeting with MoAD, NDDDB, Dairy Producer Association and farmers. Although the meeting is conducted with representatives of different sectors, the high influence of government in the price fixing of the milk is dominant. The government support in the dairy sector is poor. There is not any hard and fast rules and regulation for the quality control. The quality control department is not performing monitoring and supervision for quality control.

In the pricing system, the quality of milk is not considered. There is not a provision of the bonus and penalty for hygienic and unhygienic milk at farm level. The farmers should invest high cost for the production of hygienic milk production, but they are not getting the extra price for the hygienic milk. That's why; most of farmers are not motivated for hygienic milk production at farm level.

### **4.2.2 Milk Supply Chain of Lovkush Dairy Company, Kaski**

#### ***Introduction***

The Lovkush Dairy Company was established in 2008 in Pokhara (Capital city of the Kaski district). This company is a small company having 16 thousand liters of milk processing capacity in a day. The company has been involving in milk collection, processing and distribution of the products in the Kaski district.

During the visit time, the researcher interviewed with two officers of the company by using the semi-structured questionnaire to get detailed information about the milk supply chain and quality control mechanisms. Furthermore, the researcher also observed the milk processing plant to know about the milk processing and quality control. The detail information about about the case study is given below.

#### ***Production***

The Lovkush Company is collecting milk from other districts especially from Syangja and Tanahun districts. A little amount of milk is collected from the Kaski district. The processing capacity of the plant is 16 thousand liters per day and only around 4 thousand liters milk collects in the surrounding areas of the Pokhara in the flush season. The remaining amount of milk is imported from other districts as mentioned above. The dairy sector of the country is not commercialized so that farmers keep 1-5 milking animals for the production of milk. The total production of milk is very low and it does not meet the demand of consumers. Due the lack of milk in the lean season, the processing plant used to mix skimmed milk powder in the milk as described above SDC case.

#### ***Collection***

The company collects the milk from 5 chilling centers located in Syangja (two numbers), Tanahun (two numbers) and Kaski (one). MPCs and middle man have been involving for the collection of the milk in the collection centers. The staffs of the collection centers measure the volume, fat content and SNF level of the milk. Small chilling vats are placed in many MPCs if there is electricity facility, but some MPCs do not have a chilling facility so milk is transported to the chilling centers.

Generally, the milk is collected only once a day in the morning. In Syangja district, per day about 6 thousand liters of milk is collected by 24 MPCs and around 7-8 middle men also involving in the collection of milk from farmers. In Tanahun, there are 19 MPCs involving in the collection of the milk and collecting about 5 thousand liters of milk per day. In Kaski, about 4 thousand liters of the milk collected daily.

### ***Transportation***

The collection trend is same as described in the Sujal dairy company. Usually, the farmers carry their milk by themselves in collection centers. If the collection centers have not chilling facility, the milk is transported to the chilling center in 40 liters aluminum cans. There is not fixed time for chilling, sometimes it remains more than 24 hours. After chilling, the milk is transported to the processing plant in an aluminum cans. The duration of transportation from the chilling center of processing plant is taken about 3-4 hours.

### ***Milk testing and payment***

The collection center is tested fat and SNF of the milk for the payment, because the milk price is determined on the basis of fat and SNF content of the milk with the combination of its volume. Normally, the processing company pays about Rs. 40 per liters and MPCS deduct 10% management cost from this amount. So, the final price of milk for farmers is about Rs 36-37 per liters.

After receiving the milk in the processing plant, the organoleptic test, COB test and alcohol tests are done by the staff of the company. After completing the tests, if milk is accepted for further processing the raw milk is chilled up to 4-5 degree centigrade for the around 8-12 hours.

### ***Processing***

After completion the chilling process, the milk is pasteurized at 75-80 degree centigrade for 30 seconds and cooled down at 60 degree centigrade for 20 minutes. Then the milk is standardized in two categories and automatically packed system is same as described in the above case study. Apart from the milk, company processed other product like yoghurt, ice-cream, butter and ghee. The company strictly follows the storage rule that's why all processed products including milk are stored under the 4 degree centigrade temperatures till before it delivering to the consumers.

### ***Quality control***

Although the unhygienic practices at farm level is very high the factory is aware about the quality of the milk comparison to others dairy processors. The company conducts awareness program to the farmers and different collection centers for producing high quality of the milk. But the implementation of practices is very low at farmers' level. According to interviewees, the company is more conscious about the cleaning utensils in collection centers as well as in the factory.

Most of the collection centers have a chilling facility so that the chance of bacteria growth is less in the milk. But lack of organized transportation facility from the collection center to the processing company, the quality of milk is always remarkable.

### ***Marketing***

The company has two brand shops and 3 authorized dealers in Pokhara and Lekhnath municipality of the district. The brand shop and dealer sales the milk and milk product to the retailers and also direct sales to consumers. The company has 3 vehicles to distribute the products in the city areas. But these vehicles have not the cooling facility so that the milk and yoghurt are distributed early in the morning at 2 AM and it finished at about 9 AM.

### ***Major constraints in the milk supply chain***

The officers of the company also indicated same constraints as indicated by the managers of SDC. The major constraints focused by officers were lack of farmers' awareness in the hygienic milk production at farm level and unfavorable government policy in the dairy sectors of the country.

### 4.3 Similarities and dissimilarities of two dairy companies

Similarities	Dissimilarities
The milk collection process of both companies is found similar. They collect the milk from the MPCS and farmers' groups at village level.	The processing capacity of Sujal dairy is around 50 thousand liters per day but Lovkush processed only 16 thousand liters per day.
Farmers' involvement in the collection process is found same because they bring their milk themselves in the collection center.	Sujal dairy is collected more milk from the Kaski district but Lovkush is collected more milk from other districts (Syangja and Tanahun).
The milk testing system is found similar. In the collection center, they are adopting SNF and fat content test. In the processing level both companies are adopting COB and alcohol test.	Milk transportation time from the collection center to company is different because of road access, The Sujal dairy takes around 5 hours to collect the milk but Lovkush takes only around 3 hours.
The processing of milk is also found same because both companies are applying high temperature short time pasteurization.	The milk price is found slightly different. Sujal dairy paid around Rs 41 per liter but Lovkush paid around Rs 40 per liter. Sujal dairy already introduced high price system for high quality of milk.
The marketing process of the products is found same because both companies have dealers/ sales center in the city areas.	The product diversification is found different because Sujal dairy produced different products like ghee, butter, panner, yoghurt and ice cream but Lovkush dairy produced yoghurt and ghee.
The delivery system of the products to the sales counter/ dealers is found similar, because both companies delivered the products early in the morning by using the ordinary vehicles.	Most of the time, Sujal dairy collects milk immediately after collection, but Lovkush collect after chilling at least 4 hours.
Both companies have not proper cold chain management system during the transportation of raw milk and delivering the final products to the sales center or dealers also found similar.	The Lovkush company is found more conscious about the quality of milk because they are strictly applied cleanness of utensils in the collection center to the processing plant.



## CHAPTER 5: DISCUSSION

This chapter discusses on various findings highlighted in the previous chapter.

### 5.1 SWOT analysis of milk supply chain

The SWOT analysis tool expresses the internal and external factors and its positive and negative effects in the chain. Almost all aspects in the milk supply chain of the Kaski district are found to be similar to other districts of Nepal . But it is different in some districts of Tarai (plane) Region. The SWOT analysis of the milk supply chain is presented on the basis of involvement of chain actors, supporters and factors focusing on the production of hygienic milk.

#### Strength

- ❖ The number of milk collection cooperatives is increasing
- ❖ Total milk production of the country is in increasing trend
- ❖ Milk transportation cost of the farmers is low because of establishment of milk collection centers in rural areas
- ❖ The demand of milk and milk product is high especially in the urban areas
- ❖ Good linkage and information exchange between farmers and collection centers

#### Weakness

- ❖ Insufficient fodder and forage for dairy animals in dry season (March to August)
- ❖ Limited knowledge of farmers in the management aspects of dairy animals
- ❖ Low awareness of farmers in the hygienic milk production
- ❖ Low quality of milk and milk products are supplying in the chain
- ❖ Low milk production in lean season
- ❖ Short lactation period of the local breeds
- ❖ Insufficient loan/credit facility for dairy farmers
- ❖ High competition in processing and produce cheap and low quality products
- ❖ Low numbers of aware consumers about the quality of the products

#### Opportunities

- ❖ Explore more market within the country
- ❖ Increased the supports from the NGOs sector to dairy farmers
- ❖ Urban consumers are conscious about quality and demand high quality product
- ❖ Dairy sector is in priority of the government and implementing different dairy related projects with the collaboration of different international financial partner
- ❖ Increased the mid-level technician in the village level
- ❖ Increased the saving and credit cooperatives in village level

#### Threats

- ❖ Unfair and political influence in milk pricing system
- ❖ Poor infrastructure like electricity, road access, chilling facility
- ❖ Insufficient supervision and monitoring from the concerned authorities
- ❖ High production cost compared to India
- ❖ Insufficient fund for development of this sector
- ❖ Manual handling practices of milk mostly in producing and processing time
- ❖ Outbreak of infectious diseases like FMD, BQ and Mastitis

Above mentioned SWOT analysis shows that there are numbers weakness and threats in the milk supply chain. But there are also some strengths and opportunities which help to encourage for further development of the dairy sector in Nepal.

## 5.2 Milk supply chain

In the milk supply chain of Nepal, some functions like production and collection process of milk is similar to India discussed in the chapter 2.8 and 2.9 of literature reviews. The findings of the case studies are found that small and medium scale farmers are involved in the producer level of the chain. The literatures described that dairy sector is dominated by the small scale farmers in the Nepal. In the collection level of the chain, numbers of milk producer' cooperative Society (MPCS) are involved at village level with some specific tasks like a measurement of the volume and simple testing system of milk. But in India, cooperatives are involved in the collection of the milk with some broad tasks like input supplying to farmers, collection and marketing of the milk. The three layer tire system of cooperatives in India plays the important role in the development of dairy sectors as mentioned in chapter 2.9. The chilling process of milk is found that some cooperatives have a chilling facility in the collection centers but it is not sufficient numbers for chilling. Some cooperatives are transported to the chilling center through ordinary vehicles without maintaining the cold chain. At the time of milk transportation, the cold chain management is a very important issue to maintain the quality of milk. It should compulsory follow every step of the chain for maintaining the quality of milk. Testing and payment system of milk is found same in the both case studies. Some collection centers performed fat test and SNF test regularly. But some test like CoB, Alcohol and acidity tests are not performed on a regular basis. These tests are simple and easy for the collection centers. For control the bacteria contamination in the milk these tests are necessary to perform in the collection center. The payment system of milk is on the basis of fat, SNF including its volume. Some processors (Sujal Dairy) are paid slightly higher than the normal price of other dairy company.

## 5.3. Dairy farmers' activities and practices

At the farm level, the dairy farmers should compulsory perform some important activities for the production of hygienic milk. These activities are mentioned in an earlier chapter. The survey result shows that some activities like cleaning of utensils, wearing the apron or clean cloth, drying udder and teat before milking, cleaning hands before milking, milking the animals only in the healthy condition of milker are not performed by every farmer during producing of milk at the farm level (Table: 1). These are some critical activities applied by the farmers which are enough for contamination of milk. For example, if the hand of milker is not properly cleaned, there is a high chance for contamination during hand milking. Sanitation of utensils before using the milking is also a very important point. If every farmer is not adopting this practice, there is also a high chance for contamination of milk by bacteria.

In addition, the survey result shows that, some farmers are delivered infected milk to the collection centers produced by the unhealthy animals (Mastitis suffering). In this case there is very high chance for contamination in the collection centers (figure 9). The milk is not appropriate for human consumption, if milk is produced by the animal which is treated with antibiotics or other medicine. But the survey result shows that many farmers in both cases (selling <10 and >10 liter per day) are selling the collection centers. It means that the awareness levels of the farmers are very low about the bad effects of unhygienic milk (figure 10). For the production of hygienic milk, all dairy farmers should strictly apply every hygienic practice at the farm level. In the chapter 2, the topic of the role of the actors clearly described that most of the farmers have not followed the basic hygienic practices during the milk production. This scenario is not in Kaski district only, same situation in the whole country.

#### 5.4. Milk quality control and testing system

The result of the survey and case studies shows that most of collection centers performed the organoleptic test during the collection time of milk in the collection centers. Some collection centers performed the Clot and Boiling test (COB) before accepting the milk. But the fact is that, this test is done only for suspected milk in the collection centers. The processing company performed both COB test and alcohol test before further processing of milk as described in the case studies (chapters 4.2.1 and 4.2.2). Although there are different cheapest and simple tests for farmers and collection centers which are described in the chapter 2.10, the farmers and milk collection centers are not applied it in the milk testing system. For the control of contaminated by mastitis suffered milk, these tests are very useful and practical in the collection centers.

#### 5.5. Payment system of milk

The milk price and its payment system in the country is on the basis of the fat content and the SNF content of milk including the volume. The survey result shows that only a few numbers of farmers are satisfied with the current payment system but the majority of the farmers are in favor of price should be on the basis of the quality of milk including the fat, SNF and its volume (Figure: 12).

In India, the payment is same like Nepal. They are also paid on the basis of fat, SNF and the volume of milk. But some cooperatives introduced the incentive system for the quality of milk as described in the literature review (2.8). In Nepal, some private dairy companies are starting this payment system. But during the survey time only a few respondents were surveyed who are adopting this system. The government of Nepal was announced for the new pricing system of milk on the basis of its quality since long time. But still the plan of government is same stage.

The involvement of the government in the supervision and monitoring of the dairy sector is very poor. So, only private sector and cooperatives cannot implement the hygienic production system without the support and strict policy of the government. If the payment system of milk is on the basis of its quality including fat, SNF and volume, there is very high possibility to collect the quality milk in the milk collection centers. But there are several other factors which are leading to decrease the quality of milk. Insufficient chilling facility in the collection centers, milk transportation from the long distance, poor electricity services, normal vehicles use for the transportation of milk and milk products, poor quality control mechanism of the government (discussed on chapter 2 and case studies) are some critical points is found.

#### 5.6 Bonus system and problems for hygienic milk production

The result of survey proves that the majority of the farmers are willing to produce milk on hygienic way if there is a provision of bonus system for hygiene milk (table: 6). If the price of milk is reasonable and there is provision of incentives for high quality milk, farmer definitely involve in the hygienic milk production at the farm level as mentioned chapter 2.7. The result also shows that there are some farmers already producing on hygienic way at the farm level who are getting a higher price from the processing company so they are motivated to apply the hygienic practices at the farm level.

The findings of the survey also show that, some farmers are not motivated to produce hygienic milk because they are not getting the extra price for high hygienic milk. Similarly lack of awareness is also found in some farmers for the production of hygienic milk.

## 5.7 Farm visits by collection centers and effect of unhygienic milk to the human health

The findings of a survey shows that more than 50% farms are not visited by the personnel of the collection centers and only 7% farms are visited twice a month (figure:11). Farm visit by the technical person is important to monitor about the shed environment, the health condition of the animal and hygienic practices during the production of milk. The monitoring practices either from the government side or from the private sector is very poor condition. It is true with literature as described in 2.5. But result also shows that some farms are visited by personnel at one time or two times a month on the regular basis. This practice is applied by the processor who have already introduced a quality based pricing system including fat, SNF and the volume of milk. It is discussed in the chapter of the literature review and case study.

The result of the survey also shows that 80% farmers are aware about the effects of unhygienic milk to the human health and only few farmers (3%) are not aware about it (figure: 13). Although more farmers are aware about the effects of unhygienic milk to the human health, they are not motivated to produce more hygienic milk because there is not any compulsory rules and regulation for the hygienic milk production and the cost of production is also high for hygienic milk production. The provision of incentive or an attractive price of milk is the way of motivation for adopting the hygienic practices at farm level.

## 5.8 Expectations from concerned authorities

The findings of the survey show that, numbers of expectations are found from farmers. They are expected that the regular animal health check-up, availability of veterinary services and medicines when it's required, loan/credit facilities at soft interest rate, regular monitoring of farm, more participation in policy formation activities of dairy sectors, provision of animal insurance, increase the price of raw milk etc.

These are the basic requirements for increasing production and also encouraging factors for hygienic milk production. In India, most of the farmers under cooperatives are getting technical services from the veterinarian because cooperatives are responsible for supplying input to the farmers as described in chapter 2.9. But in Nepal, due to insufficient qualified technical person in the veterinary field, farmers are deprived to get the effective technical services in their farm. In addition this, most of the farmers in the rural areas are poor, so they are not in a position to pay high service and medicine charge for the veterinarian. The cooperatives can start the veterinary services through mid-level technician and Village Animal Health Worker (VAHW) because these technicians can provide first aid treatment and advice to the farmers which will be cheaper than the veterinarian.

## CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

This chapter describes about the conclusions and the recommendations drawn from the case studies, result of the survey and especially from the discussion.

### 6.1 Conclusion

The objective of the research was to increase the farmers' involvement in hygienic milk production to obtain the better milk price at the producer level in the Kaski district of Nepal. Furthermore the researcher also wanted to assess the quality control mechanism in the whole milk supply chain of the district.

On the basis of discussion and findings following conclusions can be concluded.

A majority of the dairy farmers who are directly involved in the milking process are not adopting essential basic hygienic practices in their farm during the milk production because there is not any strict policy and rules for the hygienic milk production and the awareness level of the dairy farmer is not sufficient for the production of hygienic milk. The involvement of cooperatives in the dairy sectors of India makes more compatible for hygienic milk production. The hand milking practices and manual handling of milk from the farmers' level to the processor level, transportation of milk from long distance, insufficient basis infrastructure like road access, electricity facility, chilling facility, and poor government policy in the dairy sector are some important constraints to supply the quality milk in the milk supply chain of the district. That is why there is a need to improve above mentioned problems but only one improvement will not be sufficient for supplying the quality milk in the chain.

The present payment system of the milk on the basis of fat content, SNF and its volume which is not encouraging dairy farmers to produce hygienic milk at farm level. Although there are different simple and easy milk testing system like COB, alcohol and acidity test, these tests are not applied by the farmers and milk collection centers. The farmers who are not aware about the hygienic milk production process, training and awareness program for them is another encouraging factor to increase the involvement in the hygienic milk production at farm level. The provision of bonus for high quality milk and penalty for low hygienic quality milk, sufficient veterinary services and technical advice to the farmers, loan facility with low interest rate, animal insurance program are also some motivating factor to increase farmers' involvement in hygienic milk production. The government policy especially about the price of milk is an important encouraging factor to increase the farmers' involvement in hygienic milk production.

### 6.2 Recommendations

On the basis of the conclusion, the following recommendations are recommended for increment of farmers' involvement in hygienic milk production at the producer level.

- ❖ The cooperatives should implement a provision on bonus for high hygiene quality and penalty for low hygiene quality of milk.
- ❖ The training program should be organized for those farmers who are unknown about the hygienic milk production. The course will be on the topic of management of dairy animals, the importance of personal hygiene in milk production, effects of unhygiene milk to human health, identification of risk factors in hygienic milk production and its reduction method etc.

- ❖ The awareness and interaction program should be organized between dairy farmers, because the experienced farmer can share their ideas to new farmers.
- ❖ Some milk testing system like COB, Alcohol and Acidity should be strictly applied in the collection centers. If this test is applied on a regular basis there is very less chance to receive the mastitis suffered milk.
- ❖ There should be easy accessed on technical services and credit facility to the farmers. It should be through the cooperative because cooperative can manage cheap technical service by using VAHW and JTA and also can monitor the loan is used in the right place or not.

### 6.3 Implementation of the recommendation

There are some possibilities for the implementation of recommendation on the dairy sector of the district. The government is focusing to improve this sector by providing technical and financial supports to the farmers as mentioned in chapter 2.6. So, the recommendation will useful to formulate a new plan from the government side like District Livestock Service Office (DLSO), Regional Livestock Training Service Center (RLTCS). Besides this, training and awareness programs for hygienic milk production will conduct through the Animal Health Training and Consultancy Service (AHTCS) where the researcher is working in the capacity of Training Officer.

AHTCS is going to implement a 4 year long project about the strengthening of small scale dairy farmers and milk cooperatives with a collaboration of a private company (Surya Nepal). In the first phase of the project, AHTCS will conduct need assessment of the dairy farmers. Based on the need assessment the training curriculum and teaching materials will be prepared. At the time of curriculum development my finding will also be helpful to prepare more practical guidelines for training to the small scale dairy farmers and cooperatives as well. In addition, some training materials like poster, booklets and brochures will be published and it will distribute to the dairy farmers through the cooperatives in the district.

The strengthening of cooperatives is another program of this project. The project will support to milk collection cooperatives by providing the basic equipment, milk testing materials, technical training and cooperative management training. If cooperatives are well equipped and personnel are capable to perform the milk testing, definitely they will adopt the milk testing system. After the training, the cooperative members will be more aware and competitive about the importance of hygienic milk and it management skills. So cooperatives will influence to the farmers for adopting the hygienic practices at farm level and they will introduce the bonus and penalty system on the basis of milk quality. Besides this, the cooperatives will negotiate to the processing plant for increasing the price system of milk.

In the district, there are already many mid-level technicians like Village Animal Health Worker (VAHW) Junior Technical Assistant (JTA) and Junior Technician (JT). Some NGOs and governmental organization are producing numbers of mid-level technicians every year. The cooperatives will mobilize these mid-level technicians to provide the health and management services for the animals of the dairy farmers. The cooperative will play a mediator role between farmers and financial institutes to manage the credit for the dairy farmers.



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## ANNEXES

### Annex : I Questionnaire for dairy farmers

Name of the farmer:

Age:

Address:

Education level:

Name of MPCs:

1. How much milk do you sell daily to milk collection center?  
..... Liters/per day
2. To what processor do you sell the milk?  
a. Safal dairy   b. Gaurishankar dairy   c. Lovkush dairy   d. Other.....
3. In what price are you selling a liter of milk ?  
..... /Liter
4. What following activities are you performing in your farm during the producing of milk?
  - a. I always clean the shed of animals  
(i) Yes                      (ii) No
  - b. I always clean the animal daily  
(i) Yes                      (ii) No
  - c. I always clean the udder and teat with clean water before milking  
(i) Yes                      (ii) No
  - d. I always keep the udder and teat dried before milking the animal  
(i) Yes                      (ii) No
  - e. I always clean my hands with soap and water before milking  
(i) Yes                      (ii) No
  - f. I always wear the clean clothes or apron during the milking time  
(i) Yes                      (ii) No
  - g. I have never milked if I am suffering from diseases, cold and cough or any other problem like hand wounded  
(i) Yes                      (ii) No
  - h. I always clean utensils with detergent before milking  
(i) Yes                      (ii) No
  - i. I always keep the milk in cool condition as much as possible  
(i) Yes                      (ii) No
  - j. I always deliver the milk to collection center as fast as possible  
(i) Yes                      (ii) No                      (iii) If any others.....

5. What will you do for the milk produced from diseased animal like mastitis?
  - a. I sell to consumers or collection center
  - b. It is used for home consumption
  - c. I give to calf
  - d. I destroy it
6. How many days you don't use milk if the animal is treated with drugs?
  - a. I care only three days
  - b. I care during treatment
  - c. I don't care about it
  - d. any others.....
7. What activities perform by the employer of collection centers during milk collection?
  - a. Volume measurement
  - b. Fat content test
  - c. Observe the quality of the milk
  - d. If any others.....
8. What is the quality control mechanism of milk in the collection center?
  - a. Performing the bacteria contamination test
  - b. Organoleptic test
  - c. COB test
  - d. Any others.....
9. How often does a representative of the collection center visit your farm per months?
  - a. Once a month
  - b. Twice a month
  - c. More than two times a month
  - d. Never
  - e. When it's necessary or after request
10. How often do you face the clotting problem in your milk?
  - a. One time a month
  - b. Two times a month
  - c. Three times a month
  - d. Never
11. What do you know the effect of unhygienic milk on human health?
  - a. It is harmful and can cause disease
  - b. No effects
  - c. I don't have any idea

12. What difficulties are you facing to apply the hygienic milk production?
- I don't have any idea
  - Not provision of bonus system and production is costly
  - Not any compulsory rule and regulation
  - Others if any.....
13. If there is a provision of an extra bonus for good quality and penalty for low quality of milk, are you ready to produce hygienic milk on your farm?
- Yes
  - No
  - I have already produced on hygienic way
14. What type of test do you perform in your home before selling the milk to the collection center?
- Organoleptic test (See, smell, taste)
  - Clot on boiling (COB) test
  - Not perform any test
  - Any others.....
15. What type of utensil do you use while delivering the milk in the collection center?
- Plastic bucket with cover
  - Plastic bucket without cover
  - Aluminum/ steel with cover
  - Any others.....
16. What is your opinion about the payment system of milk on the basis of fat, SNF and volume?
- It is reasonable
  - It should be on the basis of quality, fat, SNF and volume
  - Any other suggestion.....
17. What type of support do you expect from the collection centers, government side and NGOs/ INGOs sector for hygienic milk production?
- Milk collection centers
  - Government side
  - NGOs and INGOs
  - Dairy Company

## **ANNEX: II Checklist for interview to processor**

The interviews were taken from the managers and officers of two dairy processing company by using following semi-structured questionnaires.

### **Milk Supply Chain**

- Input supplying process
- Milk Producing Process
- Collecting Process
- Milk transportation process
- Milk Processing process in dairy company
- Marketing process of final products
- Consumption

1. What is your opinion about the quality of milk that you are collecting from the different collection center?
2. What type of quality control strategy you are applying in the milk chain?
  - At producers' level
  - At collection centers
  - At the time of transportation
  - At the time of processing in the factory
  - At the time of marketing
3. What activities are you performing in the hygienic milk production at farm level?
  - Financing and equipment support
  - Providing the awareness and training program
  - Supervision of dairy farm
  - Others
4. What are the main constraints to hygienic milk supplying in the chain?

### **Annex: III Interview checklist for milk collection centers**

Name of Collection center:

Established date:

Address:

Name of responsible person:

1. What is the capacity of the collection center?
2. How many staffs are working in the collection center?
3. What is the quality control mechanism in the collection Centre?
4. What are the main functions performing by collection Centre?
5. What are the main constraints of your collection Centre?
6. What is the transport process of milk for the processing company?

#### Annex: IV Some Pictures



Figure: 16 Survey questionnaire filling by farmers in collection center



Figure: 17 Utensils using by farmers to bring milk in the collection centers





Figure: 18 A vehicle used for transportation of processed product to the sales center



Figure: 19 Milk and yoghurt delivered in the dealer





Figure: 20 Pasteurized milk in half liter plastic sachet



Figure: 21 Cold chain maintaining in refrigerator of the dealer