

DAIRY PRODUCTION AND ITS IMPLICATION IN HOUSEHOLD INCOME IN ASIAN TROPICS AND SUBTROPICS: SOME FINDINGS FROM INDONESIA AND NEPAL

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ABSTRACT

Indonesia and Nepal two far away countries too different from each in many aspects in fact also have some very similar aspects as well. Both are multi ethnic country and agriculture is one of main sector of the economy. Most of the people in rural region depend on it for their livelihood. In both the countries these rural people are small holders in the sense they own little assets and production means, such as, land, livestock, physical constructions, machinery, etc. As such, they carry out labor-intensive crop-livestock mixed farming to make best use of their self-resources. Dairying (dairy farming) singles out to be one main component of such mixed farming system suitable for such small holders to under take as they can be relatively started with little capital, can be managed basically by family labor and generates income within a short period and almost daily. Additionally, it also suits the government policy of addressing the problems of (disguised) unemployment and under employment and increasing the domestic milk production to meet the ever growing domestic demand of milk, which in turn improves the nutritional health of the people and saves dear foreign currency used for importing the milk. Hence both the governments have been promoting it through various development programs supported by needed know how, services, capital and milk procuring through extension and cooperative systems.

The household level features of the dairy farming also have strikingly structural similarities in terms of share of the populations engaged in it as their main job, average number of dairy animal holding, ratio of dry and milking animal, average milk production per animal per year, usage of self resources, strategy managements, an so on. In both the cases labor, concentrate and roughage fodder are the three largest components of the production cost, together constituting more than 90% of the total cost. Milk is the single most component of the income. Production ranges from 75% to 90% depending the farm size in Nepal and location specificity in Indonesia. Finally, the net return to farm, inclusive of evaluated return to self resources sum up to be between \$600 to \$800 per annum in both the countries.

INTRODUCTION

Most of dairying (dairy farming) in tropical and subtropical Asia including Indonesia and Nepal can be classified as smallholder dairying under mixed crop-livestock farming system. For smallholder in rural areas, the dairy operation is generally integrated with the production of rice, upland crops and or various other crops, including fodder crops, such as, rye, maize. The distinctive feature of dairying in such integrated mixed farming system is the use of byproducts of dairying, such as, dung and

animal shed beddings as manure in the crop farming and use of byproducts of crop farming, such as, wastes and residues, straw, stover, grass, etc. as fodder for the animals. Some of the older dairy colonies which have become urban and suburban smallholder dairying also still rely on the use of such crop by products from neighboring farming areas, as a source of feed supply, in addition to the concentrates procured in the market.

Dairying is a very important cash income-generating component of such integrated farming system. This importance is more apparent in smallholder farming systems where multi-cropping is the rule, and production resources have to be used to maximum advantage to generate immediate income and meet day to day living expenses. As fresh milk can be sold daily, and cash income generated likewise, farm operations are able to become more flexible and perhaps even stable. In this context, dairy production is becoming an increasingly important sector of the integrated system, being more significant to the smaller holders and the ones with fewer other resource endowments. It is for these reasons that dairying in the developing countries is considered to be an important instrument of social and economic change, and is identified with rural development.

Thus, in such Asian countries of tropics and subtropics, dairying is promoted in line with the government objectives to create employment opportunities and to increase income of the small holders, in addition to regarding it as an economic process to meet the domestic demand for milk.

Keeping this in mind, the dairying in Daerah Istimewa Yogyakarta (DIY) Province, Indonesia, as a country (region) of tropics and dairy farming in Chitwan District of Tarai, Nepal as a country (region) of subtropics is examined in detail in this study. In doing so the practice and promotion of smallholder dairying, their management and profitability at household level, share of its net return in their household income and its implication in their livelihood will be given due consideration.

Objectives and Research Method

Hence, the main objectives of the study are, 1) to find the situation of dairying in DIY Province, Indonesia and Chitwan District, Nepal, especially the dairy animal holding, feeding practices and labor use according to location specificity and socio-economic characteristics of the holders, 2) to analyze the profitability of dairying considering the maximization of the self resource use and 3) to find out the contribution of dairying in the household income, each, in Indonesia and Nepal. Accordingly, implication of dairying on rural livelihood will be discussed in each country and a comparative analytical discussion will be made to learn lessons from each other.

To achieve the objectives, in Indonesia, the study of dairy cooperative was undertaken in DIY Province (**Figure 1**), one of 30 provinces in Indonesia, undertaking research survey that represent different regencies; Sleman Regency (mountainous and rural area), Bantul Regency (costal and sub urban area) and Yogyakarta Municipality (capital city of the province, urban area). Some 76 of 1,133 dairy households in Sleman Regency, 7 of 22 dairy households in Bantul Regency and 5 of 20 dairy households in Yogyakarta Municipality were randomly selected in 2003. They were interviewed about their dairying in terms of dairy cows holding, milk production, feeding practices, labor use, cost and income of dairying and income form other activities at the household level. They were interviewed through a structured questionnaire, on site observation and participatory appraisal. The collected data were both qualitative and quantitative. In this

case location specificity was considered to understand the different types of dairy production within the bigger region of DIY Province.

In case of Nepal, multistage sampling was used to select district, village and household for the empirical study. Village Development Committees (VDC) were selected with purposive sampling process among dairy pocket areas, having relatively high numbers of dairy animal holdings and high milk production in the subtropical plains of Tarai region in the Chitwan District (**Figure 2**). Households in the village were selected randomly among the dairy farmers. In order to collect primary data in household level, detail survey was conducted among 104 households from two VDCs (dairy pocket areas) in the district. A semi-structured interview approach was also conducted to collect additional data. The collected data were divided into three farmer's group according to landholding size; large, medium and small. Information on socio-economic characteristics of the dairy farmers, agricultural land distribution, dairy animal holdings, income from dairy production were analyzed according to the farm size to grasp the difference in the dynamics therein. Information on income and percentage share from different economic activities other than dairy production were also analysed to evaluate their significance to the total household income. In this case socio-economic characteristics of the dairy farmers were considered to understand the difference in dairy production mainly according to landholding within the defined dairy pocket area of the district where dairy farming is encouraged.

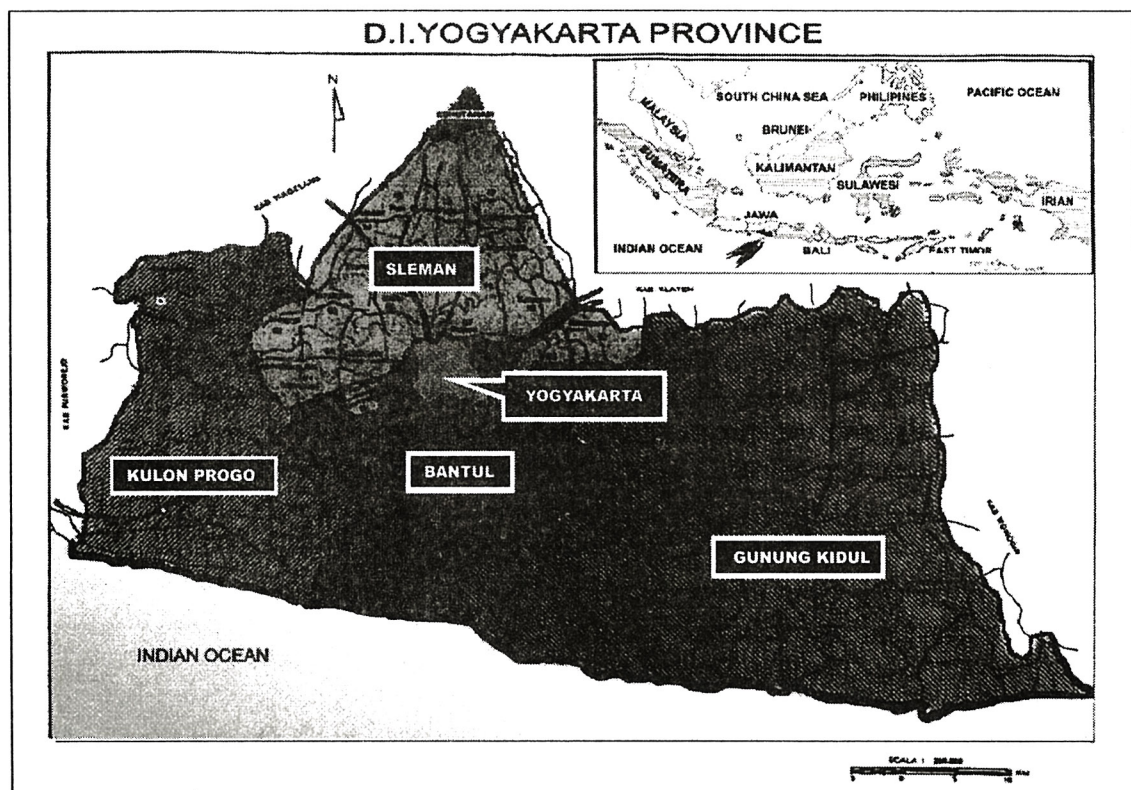


Figure 1. Map of Daerah Istimewa Yogyakarta Province

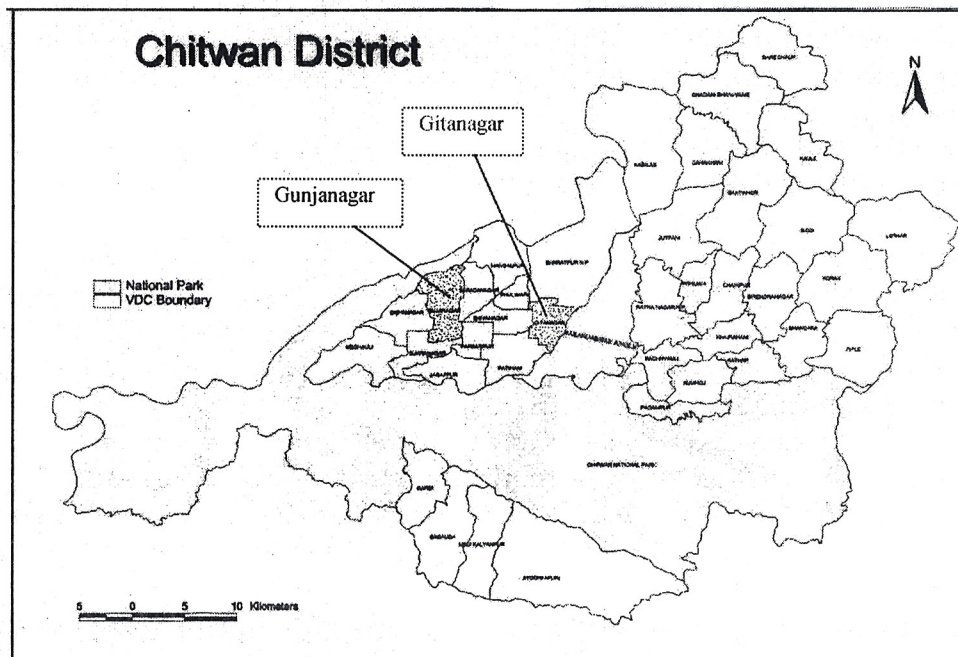


Figure 2. Map of Chitwan District showing Study Villages

Development of Dairy Farming in Indonesia

Dairy farming was first introduced in Indonesia on the island of Java in 1905 by Dutch to fulfill their need for milk and milk product (cheese). First, they introduced dairy cows in the state farm in the mountainous areas in Central Java (Boyolali, Salatiga and Ambarawa) and then expanded to West Java (Bandung area near to Jakarta) and East Java (Nongkojajar, Malang and Batu). But the local farmers undertook the dairy farming only after the independence when Holstein Friesian dairy cows were distributed to the small farmers in East Java (Pasuruan, Malang and Batu), Central Java (Semarang, Boyolali, Salatiga, Ambarawa and Solo) and West Java (Pasarminggu, Bogor, Sukabumi, Cianjur and Bandung). After some years its development in some special areas, under efficient cooperative system, such as, Malang, Boyolali and Bandung were better than other areas. Presently, these areas are the main areas of dairy farming in Indonesia.

During first and second Five Years Development Plan (1969-1979) artificial insemination and feed improvement program was introduced to enhance the milk production through the cooperative system. These cooperatives at various provinces in Indonesia collaborate under the Union of Indonesia Dairy Cooperatives (UIDC), a national organization of dairy cooperatives that formulates different services of the cooperative for dairy farming, i.e., dairy cow supply, fresh milk marketing, technical support, animal feed production, basic animal medicines, milk equipment, road tankers, milk processing and training. It was introduced in 1978 to strengthen the cooperative system and upgrade the services rendered by the cooperative to the dairy farmers. The pricing of milk based on solid non-fat particle (SNF) and fat contains was introduced by UIDC to attain higher level of milk production and maintain milk quality. Periodically dairy cows were imported from Australia and New Zealand by the Indonesian Government and supplied them to the farmers.

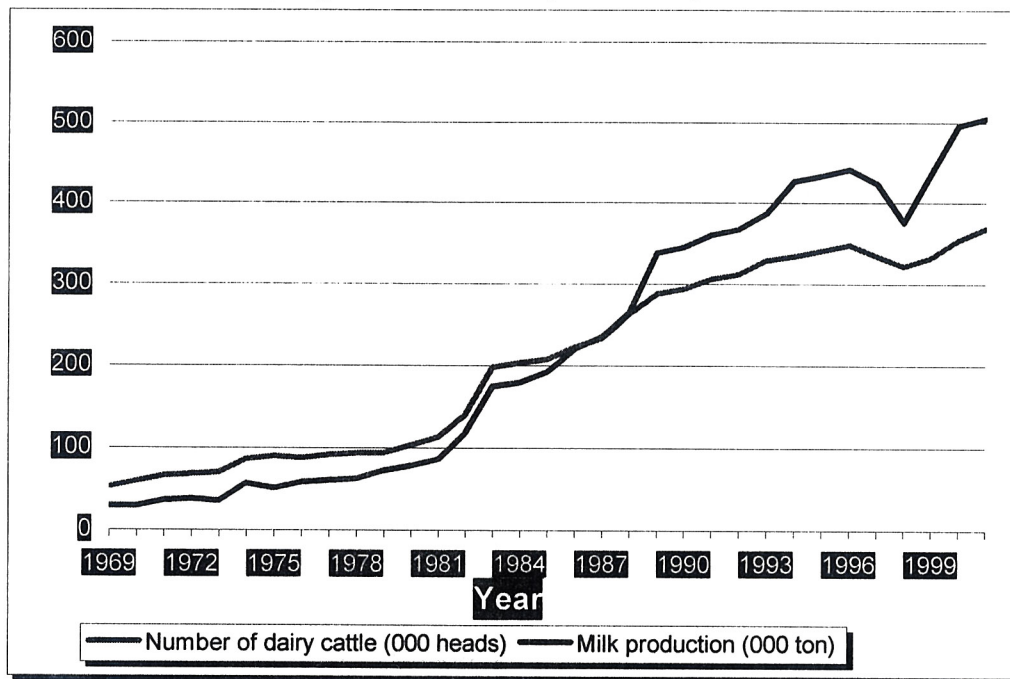
During the third Five Years Development Plan (1979-1984), Indonesian Government along with UIDC made the obligatory for the milk processing industry to buy the milk produced by the small farmers and support dairy farming. Since 1982 three ministerial decrees by Minister of Industry Affairs, Minister of Agriculture and Minister of Trade and Cooperative were issued in order to increase production, processing and domestic marketing of milk. The implementing group for the above-mentioned joint decrees is the dairy technical team. This team is responsible for coordination between the milk processing industry and the UIDC in order to determine the milk purchasing price from the dairy farmers and to determine the ratio of absorption of such milk produced by the farmers and the volume of powdered milk which could be imported by the milk processing industry. UIDC also started to get involved in reviewing the milk price every six months.

During fourth Five Years Development Plan (1984-1989), the government made a target by the end of 1989 domestic milk production would fulfill 50% of the total milk requirement by reducing importation milk and increasing domestic milk production. In 1985 in order to reach the target, the Indonesia President made a Declaration of Presidential Decree regulated national dairy development by linking seven ministries: Ministries of Agriculture, Industry and Trade, Cooperative, Health, Home Affairs and Investment Coordination Board. Government also provided some support facilities by establishment of artificial insemination center in Lembang (West Java) and Singosari (East Java), disease investigation center in DIY Province and dairy training center in Batu (East Java) and Baturaden (Central Java). The domestic milk production increased steadily during this period. Although it felt short of meeting the target, it was able to produce 292.8 million liters of milk in 1989. Ever since the target to increase domestic milk production to fulfill 50% of the need for domestic milk consumption is a focal issue of dairy farming in Indonesia. Dairy farming which took off during early 80's and partially is going through transformation period during late 80's and 90's has not yet been able to meet that target in spite of the fact that milk production has been increasing and produced 379 million liters of milk in 2000, primarily due to increasing milk demand, a consequence of expansion of milk consumption. Despite the increase in the milk production, only about 25% of the milk consumed in 2000 came from the domestic production. Indonesians consumed about 5.5 liters of milk on average per capita in that year. Hence domestic share of the milk consumed per capita per year is only a little over a liter. **Figure 3** shows the number of dairy cattle and amount of milk produced in Indonesia during the period of 1969–2001, as the combined consequence of the different measures taken, as mentioned above. In the mean time the numbers of dairy cows have also increased to more than 5 million by 2001.

DIY Province

Dairy farming in DIY Province was also introduced before independence Indonesia in 1945. First, dairy cows were introduced in Yogyakarta Municipality in 1930s. Then after independence, in 1940s dairy cows were introduced in Bantul Regency. In accordance with the Indonesian Government to promote the dairy cooperatives throughout Indonesia to enhance dairy farming, Warga Mulya Dairy Cooperative was established in DIY Province in 1979. Warga Mulya Dairy Cooperative started with 35 members in Bantul Regency and Yogyakarta Municipality of the province and provided the services of milk collection, credit and extension and training

to its members in line with the policies formulated by UIDC. **Figure 4** shows the development of dairy farming in DIY Province during 1979 and 2000 in terms of dairy cows, dairy farmers (cooperative members) and milk production.



Dairying in
 Figure 3. Number of Dairy Cows and Milk Production in Indonesia, 1969-2001

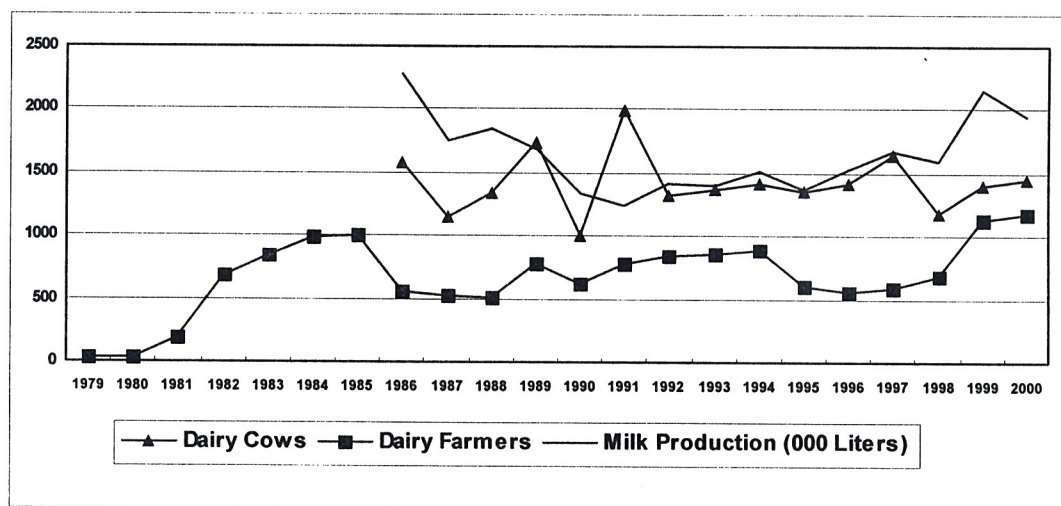


Figure 4. Number of Dairy Cows, Dairy Farmers and Milk Production in DIY Province

Milk Producers Occupation

Most of the dairy households do dairy activities as the secondary job. **Table 1** indicates that they are engaged in various kinds of occupation. In Yogyakarta, dairying was secondary occupation for all households in 2003. The main household income was from business, clerical job and professional job. In Bantul, there were 3 households

(43%), which had dairying as main occupation. Other main occupations in Bantul were business and clerical job. In Sleman Regency 17 households (24%) had dairying as the main occupation. Most (70%) had crop farming as the main occupation. Other main occupations were business and professional job.

Table 1. Milk Producers Occupation in the Study Regions.

Job	Sleman		Bantul		Yogyakarta	
	Main	Secondary	Main	Secondary	Main	Secondary
Crop farming	51	3	-	1	-	-
Dairying	18	56	3	4	-	5
Business	3	6	2	1	3	-
Professional job	3	11	-	-	1	-
Clerical job	1	-	2	-	1	-
Total	76	76	7	6	5	5

Source: Field Survey, 2003.

Dairy Cow Holding

Dairy cows composition is based on the age of cows, calves, heifer and adult. Milking cows, dry cows and bull are categorized as adult. Although Jerseys could better tolerate the average in DIY Province and the Animal Husbandry Service has been promoting the Jersey cows since 2000, the milk producers prefer to rear Holstein Friesian crossbreed as they are more used to rearing this breed. There are only four Jersey cows owned by two milk producers in Sleman. Rest is all Holstein Friesian crossbreed.

Table 2. Composition and Average Dairy Cows Holding per Household in the Study Regions

Description	Sleman	Bantul	Yogyakarta
Average dairy cows holding (head)	4.4	6.7	5.6
Dairy cow composition			
Milking cow	1.8 (40.9)	3.9 (58.2)	4.1 (73.2)
Dry cow	0.8 (18.2)	1.7 (25.4)	0.6 (10.7)
Heifer	0.2 (4.5)	0.1 (1.5)	-
Calf	1.6 (36.4)	1.0 (14.9)	0.9 (16.1)
Milking cow: dry cows ratio	69:31	70:30	87:13
Milk production/head/year (liter)	2,126.7	2,362.8	2,102.3
Average lactation period (days)	287.2	292.7	286.5
First calving age (months)	27.2	25.6	27.3
Calving number (times)	2.8	2.9	2.9
Calving interval (months)	18.1	15.2	18.7

Source: Filed Survey, 2003.

Note: Inside (), percentage is shown for each of the dairy cows composition.

Milking cow: a cow which is producing milk. **Dry cow:** a cow usually in the latest part of pregnancy, whose lactation has been terminated and who is being prepared for the next lactation. To dry a cow is to stop her milking. **Heifer:** a young female bovine from the first heat to the time she gives a first calf. **Calf:** a young cow before the first heat. **Bull:** a male cow after got the first heat. **Lactation period:** the period following calving during which milk is formed in the udder. **First calving age:** age of cow (months) at the first parturition. **Calving number:** no of calves given. **Calving interval:** time from one parturition to

next parturition.

Table 2 presents the average dairy cows holding by the milk producers in all three regions. The average dairy cows holding were 4.4 in Sleman, 6.7 in Bantul and 5.6 in Yogyakarta. Out of five milk producers in Yogyakarta, two of them had a plan to change their dairy activities to other business. They wanted to build student rental rooms on the land where the dairy activities were done. They think that a rental room will give more profit and fewer burdens.

The highest share of dairy cow composition was milking cow. The ratio of milking cow and dry cow was normal. The milk producers in Yogyakarta try to increase the ratio of milking cow in its herds as a management strategy by replacing the dry cows and heifers with milking cows. They keep no heifers. They do so to fulfill the demand of their neighbor consumers who buy their milk constantly everyday. Most of the milk producers in Sleman and Bantul do not practice the knowledge of ratio milking cow and dry cow in order to maintain continuity of milk production through out the year at the maximum possible level. The government through the cooperative gives more focus in increasing the dairy cow population to achieve the daily milk production target of 8,000 liters per day.

An average lactation period in all study regions was around 290 days. The lactation period and milk production is increased by improving breed and feed quality. Most of the milk producers in three regions agreed that cooperative has helped them to improve their milk production through extension; artificial insemination and animal feed supply services. In order to increase number of improved breed, artificial insemination has been implemented using imported Holstein Friesian bull semen. Such semen is imported regularly to maintain the genetic quality. Selection of the animal for high milk production is still the most important factor for assuring high economic returns to milk producers. Therefore, the primary goal of genetic improvement should be directed to increase the annual milk production per cow and to select for desirable milk quality. Currently, the average milk production per animal per year is around 2,100 liters in Yogyakarta and Sleman and around 2,400 liters in Bantul.

Ideally, a dairy cow should calve at yearly interval and should have a lactation period of about 300 days, but in practice calving intervals are often longer or lactation period being shorter. The calving interval was becoming shorter in all study regions. A longer breeding interval will result in a long calving interval, which reduce production efficiency. In all study regions the first calving age was around at the age of 26-27 months. The calving number in all regions is between 2 to 3. It means in general, the cows are in the second or third lactation. The milk producers prefer to raise the cow until third lactation because the milk production is in the peak at that lactation number. Generally, the cows are replaced after the third calving. There are also some milk producers who cull the dairy cows even after giving 5 or 6 calves (after 5-6 times of calving). In Yogyakarta, some milk producers do not do the replacement of their dairy cows as they have plans to close their dairying and undertake other activities and businesses.

There are no milk producers who raise Holstein Friesian bull in all three study regions due to the provision of artificial insemination by cooperative and Animal Husbandry Service. The non-necessity of raising bull allows them to raise more number of dairy cows, consequently producing more milk. Whenever a male calf is born, milk producers sell it to the cooperative to pay their credit (Sulastri and Maharjan, 2002).

Feeding Practices

According to Shukla and Brahmankar (1999), an efficient system of milk production depends largely on three factors; the productivity of an animal (genetics), the level of feed nutrients and its maintenance. Efficient dairy cows are the result of inheritance and improved breeding. The dairy cooperative aids the members in this aspect by supplying proper semen for artificial insemination. Thus, the most important aspect of dairy management for increasing milk production is the quantity and quality of feed provided to the cows.

Devendra (1988) mentions that improving nutritional management is important factor for economic and high milk yield of good quality. According to Malcolm (1999), milk production in the tropical countries (including Indonesia) has been limited by the extreme climates, by low quality tropical feeds that are generally high in fiber and low in digestibility and have a short season to growth. Also limiting milk production are the diseases and parasites associated with hot and wet in climate. Here, to solve the problem of animal feed, cooperative provides feed supply service that it sell concentrate to the members. Cooperative also introduces the fodder cultivation by giving fodder seed to the members.

The cow feed is divided into two types: concentrate and fodder and their balanced ratio are regarded to be very important to sustain and or increase the production (of milk) and reproduction ability of cow. Since fodder quality, composed of green grass and dry roughages, is variably poor, dairy cows are unable to produce milk unless they are fed with concentrate in addition to fodder. The feeding practices that are followed in three regions have been summarized in **Table 3**. All the milk producers keep the dairy cows at their stall and generally feed fodder and concentrate separately two or three times a day. But in Sleman some milk producers feed their dairy cows only once a day in the morning, giving fodder and concentrate together. Most of the milk producers feed the cows individually, although some still practice group feeding due to it's being less laborious. Individual feeding practice aids in assessing the nutritional intake of each animal rather easily hence recommended for better management.

The average daily amount of concentrate given to Milking cow per head is 3 kg, 4, 5 kg and 4 kg in Sleman, Bantul, and Yogyakarta, respectively. Currently dry cows are not fed concentrates in Sleman. In Bantul and Yogyakarta currently dry cows feeding on concentrate are given half the amount of Milking cow's allocation.

Table 3. Feeding Practices in the Study Regions.

Regencies	Frequency/day			Type of feeding	
	Once	Twice	Thrice	Individual	Group
Sleman	3 (3.9)	10 (13.2)	63 (82.9)	55 (72.4)	21 (27.6)
Bantul	-	-	7 (100)	6 (85.7)	1 (14.3)
Yogyakarta	-	-	5 (100)	5 (100)	-

Source: Field Survey, 2003. Note: Inside () is percentage. Once: fodder and concentrate are fed in the morning. Twice: fodder is fed in the morning and concentrate in the afternoon. Thrice: fodder is fed twice in the morning and afternoon, and concentrate is fed after morning milking.

According to Ranjhan (1999), during dry period the cow should build up body fat lost in previous lactation, which will be required to provide for the growth of the

fetus and for the regeneration of mammary tissues. In the practice known as 'steaming up', dry cows are offered quantities of concentrate which increase gradually during the last six weeks of pregnancy. Steaming up is claimed to increase milk production, in part by preparing the cow for high intakes of concentrates that should be fed in early lactation. During the last 60 days of pregnancy live weight increases by about 20 to 30 kg. The response to 'steaming up' probably depends on body condition at the beginning of the dry period. Restoring the reserves of the thin cow will probably have a greater effect on subsequent milk production than increasing the reserves of an already fat cow. Generally, the nutrient of dry cows should contain a minimum 12% of crude protein, 22% of crude fiber, 50% of total digestible nutrient, 0.39% of calcium, 0.24% of phosphorus and 0.16% of magnesium (Smith and Guthrie, 1995).

In terms of quantity, it is very difficult to calculate the amount of fodder given to each cow as they are fed in lump sum amount. Milk producers face problems with the availability of fodder; there are problems with quality and quantity and a lack of economical technology for optimum utilization of local feed resources.

One of most common problems facing smallholder dairying in the tropics is the scarcity of good quality fodder during the dry or summer season (Chantalakhana, 1999). Most of milk producers in DIY Province have to use whatever sources of fodder available for dairy feeding, sometimes at very high prices. These sources of fodder consist of: 1) agricultural fibrous residues or by products such as soybean hull, sweet potato leaves, young corn leaves and sugarcane top leaves and 2) forage or fodder leaves either produced on the own farm or collected from outside the farm.

The type of fodder that is available to dairy cows in DIY Province are native grasses, king grass (*Pennisetum purpides*), leucaena (*Leucaena leucephala*), gliricidia (*Gliricidia sepium*), sesbania (*Sesbania grandiflora*), cassava (*Manihot utilisima*) leaves, sweet potato (*Ipomoea batatas*) leaves, rice (*Oryza sativa*) straw, maize (*Zea mays*) stover and calliandra (*Calliandra sp.*). The most common and more frequently fodder fed to dairy cows are native grasses, king grass (*Pennisetum purpides*), leucaena (*Leucaena leucephala*) and gliricidia (*Gliricidia sepium*).

During the dry season, dairy cows are believed to be increasingly dependent on abundantly available agricultural crop residues, which according to Bakrie (1996) are high in fiber but low in dietary protein and digestibility. Purwantara et al. (2001) mentions that rice straw is by far the most important crop residue contributing more than 90% of feed energy available to ruminants in Indonesia. However, animal fed on this diet fail to get adequate nutrient for maintenance and production. Efforts are being made by the government through the cooperative and Animal Husbandry Services to examine the possibilities and economic feasibility of improving feeding value of various agricultural and industrial by products, such as bran, oilseed cake.

To overcome the problem of fodder availability in DIY Province, the cooperative has introduced to the milk producers the integration of fodder and legumes into rice production. In order to get their responses, the cooperative initiated the pilot project of the integration fodder, legume and rice in Maguwoharjo, Sleman. Kusudewa et al (1988) mention that the integration does not have a negative impact on the yield of rice.

Labor Uses in Dairying

The milk producers and dairy cows are the two most important factors to determine the degree of profitability and personal satisfaction derived from dairying.

The milk producers are responsible for doing many things, including a number of little things needed to be done in dairying. Doing these things well and when they need to be done can make dairying a profitable job and an interesting and challenging way of life. Neglecting them can make the dairying a failure or return a little profit. Labor is one of the important inputs in dairy enterprise. The knowledge of dairy management and the requisite skills needed in dairying determine the quality of labor, and quantity of input to enhance the productivity of dairy cows.

Milk production implies a basic and compulsory daily routine of milking, feeding, watering and taking care of the dairy cows. Other major activities related to milk production are the production, harvesting and cutting of fodder crops and the processing, marketing and transport of inputs and outputs. Seasonal differences in feeding, watering and milking have to be taken into account as well as seasonal changes in the labor input of different household members and their relationship to other farm and non-farm activities. In some cases hired laborers are used now and then, in others they are used permanently.

In addition to increased investments, many improvements require extra labor. It is essential to verify whether this extra labor is available and whether other activities need to be abandoned as a result. The consequences for the household unit must also be established. It is most important to determine whether the labor input is sufficiently rewarded and whether the additional benefits revert to those who provide the extra labor (Chai et al, 1999).

In Indonesia, like in the study regions, smallholder rearing a few numbers of cows mostly undertakes dairy. They basically use family labor, both male and female, to perform the dairying activities from cleaning cows and their stable, milking, watering, delivering milk to cutting fodder and work related to usage of cooperative facilities. When they have to hire labor for such activities they hire local male people.

Table 4 shows the data on man-days labor use for various dairying activities in all the study regions. Because of the nature of the dairy work, usually centered in the homestead area, like cleaning cows, milking, feeding, watering and delivering milk, there is a tendency for more female family members to perform them in Sleman and Bantul. Female family members in this region do more than half of the dairying activities. In Bantul the trend was that more female family members were performing the dairy activities after they started to sell more of their milk to the consumers other than the cooperative.

Table 4. Family Labor and Hired Labor Use per cow per Household in the Study Regions

Labor	Sleman	Bantul	Yogyakarta
Family labor: female	62.5 (59.6)	50.3 (37.6)	-
Family labor: male	38.7 (36.9)	19.4 (14.5)	5.2 (4.1)
Hired labor (male)	3.7 (3.5)	64.0 (47.9)	121.2 (95.9)
Total labor	104.9 (100)	133.7 (100)	126.4 (100)

Source: Field Survey, 2003. Note: Percentage inside the (). Unit: man-day (one man-day is 8 hours).

Table 5. Dairying Labor Use per Household per Annum in the Study Regions (Unit: man day)

Activities	Region								
	Sleman			Bantul			Yogyakarta		
	FFL	MFL	MHL	FFL	MFL	MHL	FFL	MFL	MHL
Cleaning animal shed	23.2	45.2	3.9	24.2	21.0	31.1	-	-	70.2
Cleaning cow	49.8	9.1	0.8	66.4	10.8	21.8	-	-	71.1
Milking	49.8	3.7	0.6	72.1	4.1	8.1	-	-	87.4
Feeding	41.2	25.2	1.4	64.9	16.1	70.3	-	-	98.7
Watering	30.1	9.8	0.8	86.6	3.3	22.8	-	-	81.6
Delivering milk	30.7	1.9	0.6	20.8	6.5	188.3	-	17.9	188.9
Cutting fodder	48.3	73.1	8.3	-	63.9	86.4	-	8.1	78.8
Others	1.9	2.3	-	2.1	4.3	-	-	3.2	2.0
Subtotal	275	170.3	16.4	337.1	130.0	428.8	-	29.2	678.7
Total labor		461.7			895.9			707.9	
Female labor		275.0			337.1			-	
Male labor		186.7			558.8			707.9	
Family labor		445.3			467.1			29.2	
Hired labor		16.4			428.8			678.7	

Source: Field Survey, 2003.

Note: Others (going to cooperative for asking of AI, concentrate and credit). FFL: Female family labor, MFL: Male family labor, MHL: Male hired labor. One man-day: 8 hours.

In Yogyakarta, hired male laborers did almost all the dairying activities. Most of family members, male and female, were engaged in other jobs, such as, clerical work, business and professional work. In Bantul, the hired labor was basically used for delivering milk, cutting fodder, feeding animal and cleaning animal shed. It constituted nearly half of the total labor used. In Sleman hired labor used in dairying activities was very low and hired only during the peak period of harvesting and cultivating. All such hired labors were males in both the regions (Table 5).

Economic Aspects of Dairying

According to Saadullah (2002), many smallholders in the developing countries, particularly in mixed farming systems, prefer the flow product (milk, draft power and manure) rather than the end products (meat, hides and skins) since their animals for slaughter entail the permanent loss of flow products. This is also true for the Indonesia dairying, in which the incomes are gained from selling of milk, cows, calves and manure. In the study regions, there was no dairy cow used for draft power. Income from dairying is used to meet/provide farm household expenses, savings, investment and insurance.

Profitability of Dairying

Cost of dairying is divided into two types: variable cost and fixed cost. **Variable cost** includes: fodder, concentrate, veterinary services, labor, transportation, interest of credit, energy and others. **Fixed cost** includes: animal tax, land tax, animal insurance, depreciation of animal, depreciation of equipment, and depreciation of building. The overall cost of production is the summation of these two components.

Table 6 shows the details of cost and income of dairying in the study regions.

The variable costs are the biggest cost in all three study regions, comprising about 90% of the total cost. Within the variable cost labor cost, including the actual wage paid to the hired labor and evaluation of the self-labor, each separately for female and male, according to the market price, can be singled out as the most significant one, comprising more than 40% of the total cost in all the regions.

Fodder is another significant cost component of the dairying. The highest fodder cost was in Bantul (16.5%), followed by Yogyakarta (12.7%) and Sleman (7.6%). Milk producers in Bantul and Yogyakarta used both self-produced and bought fodder for their dairy cows. They buy fodder during the peak of dry season because self-produced fodder is not enough then. In Sleman, the milk producers use both; self produced fodder and or collected fodder from forest, roadsides and riverbanks, free of charge. Thus, the amount of fodder cost shown in Table 6 was fodder production cost for Sleman where as it was the summation of purchased value and production cost for Bantul and Yogyakarta.

Concentrate is another key component of the variable cost. All the milk producers buy the concentrate from the cooperative where the price is cheaper than the outside market and the door delivery is made by the cooperative, which ultimately reduces the transportation cost. The share of this cost was around 30% of the total cost in all the three study regions.

Other variable costs, including veterinary services, transportation, interest of credit, energy, are nominal in all the regions. The share of fixed cost was 12.9% in Sleman, 6.5% in Bantul and 7.9% in Yogyakarta. Other components of fixed cost were very nominal. The higher share of this cost in Sleman is due to the cost of animal insurance, which comes in package when the dairy animals are procured from the cooperative, as they generally do.

The main source of income is milk in all three regions. The other sources are cows, calves, and manure. Milk producers also receive the bonus on the basis of fat and SNF content of their milk from the cooperative. The income of manure is divided into selling of manure and evaluated manure used in the self-farm. The amount of income from these sources varies according to the regions.

The total amount of gross income summed up to 13.6 million rupiahs in Sleman, 29.4 million rupiahs in Bantul and 25.7 million rupiahs in Yogyakarta. The subtraction of total production cost from the gross income gives the net income per household. Thus, the net income from dairying was 3.4 million rupiahs per household in Sleman and 4.8 and 4.2 million rupiahs in Bantul and Yogyakarta, respectively. This net income is the evaluated profit of the milk producers from the dairying. The net return to farm, including the returns to self-resources, like labor, is, 7 million rupiahs in Sleman, 9 million rupiahs in Bantul and 4 million rupiahs in Yogyakarta. It can be said that the returns for what remains in the farm nearly doubles the net earnings in Sleman and Bantul when the returns to their self-resources are considered.

This indicates that these milk producers have been able to well use their self-resources, especially family labor, through self-employment. This aids in tackling the problem of disguised unemployment. Similarly, better use of crop byproducts and collected fodder, which other wise would have been simply wasted is also worth noticing, as such they contribute in increasing the net return to the farm significantly.

Table 6. Annual Cost and Income per Household in Dairying in the Study Regions

Description	Sleman		Bantul		Yogyakarta	
	Amount	Share	Amount	Share	Amount	Share
1. Variable cost						
Fodder	778,343.1	7.6	4,127,031.8	16.5	2,727,593.0	12.7
Concentrate	3,243,664.8	31.8	7,375,637.4	29.4	6,096,552.2	28.3
Veterinary cost	176,214.5	1.7	577,290.6	2.3	485,547.8	2.3
Family labor	4,468,829.1	43.8	5,050,716.1	20.1	369,755.8	1.7
Hired labor	20,724.6	0.2	5,418,702.9	21.6	8,576,663.9	39.8
Transportation	40,101.9	0.4	579,546.2	2.3	328,359.4	1.5
Interest of credit	94,157.8	0.9	179,622.1	0.7	204,896.2	1.0
Energy	62,670.4	0.6	137,143.6	0.5	1,037,347.5	4.8
Total variable cost	8,884,706.3	87.1	23,445,690.6	93.5	19,826,715.8	92.1
2. Fixed cost						
Animal tax	5,418.8	0.1	8,466.8	0.0	7,124.5	0.0
Land tax	50,231.4	0.5	60,657.8	0.2	156,705.3	0.7
Animal insurance	929,447.9	9.1	490,854.1	2.0	541,700.2	2.5
Depreciation of animal	214,816.8	2.1	665,419.0	2.7	741,082.0	3.4
Depreciation of equipment	58,494.4	0.6	197,707.2	0.8	158,373.0	0.7
Depreciation of building	61,680.1	0.6	201,924.8	0.8	104,231.4	0.5
Total fixed cost	1,320,089.4	12.9	1,625,029.7	6.5	1,709,216.4	7.9
Total cost	10,204,795.7	100.0	25,070,720.4	100.0	21,535,932.2	100.0
3. Gross income						
Selling cow	4,411,725.9	32.5	5,691,948.3	19.1	4,070,854.6	15.8
Selling calves	1,537,196.4	11.3	3,697,559.6	12.4	4,784,289.1	18.6
Selling milk	6,335,308.5	46.7	18,673,197.0	62.6	15,700,182.0	61.0
Bonus	159,869.6	1.2	276,737.5	0.9	77,654.6	0.3
Self use manure	834,729.1	6.2	905,794.3	3.0	434,579.9	1.7
Selling manure	278,243.0	2.1	603,862.8	2.0	651,869.8	2.5
Total gross income	13,557,072.4	100.0	29,849,099.3	100.0	25,719,430.1	100.0
Net income	3,352,276.7		4,778,378.9		4,183,497.9	
Net return to farm	6,986,376.7		8,923,300.8		4,118,673.7	

Source: Field Survey, 2003.

Note: Cost and income is calculated from September 2002 to August 2003. The nominal values have been evaluated at 2000 constant price. Rupiah is Indonesian currency (11,300 rupiahs = 1 US\$ in 2000).

Contribution of Dairy Income to the Household Income

Table 7 presents the total income from agricultural activities (crop, dairy, and other livestock) and non-agricultural activities in the study regions. This showed that the households in Sleman were fully dependent on the agriculture including dairy for their income (more than 80% of the income came from the agricultural activities). The contribution of dairy in the household income was the highest (53.2%) there. Most of the milk producers in Sleman gave more attention to dairying. They raised more dairy cows and hence, it was the biggest contributor in their total household income.

In Bantul and Yogyakarta the non-agricultural activities have the highest share in the household income amounting to 59% and 82%, respectively. The contribution of dairy in the household income is 32%, and 11%, respectively. A very high share of non-

agricultural activities in Bantul and Yogyakarta shows that the households have diversified their income generating activities. In that sense, dairying and agriculture has become a part time activity in the households. It is not infrequent in the case of such households that a small *sawah* is cultivated by an elderly person or by the head of household in the evening after having completed the activities of the primary job. The dairy activities are done by mostly female family labor and or supported by hired labor mainly for delivering of milk to the consumers.

Table 7. Share of Dairying in the Household Income in the Study Regions

Income gaining activity	Sleman		Bantul		Yogyakarta	
	Amount	Share	Amount	Share	Amount	Share
Crop	2,949,051.7	31.1	1,796,541.8	7.7	2,218,616.8	6.0
Dairy	3,352,276.7	35.3	4,778,378.9	20.4	4,183,497.9	11.2
Other livestock	751,636.0	7.9	580,100.6	2.5	205,535.0	0.6
Non agriculture	2,436,675.0	25.7	16,297,279.9	69.4	30,525,798.3	82.2
Total	9,489,639.3	100.0	23,452,301.2	100.0	37,133,447.9	100.0

Source: Field Survey, 2003.

Note: Cost and income is calculated from September 2002 to August 2003. The nominal values have been evaluated at 2000 constant price. Rupiah is Indonesian currency (11,300 rupiahs = 1 US\$ in 2000).

Other livestock includes income from chicken, duck, cows and goat. Non-agriculture includes business, professional job; construction, mining, manufacturing, transportation and army, and clerical job.

A low share of dairy activities in the household income in Bantul and Yogyakarta not necessarily means that dairy activities are virtually on the process of disappearing from the dweller's choice and they are no more efficient in dairying. In fact, as seen earlier the net incomes in these regions are better than that of the rural region of Sleman. Rather, it is due to their limitation in being able to use their self resources better in this activity, primarily due to other opportunities available to them to use these resources, i.e., land being used as the apartment for the students and family labor being engaged in business and clerical jobs, which bring them relatively more income.

SUMMARY

Small scale or smallholder farms dominate dairying in the study regions under crop-livestock mixed farming system. There is a rather stable composition of cows at household level with good future prospects and produces about 2,100 liters of milk per head per year. It has been growing with the favorable government policies, which intend to increase the domestic production of milk and also address the disguised unemployment issue in the rural region with such policies. Feeds are one of the major inputs for dairy production. Milk producers benefit from concentrate feed produced by cooperative. The roughage fodder though relatively abundant in DIY Province has seasonality in the availability and those in the urban region are not able to use them in the same way as the ones in the rural region. Making of the silage to improve the quality of roughage fodder and to use them during the fodder scarce season is not in practice at the producers' level, yet.

As a whole, dairying in DIY Province is labor intensive. They mostly use family labor to carry out various dairy activities. But, those in rural and sub urban regions also use hired labor in dairy cows caring and delivering of milk. In urban areas, there is a

greater use of hired male labor in dairy. In rural areas hired labors are used only during the peak period of harvesting and cultivating.

Consequently, the feed (concentrate and fodder) and labor (family and hired) are the two major cost components, comprising more than 70% of the total production cost in dairying. Hence, efficient use of feed and labor would minimize the total production cost and maximize the net income. Further, to be able to use self-resources, feed produced by using self-products and by products of mixed farming system and family labor, would retain more of the income to self-enterprise, contributing to increase the net return to the farm/household.

On the income part, selling of milk, cow and calves as the main sources of income in dairying. Hence, increase in milk production during each lactation by, lengthening the lactation period, shortening the dry period, and increasing the daily milk production with well managed calving, supported by the genetic quality and nutritional feeding is key to the increase in gross income. This aspect is also needed to be addressed to increase milk production to 4,500 liters of milk per lactation period of 300 days, the latest target set by the government.

Income from dairying gives different level of contribution to the household income of the milk producers in the three study regions. In Yogyakarta (urban) and Bantul (sub urban), non-agriculture activities give the highest share in household income. On other hand, dairying in Sleman (rural) has the highest share in the household income where the self-resources are well used, which aids significantly in addressing the issue of disguised unemployment. The share of use of self-resources decreases in sub urban and urban regions, primarily due to abundance of opportunities to use them in non-agricultural activities. Hence, it is clear that there is correlation between location specific characteristics and the nature of dairying. Over all, Sleman has been indicated to have a better chance to undertake and develop dairying in the future, as well.

Livestock Farming in Nepal

Geographically, Nepal is divided into three regions, Mountain, Hills and Tarai. The Tarai, being an extension of the Gangetic plains of India, forms a low flat land, ranging from 22m to 600m above, mean sea level. Unlike the general image of Nepal it has subtropical climate with hot and humid summer, torrential monsoon rain and dry winter. It stretches along the southern boundary of the country. It comprises only 23 % of the total land of the country and accommodates 47% of population. This region includes most of the fertile land and dense subtropical forest. Most of the forest is cleared for settlement and cultivation. About 40% of land is suitable for cultivation.

Livestock farming being a major component of Nepalese farming system is one of the important occupations in the rural area of Nepal. It contributes 31% of agriculture gross domestic product (AGDP), among this, 53% derived from the hills, 38% from the Tarai and 9% from the mountains (APP, 1995). Dairy farming constitutes 78% of livestock farming and alone contributes 24% in total AGDP. It is presently undergoing a transition phase from subsistence to commercial dairy farming in the various places of the Tarai region due to the increase of milk marketing facilities in the area.

Dairy animals that include cow and buffalo are evenly distributed throughout the country, with some predominance of cow in Tarai and lower hills and buffalo in Tarai and Hills in general. About 75% of Nepalese household keep cow and 48% keep

buffalo mainly for milk, draft power and manure for their farmland. Crop-livestock mixed farming system prevails almost everywhere in the country. There is about 7.0 million heads of cow with the annual increment of 0.05% and 3.4 million heads of buffalo, growing at a rate of about 1.6 % per annum in the year 2001 (**Table 8**).

Table 8. Dairy Animal, Milk Production and Yield according to Geographical Region

Region	Dairy animal	Total number	Milking animal	Milk production (ton)	Milk yield (kg/year)
Mountain	Cow	819,243	104,533	33,882	324
	Buffalo	313,500	81,802	57,632	705
Hill	Cow	3,447,598	459,703	178,907	389
	Buffalo	1,939,134	567,007	446,660	787
Tarai	Cow	2,760,302	288,347	129,949	450
	Buffalo	1,163,435	288,002	277,102	962
Nepal	Cow	7,027,143	852,583	342,738	401
	Buffalo	3,416,069	936,811	781,394	834

Source: APSD, 2001.

Cow and buffalo are the main grazing dairy animals in the Tarai region. The main cow breeds found in the region are Bos Taurus Jersey, Holstein Friesian, Bos indicus Haryana and Sahiwal. Buffalo breeds are crossbred Murrah from India. The upgrading program implemented by the Department of Agriculture Development (DAD) using both natural services and artificial insemination supports the maintenance of breed. Murrah crossbreed are more common in the mid-hills and the Tarai, particularly where access to milk market is good. Dairy animals, cow and buffalo, are reared in the region mostly to get manure for their farmland and the draft power for crop cultivation. Female calves are reared as herd replacements while male calves are either reared for replacement draught oxen for ploughing and for pulling carts, or they are neglected, killed or sold to the buyers from India and local areas. Male buffalo calves are also weaned very early and slaughtered for meat. Both the producers and the consumers prefer Buffalo milk, which contains high amount of milk fat particles, to cow milk. When there are less open/private grazing land and roughage fodder from forest, more crop residues (paddy, wheat, maize, cotton, sugar cane tops, and lentil) are given to the animals to compensate their diet. It is also generally supplemented with some home made concentrates, locally known as *kundo*, predominately made boiling maize flour, rice bran, salt and kitchen waste in about 2-3 liters of water. The amount *kundofed* to the animal per day varies from 0.5-1 kg/day/animal during or after the lactation.

Milk production varies according to geographical region. **Table 8** shows the number of milking animal and milk production according to region, which is less in Tarai compared to Hill. However, the milk yield of cow and buffalo in Tarai is 450 kg (1 kg is regarded equivalent to 1 liter) and 962 kg per year, respectively, which is the highest among all the Geographical regions. Country as a whole, cow milk contributes about 32% of the total milk production with average milk yield of 401 kg per year. A large share of milk production is produced by buffalo, which with the milk yield of 834 kg per year contributes 68% in total milk production. The recent trend of milking animals and milk production in Nepal is shown in **Figure 5**.

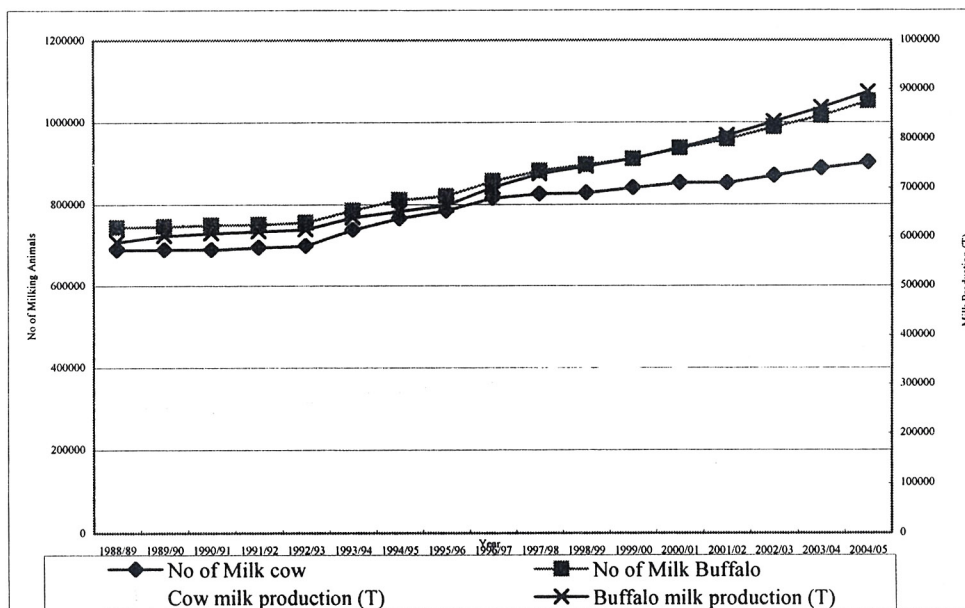


Figure 5. Recent Trend of Dairy Animal Population and Milk Production in Nepal. Source: CBS, 1987, 1997 and APSD, 2006.

4-1. Development of Dairy Farming in Nepal

In Nepal, dairy development activities began in 1952 with the establishment of a small-scale milk processing plant on an experimental basis in Tusal, a village in the Kavreplanchok district, under the Department of Agriculture. After that few yak cheese factories were started with an assistance of Food and Agriculture Organization (FAO) of the United Nations in 1952/53. With the growing prospect of expanding the dairy sector, the First Five-Year Plan (1952-57) emphasized the need for developing a modern dairy industry. It had programs to establish milk collecting centers and central milk processing plant in Kathmandu valley, cheese making plants, using yak milk, in high hills and ghee purification center at the exporting points in the Tarai. In order to streamline the dairy development activities, Dairy Development Commission was formed in 1955, and it was then converted into the Dairy Development Board in 1962. In accordance with the Corporation Act of 1964, the board was again converted into the Dairy Development Corporation (DDC) in 1969 in order to meet the growing milk demand in the Kathmandu valley. The main objectives of DDC are to provide guaranteed market, fair price to the rural milk producers, supply pasteurized milk and other standard dairy products to the urban consumers. When DDC started its operation it had only Kathmandu Milk Supply Scheme (KMSS) and one Cheese Production and Supply Scheme with four Cheese Production Centers. Over the years, DDC gradually extended its activity area outside Kathmandu Valley, and established various milk supply schemes in different parts of the country to meet the growing demand for processed milk and milk products. Currently there are six milk supply schemes and one milk production and distribution scheme in Nepal (Table 9).

Table 9. Features of the Milk Supply Scheme under DDC

Particular	KMSS	BMSS	HMSS	PMSS	LMSS	MPPSS	DDC
Processing capacity	75,000	25,000	15,000	10,000	2,500	-	
Milk collection (ton)	31,325	9,127	7,246	2,029	3,127	2,485	55,339
Milk production (ton)	48,244	12,393	6,935	5,680	323	-	73,575
Milk tale (ton)	46,193	3,315	2,744	5,162	260	-	57,674
Skim milk powder Production (ton)	-	651	-	-	-	-	651
MPCs/MPAs	479	144	151	58	-	-	832
Collecting centre	469	230	200	109	84	25	1,117
Chilling centre	14	10	8	3	8	11	54
Milk-selling booth	965	148	175	-	-	-	1,288
Districts covered	9	7	5	7	5	3	7
Staff	149	140	135	89	39	127	679

Source: DDC, Annual Report 2004.

Madhya Paschimanchal Supply Scheme (MPSS) has recently been established in order to supply pasteurized milk in the local area. Since MPSS has not yet established milk-processing plant (under way), it also has been transshipping raw milk to KMSS. Hetauda Milk Supply Scheme supports KMSS by supplying excess milk that is above their local requirement, where as Biratnagar Milk Supply Scheme (BMSS) manufactures skimmed milk powder from its excess milk and that of other milk supply schemes as well.

DDC collects cow, buffalo and yak milk from different districts. Milk is collected through the farmer owned organizations such as Milk Producer's Association (MPA) and Milk Producer's Cooperative Society (MPC). The present milk collection network of DDC has spread the collection network under different Milk Supply Schemes is presented in Table 9, as well. All these schemes have a mandate to collect, process and sell milk in their respective command areas consisting of certain districts. At present, the DDC has a milk collection network in 39 districts throughout the country from Panchthar district in the East to Surkhet district in the west.

Dairy Farming in Chitwan Cooperative Dairy

One of the most significant contributions of first Livestock Development Project in 1979/80 was to promote and expand the establishment of MPAs/MPCs in the rural areas. These MPAs/MPCs as primary cooperatives were formed under the initiation DDC, based on the cooperative principle. The main aim of this program was to link the milk producers with technical inputs and financial help. DDC did provide technical support, training, supply of all required inputs to these MPAs/MPCs. These MPAs/MPCs are a local organization formed with the local milk producers with an objective of collecting, testing, selling milk to DDC and receiving payment of the milk, as the farm gate price, with collective bargaining, as per need. The milk producers become member of the cooperatives after purchasing certain numbers of minimum required shares issued by the cooperative, i.e., becoming shareholder of the cooperative and other rules regarding milk production, selling and cooperative movement principles set by respective cooperatives individually.

In the district level, District Dairy Cooperative Union acts as an umbrella organization of the dairy cooperatives (MPAs/MPCs) in Chitwan district, as elsewhere. This union has the responsibility of policy planning, monitoring and evaluation for the primary dairy cooperatives. It was established in 1994 and has 12 committee members, including a president, a vice-president, a manager and 9 executive members, and an accounting committee with one coordinator and two members in its management committee. The shares of the primary cooperatives sold to their respective individual members are monitored and at times managed by the union. The list of sampled dairy cooperatives and their general characteristics are summarized in **Table 10**.

The main objectives of these dairy cooperatives are the collection and marketing of the milk produced by the member farmers. Besides, cooperatives also provide various services on animal health; veterinary and medication, feed supply and supplying of high breed animals. They also conduct training and awareness programs regarding the benefits of dairy to motivate farmers to undertake dairy farming. They also arrange tour program to visit dairy facilities and other dairy unions, cooperatives for sharing the experiences and broadening the knowledge. At times, they also organize livestock health camp, veterinary camp, animal infertility camp, group discussion, etc. in coordination with district livestock directorate, agricultural university. However, very few cooperatives provide artificial insemination services in the area, primarily due to lack of quality semens.

It seems cooperative are more focused in the milk collection and milk marketing produced by the farmers. Farmers of the surrounding area carry their milk to the MPAs/MPCs in the morning as well as in the evening. Fat and solid non-fat particles are checked at these collection centers. Such collected milk is transferred directly to the DDC chilling center. Those cooperatives with chilling center facilities also send the milk directly to DDC processing plants within five to six hours period. Some cooperatives also have provision of saving and credit program. Annapurna Dairy Cooperative (*Annapurna Dugda Utpadak Sahakari Sanstha Ltd*) is one of the oldest dairy cooperative and having maximum number of shareholders. Two dairy cooperative Annapurna and Triveni has their own chilling center and they collect milk more than 2,000 liters per day. Among the 104 dairy farmers studied, 86 are the co-operative members. Among them, 76 households are receiving feed, 5 are receiving fertilizer and 9 are receiving veterinary and medication services from dairy cooperatives.

Socio-economic Characteristics of Dairy Farmers

According to the preliminary census 2001, the total population of Gitanagar VDC is 10,244 living under 2,012 households making an average household size 5.1. This includes 4,905 males and 5,339 females. The male to female sex ratio is 0.91, which is slightly less than national average of 0.99. The total population in Gunjanagar VDC is 12,868 living under 2,499 households with family size 5.1. The male to female sex ratio is 0.93.

Land holdings

Table 11 shows the population distribution according to the farm size and sex of the sampled household among the dairy farmers in the study area (Gitanagar & Gunjanagar). The total population of sampled household is 650 living under 104 households. The majority of sampled household belongs to medium size, holding less

than two hectare of land. The average household size is 6 with male and female population approximately equally distributed.

Table 10. General Characteristics of Sampled Dairy Cooperative in the Study Area

No	Name of the Milk Producers Cooperative	Established	Shareholder (member)	Objectives	Membership qualification
1	Annapurna Dugda Utpadak Sahakari Sastha Ltd. (Chilling Center)	1992	199	- Generate income - Milk collection and sale	- At least 9 months milk sell per year
2	Gunjanagar Dugda Utpadak Sahakari Sastha Ltd.	1993	170	- Milk collection and sale - Feed Supply	- Nepalese citizenship - Livestock farmer - Involved in group activities.
3	Kalpabriksha Multicooperative Sanstha Ltd.	1993	83	- Saving and Credit - Milk collection and sale	- Economically viable - Good social prestige
4	Chanauli Dugda Utpadak Sahakari Sastha Ltd.	1993	50	- Group formation - Increase income	- Minimum of 200 lts. Milk sell per year - Collective motive
5	Triveni Dugda Utpadak Sahakari Sastha Ltd. (Chilling Center)	1994	113	- Group formation for integrated work - Milk collection and sale	- Minimum of 500 lts milk sell per year
6	Devnagar Dugda Utpadak Sahakari Sastha Ltd.	1995	70	- Employment generation - Milk collection and sale	- Minimum of six months milk selling
7	Shree Shanti Dugda Utpadak Sahakari Sastha Ltd.	1995	65	- Milk collection and sale - Feed sale and buy - Saving and credit	- Minimum of 500 lts milk sell per year
8	Adarsha Dugda Utpadak Sahakari Sastha Ltd.	1995	48	- Create awareness of dairy - Saving and Credit	- Purchase share and saving
9	Shrejanshil Krishi Shamuha.	1995	30	- Provide dairy service for farmers - Milk collection and sale	- Monthly Rs. 50 saving is necessary
10	Shree Ganesh Multi Cooperative Sanstha Ltd.	1998	37	- Milk collection and sale - Income distribution - Facilitate dairy farming	- Minimum of 200 lts. Milk sell per year

Source: Field Survey, 2004.

Table 11. Population Distribution of the Sampled Household according to Farm Size

Farm size	Male	Female	Total	Percentage	No of HH	Average HH size
Small	57	57	114	17.5	22	5
Medium	233	220	453	69.7	74	6
Large	45	38	83	12.8	8	10
Total	335	315	650	100.0	104	6

Source: Field survey, 2002.

Occupational Structure

The nature of local economies and various commercial and employment opportunities are reflected in the people's occupation. In terms of occupational structure the study area is very agrarian in nature with more than 90% of people engaged in farming as a main job. The farming here too is practiced under crop-livestock mixed farming system, where the sub sectors of crop farming and livestock (dairy) farming are integrated with each other to maximize the output from it to increase the welfare of the farmers. Nevertheless, the study area has a relatively more developed local economy, which can be attributed to its location along the trade route to various market places within and outside the district. **Table 12** shows different trends in the diversity of income sources among small, medium and large farmers. All the three groups of farmers have approximately similar range of income sources (four economic activities) for income generation. The most important occupation is farming that includes crop and livestock production. It provides income to about 77.3% of them, which is far greater figure than the second largest clerical job (13.1%), professional (7.1%), and business (2.5%). These economic activities are the main livelihood strategies of the sampled household that represent the whole district. However, the majority of households have farm-based activities; crop and dairy farming as their main occupation for living.

Table 12. Occupational Structure of Sampled Household According to Farm Size

Occupation category	Small	Medium	Large	Total	Percentage
Farming	44	168	31	243	77.3
Business	1	7		8	2.5
Clerical job	10	24	7	41	13.1
Professional job	2	18	2	22	7.1
Total	57	217	40	314	100.0

Source: Field Survey, 2002.

Note: People above 65 (14), under 6 (43), Student (279) is not included. Farming: Crop & livestock. Business: Shopkeeper, Trade. Clerical Job: Government/non government Officer. Professional: Teacher, Politician, Writer, Driver, Nurse, Police, Army and Overseer. Small: 0.2 to under 0.5 ha; Medium: 0.5 and under 2 ha; Large: 2 ha and above of landholding.

4-2-1-3. Livestock Holdings

Livestock ownership is one of the other major financial assets that people have. The production of manure through livestock is a major contributor to traditional soil management practices. And dairy provides an important source of income. The main animals reared in the study area are cow, buffalo, goat, ox and chicken. **Table 13** shows the ownership of dairy animals and its composition in the study area. The average number of dairy cow and buffalo in small, medium and large farms is 4, 5 and 6 respectively. The highest number of average dairy animals is owned by large farm. It implies that the large farmers have more potential to produce dairy products for their

own consumption and selling. Other farmer groups owned less numbers of dairy animals compared to that of large farmers. Similarly, number of milking cow holding per household in small, medium and large farms is 1.1, 1.2 and 0.9, respectively and that of buffalo holding is less than one in all the cases.

Table 13. Dairy Animal Holding of Studied Household

Description	Small (22)	Medium (74)	Large (8)	Total
Milking cow	25	92	7	124
Dry cow	9	28	4	41
Heifer	6	42	2	50
Female calf	10	29	3	42
Male calf	3	14	2	19
Bull	5	37	4	46
Milking buffalo	14	46	4	64
Dry buffalo	1	16	10	27
Heifer	7	26	6	39
Female calf	2	17	2	21
Male calf	4	14	7	25
Total dairy animal holding	86	361	51	498
Dairy animal holding per household	4	5	6	5
Milking cow holding per household	1.1	1.2	0.9	1.2
Milking buffalo holding per household	0.6	0.6	0.5	0.6

Source: Field Survey, 2002.

Small: 0.2 to under 0.5 ha; Medium: 0.5 and under 2 ha; Large: 2 ha and above of landholding. Milking animal: cow/buffalo, producing milk. Dry animal: a cow/buffalo usually in the latest part of pregnancy, whose lactation has been terminated and who is being prepared for the next lactation, or stopped milking. Heifer: young female bovine from first heat to the time of first calving. Calf: young male or female animal. Bull: adult male animal kept for seed and or draft.

SURVEY RESULTS AND DISCUSSION

4-3-1. Labor Uses in Dairy Farming

Availability of labor, both quantity and quality, in the household is another important human asset and one of the important inputs in dairy enterprises. The knowledge of dairy animal management and the requisite skills needed in dairy farming determine the quality of labor and input to enhance the productivity of dairy animal. But in a low productivity framework, non-professionals do the work of maintaining and rearing of dairy cows, as their opportunity cost is lower. The dairy enterprise provides a gainful employment to the rural households. Hence, the number of household members available to perform dairy activities is an important factor for adopting labor-intensive dairy farming. **Table 14** shows the annual labor use in various dairy activities per household. In the study area all the dairy activities are performed by family labor in all the farm categories. The average number of days spent per household for dairy activities per year was 332 man-days in medium size farms. This is relatively higher than the days spent in small and large size farms, totaling to 310 and 306 days, respectively. But, the average number of animal holding is less in small and medium size farms. Accordingly, the number of man-days used per animal is least (51 man-days) in large farm, followed by medium farm (66 man-days). It is highest (78 man-days) in small farm. This implies that smaller farmers have higher tendency to get involved in dairy activities. Corolarilly,

smaller farmers are better able to use their self-labor in dairy farming. Male and female members of the family were equally engaged in over all dairy activities. But there was division of labor according to specific activity. Females were more engaged in fodder collection and animal shed cleaning, where as males were more engaged in milking and milk marketing and milk delivery to the collection centers.

Table 14. Annual Labor Utilization in Dairy Activities per Household

Activities	Small			Medium			Large		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Fodder collection	32	60	92	39	56	95	33	56	89
Feeding	35	37	73	35	33	68	40	48	88
Cleaning animal	10	7	17	14	8	22	7	10	17
Cleaning animal shed	17	33	50	22	23	45	17	29	46
Milking	25	16	40	33	24	57	26	14	40
Milk delivery	28	10	38	37	8	45	20	6	26
Total labor	147	163	310	180	154	332	142	163	306
Labor use per animal	37	41	78	36	31	66	27	30	51

Source: Field Survey, 2002.

Small: having 0.2 & under 0.5 ha land, Medium: 0.5 & under 2 ha land, Large: above 2 ha land. Unit: Man-day = Adult Equivalent Unit of working 8 hrs/day. A working child was counted as a half of an adult.

4-3-2. Milk Production and Consumption Pattern

Milk production is the major income-generating source of the dairy farmers in the study area. Fluid milk consumption among household is common in the study area as other parts of the country. Majority of sampled household member drink milk regularly. Children and old family member has given priority in drinking milk. The use of milk for tea is common practice.

Table 15 shows the annual milk production and consumption per household according to farm size. The average amount of milk production among the small and medium farms is more than double that of large farm. Similarly small and medium farms sell more than 80% of the total milk production while large farm sells only 58% of the total milk production per household. This implies small and medium farms have higher tendency to earn income from selling milk. The consumption pattern of milk in large farm is higher. However, the per capita milk consumption in this farm is lowest among all the farms, primarily due to their larger family. However, the study area being a dairy pocket area, the overall average per capita milk consumption is much higher than that of the national average and the basic need level recommended by WHO.

Table 15 Milk Production and Consumption per Household by Farm Size

Farm size	Milk production (kg)	Milk sale (kg)	Milk consumption (kg)	Milk consumption per capita (Kg/head)
Small	3117.5	2609.8 (84%)	507.7 (16%)	101.3
Medium	3145.1	2521.4 (80%)	623.7 (20%)	106.5
Large	1743.8	1004.6 (58%)	739.1 (42%)	76.2
Total	3037.8	2423.4 (80%)	614.4 (20%)	103.1
National per capita milk consumption (kg/head)				48.4
Basic Need level recommended by WHO (kg/head)				57.8

Source: Field Survey, 2002

4-3-3. Dairy Farming Production Cost

In this study different variable costs¹, (equivalent to total cost) were calculate for the net household income from dairy farming. The variable costs for individual households in dairy production were computed by summing the expenditures on self and purchased feed, dairy animal health, electricity and cost for labor, which were reported by farmers. The average purchased feed value is very high due to the high market price of ready made feed produced by feed industry or imported from India. The labor used in dairy production was all household (family) labor. The household labor value was evaluated based on the opportunity cost of agricultural labor found in agricultural labor market. The man-day labor cost for man, woman and child is NRs. 100, 80 and 50, respectively.

Table 16. Annual Dairy Production Cost per Household by Farm Size

Description	Small	Medium	Large
Self feed (concentrate, maize, oil cake)	123	655	2,100
Self feed (fodder, grass, straw)	741	1,682	3,480
Purchased feed (concentrate, maize, oil cake)	22,395	22,884	10,463
Purchased feed (fodder, grass, straw)	3,691	2,869	
Total feed cost	26,950	28,090	16,043
Health cost	1,476	1,496	2,120
Electricity cost	39	61	100
Labor cost (evaluated)	27,748	30,252	27,318
Total dairy production cost	56,213	59,899	45,581

Source: Field Survey, 2002, Unit: Nepali Rupees (NRs.), \$1 = NRs. 77.

Table 16 shows the different types of costs in dairy farming. It shows that the mean value for self-feed is one of the lowest in small and medium farm categories. These two groups of farms have high share of purchased feed in the total feed cost. The amount of purchased concentrates is more than double the amount of the purchased feed in large farm compared to self-feed. Large farmers don't buy any roughage fodder and purchased lesser concentrates. This indicates that they relied more on self resources for feed than smaller farmers, a possibility that may have come from their large land holding, consequently producing more by products in crop farming that can be used as the roughage fodder for the dairy animals.

Mean value for electricity used and health is very minimal in all the cases. The total production cost is not significantly different in small and medium farms with NRs. 56,213 and NRs. 59,899, respectively. Whereas, the production cost of large farm (NRs. 45,581) is lesser than those of other smaller farms. It may be due to the composition of animals, in which large farmers own less number of milking animals. Generally milking animals are given more care and quality feed, including more concentrates. The labor cost, including the evaluated cost of self-labor is not much different in all the farm categories. Hence, the difference in production cost between large farm and small and medium farms comes primarily from the difference in feed cost.

¹ Fixed cost such as depreciation cost for animal, animal shed and equipment used were excluded in the study. It is difficult to evaluate animal depreciation cost due to the various matters such as animal type, size, age and calving stage. In the case of animal shed and equipment, it is also difficult to evaluate the depreciation cost. Because majority of farmers are using same animal shed for dairy animals and other small animals and using same equipment for dairy as well as crop farming.

Income Earnings from Dairy Farming

Milk selling is the major income source for dairy farmers. Besides, selling of other items such as selling of animal itself in different stages; milking, heifer, calf and so on and selling of few other dairy products were also found in the study area.

Table 17 shows the highest income earning comes from selling of milk in all three groups of farmers. The gross income is about 1.5 times higher in small and medium farms than large farm though the later in average owned higher number of animals per household. Large farm, unlike the small and medium farms also do not sell any other products except milk. In fact, they are not even inclined to sell the milk if the conditions for milk delivering, including rain, storm festival or any other busy days, are not favorable. During such days they would simply self consume the milk in various ways. Accordingly, the main purpose of rearing dairy animals for them is to get manure for their farmland to enhance the yield of the crop production in the crop-livestock mixed farming system. Where as small and medium farms take it as an enterprise for income generation and hence would be always more commercial in mind.

Table 17. Annual Income Earnings from Dairy per Household

Description	Small	Medium	Large
Selling milking cow	1,681.82	4756.76	
Heifer (cow)		739.72	
Cow milk	43,363.09	44,980.33	17,793.75
Milking buffalo		2,122.97	
Dry buffalo	328.18	378.37	
Heifer (buffalo)		216.21	
She calf		14.46	
He calf	100.00	277.92	
Bullock		56.75	
Buffalo milk	19,045.90	20,137.33	20,394.37
Ghee (churned butter)		199.32	
Manure	1,909.09	113.51	
Manure self use	3,415.00	5,177.00	10,581.00
Gross income	69,843.08	79,170.65	48,769.12
Total production cost	56,213.30	59,898.65	45,581.05
Net income	13,629.78	19,272.00	3,188.07
Net return to farm	42,242.08	51,860.65	36,086.07

Source: Field Survey, 2002.

Note: Net income = Gross income - Total production cost. Net return to farm = Net income + Returns to self- inputs (feed, labor and manure). Unit Nepali Rupees, \$1= NRs 77.

4-3-5. Annual Incomes from Different Occupations

Although agriculture is the mainstay of the village economy, some people have shifted to trading and government/private services as their main occupation to maintain livelihood. During the off-farm season, people migrate to towns and market center in the same district such as Narayanghat, Bharatpur Bazar and so on to gain extra income. The main income generating activities found in the study area can be characterized in two sectors; farming and non-farming. Farming includes crop farming, livestock (dairy) farming and other farm related activities. Non-farming includes clerical job, business and professional job. Farming, together with crop and dairy engaged 77% of the total

economically active sampled population. It was followed by clerical job (13%), business (7%) and professional (3%).

Table 18 shows the mean income earned from dairy production is one of the lowest in large farm, i. e., NRs. 36,086, in spite of the fact that they own higher number of dairy animals compared to the medium and small farms. Some of the large farmers also reported that they did not have to be fully engaged in commercial-scale dairy farming as they have a sufficient amount of income from crop farming as well as non-farm activities. They were seemingly rearing dairy animal for the reason of self-consumption of milk and manure for their farmland. Their higher income earnings from crop farming and clerical job also reveal this fact, the highest compared to other two groups, i. e., NRs. 44,499 and NRs. 80,250, respectively. Medium and small farms earned very less income from non-farm based activities. The total average household income of large farm was more than double of the incomes of small farm and more than one-half of the incomes of the medium farm.

Table 18. Annual Incomes from Different Income Sources per Household

Farm Size	Household	Farm based		Non-farm based			Total household Income
		Crop	Dairy	Business	Clerical job	Professional job	
Small	22	9,239 (11%)	42,242 (52%)	2,273 (3%)	23,045 (29%)	4,364 (5%)	81,163 (100%)
Medium	74	18,578 (16%)	51,861 (45%)	4,460 (4%)	27,216 (24%)	13,068 (11%)	115,183 (100%)
Large	8	44,499 (25%)	36,086 (20%)		80,250 (44%)	19,500 (11%)	180,335 (100%)
Share of household		77%		7%	13%	3%	100%

Source: Field Survey, 2002.

Unit: Nepali Rupees (NRs.), \$1 = NRs. 77. () is share of each job contributing to total income.

Business: Shopkeeper, trade. Clerical job: Service, Computer Operator, and Meter Reader.

Professional Job: Teacher, Writer, Driver, Nurse, Police, Army, and Technician.

4-3-6. Shares of Different Incomes in Total Household Income

The percentage share of income from different income sources is presented in **Table 19**. It shows the percentage share of dairy farming is decreasing according to the farm size. Small farm had the maximum share (52%) of dairy income in their total household income. It was followed by medium farm (45%) and large farm (20%). Hence, the contribution of dairy farming in the household income was very significant in small and medium farms.

It is also note worthy that the income shares from crop farming, business and professional job in smaller farms, especially in small farm were less, primarily due to their less land holding, less capital and lower education, respectively. For them, the dairy farming was very suitable alternative income generating activity to which they could readily engage at, in the form of self employment without much land and capital and very little or no training. It also gave them the milk for self-consumption that would consequently upgrade their nutritional status, without much cash expenses.

4-4. Summary

Nepal is an agrarian country and its economy strongly depends on agriculture and agro related activities. The livelihood of large proportion of people depends on it.

High population growth causes decline in size of farmland that is leading to the decreasing trend of productivity of food grains. Dairy farming is regarded as an important income generating activity for the rural people where livestock is integral part of crop-livestock mixed farming system and where majority of people are living in subsistence level. Dairy farming is such an activity, which does not require large resources, labor intensive in nature and can generate income within a short period of time.

Most of the farm households in the study area have small size of land holdings that also carry out dairy farming in crop-livestock mixed farming system. Most of the farmers are keeping cows and buffaloes for milk as well as organic manure for crop cultivation. Dairy farming engaged household labor force more efficiently as almost all labor use in the dairy was family labor, male and female almost equally. This helps the farms to increase their household income significantly. This contribution was higher in small and medium farms as compared to large farm. This is very meaningful in enhancing the economy of smaller holders, who are less able to engage in other income generating activities due to their poor resource holdings and limitation in human capacity buildings.

This indicates that dairy sector development has direct impact on rural development and can contribute for the betterment of the rural livelihood particularly the smaller holders, more prominently. Development of dairy farming such as provision of extension services; introduction of improved breed, good animal health service, and provision of cheaper feed to the farmers, can enhance dairy production in the rural area. Policies hereafter should emphasize this sector for rural development and also for increasing the milk production to meet the growing domestic demand.

5. Comparative Analysis

Indonesia and Nepal are far apart two Asian countries lying in South East Asia and South Asia, respectively. Indonesia is an island country with many big and small islands in the ocean. Nepal is a small landlocked mountainous country in the heart of the Asian continent at the lap of mighty Himalayas. There is a vast difference in the population and other resources of the two countries. The size and the nature of the national economy are also very different. But there are socio-economic aspects that are similar and or same in nature, as well. Both the countries are multi ethnic and agriculture is the main stay of the vast majority of the people. Almost all the people in the rural region depend on agriculture for their livelihood. Agriculture cant be said to be very much modernized and is dominated by small holders/farmers who won small pieces of land in fraction in number of parcels, together not becoming more than few hectors. Such agriculture is subsistence in nature and labor intensive. The family members, male and female carry out farm works basically together, with division of labor as per need. Since farmers tend to procure all sorts of their necessities from it, including food, clothing, shelter, etc. different sub sectors tend to be integrated into a mixed system of farming. One of the most common such farming system is crop-livestock mixed system. Small farmers in both the countries practice crop-livestock mixed farming system as a strategy of their livelihood. Dairy farming is one of the most common components of such mixed farming system livestock. People attach more value and give importance to it as their occupation to make life. Consequently, government

also gives importance to it in the development process and formulates policies to its development. This is true for both the governments of Indonesia and Nepal.

Although “modern” dairy was introduced in Indonesia by the Dutch in early 20th century it can be said that it took its place in development policy only after the independence in mid 20th century when it was introduced in various pocket areas of the country in a package programs with technical support to rear imported dairy animals, loan services to invest and extension service in the frame work of cooperative system. Later artificial insemination added to strengthen the herd replacement function and in 70’s was brought together under the integrated system of cooperative system. Introduction of cooperative dairy in DIY province with the formation of Warga Mulya Dairy Cooperative in 1979 can be said to be in this line. With these efforts dairy development can be said to have transformed in 80’s with a drastic increase in dairy cattle and milk production that made the policy formulation of targeting the milk production by government possible. Currently, there are some 500,000 dairy cattle in Indonesia and produces near to 400,000 tons of milk as of 2000. The number of dairy cows in DIY province during the same time is around 1,500 and produces around 2 million liters of milk. In general, dairy development policy of the government can be said to be dairy promotion oriented and encouraging for the people who would want to get engaged in dairying. It not only encouraged the farmers/milk producers but also others in the dairy related enterprises.

In case of Nepal livestock is an essential component of farming from ancient times and the animals, including the dairy animals, such as, cow and buffalo were kept more for manure and draft power. Milk was regarded as wishful byproduct and farmers would be happy to be able to reap any amount of milk, though not must, what ever left over after the calf consuming. Modern dairy is said to have its root in 50’s when some Jersey cows were brought from United Kingdom but supposed took a turning point when varieties of dairy cows, i.e., Jersey, Holstein, Brown Swiss, Sahiwal, Red Sindhi, were introduced along with veterinary services, artificial insemination, quality feed and fodder plantation. Some dairy plants and cheese factories were established in Kathmandu. With the implementation of first livestock development project and establishment of Dairy Development Corporation in 70’s, improved buffalo (Murrah crossbreed) and yak (crossbreed with cow) were added for “modern” dairy production. Cooperative dairying was also promoted at the same time. Different milk schemes were introduced in various parts of the country with an aim to produce and collect the milk through out the country. By 90’s dairy development programs have become an essential component of the livestock development policy of the government. Like in Indonesia the government policies can be said to be pro dairying encouraging the farmers and others involved in processing (making cheese, yoghurt, ice cream and sweets), marketing and so on. Recently dairy has a 25% share in the AGDP. Ever since, the dairy animal population has been steadily increasing and their number recently has reached more than 10 million (7 million cow and more than 3 million of buffalo), 2 million, a million each of cow and buffalo milking and producing about 1.1 million ton of milk. The corresponding figures for Chitwan District in 2002 are, 81,000 for number of cows, 107,000 for buffaloes and 34,000 ton for milk produced. Cooperative dairying is main form of dairy being practiced to collect little produce of milk of each of the small holders. Many farmers are becoming shareholder members of the primary cooperative at the locality where there is a collection center of the milk. These primary cooperatives

are federated to the cooperative union at the district level where milk from primary cooperatives are collected and chilled and channeled to the milk supply scheme where the milk is processed and sold.

Dairy features at household level:

Of all the milk producers in DIY province, 26% were engaged in it as their main job though location specific variation can be seen between Sleman, Bantul and Yogyakarta. In Sleman, the montane rural region, 65% took crop farming as the main job, together with dairy forming 90% as the ones engaged in farming. Non-farm jobs were minimal there. It becomes clear that the farming is the mainstay of the people in Sleman, the rural region of DIY province. In case of Chitwan, 77% of the milk producers have farming as their main occupation. They are virtually carrying out the dairying as a part of their crop-livestock mixed farming. Rest is engaged in non-farm jobs, such as, clerical job, professional job and business as their main occupation.

Average number of cow holding are fewer in Sleman, less than 5 but the ratio of dry and milking cow is same, except in Yogyakarta where the heifers are strategically not kept. The average milk production per cow per year is over 2,100 liter with lactation period of about 290 days and calving interval of about 15-18 months. The first calving is generally after 25 months of age and most of animals are at their 3rd stage of calving, although some are even at 5th or 6th stages. Almost all the cows are Holstein Friesian crossbreed. The average milk yield per cow is 6-8 liters per day.

In Chitwan the average dairy animal holding, inclusive of cow and buffalo is 5, not much different from DIY province. The ratio of dry and milking cow is not much different, either. Most of the cows are Jersey, though Holstein Friesian crossbreed and local breed was also found. Buffaloes are mostly Murrah crossbreed from India. Most of the farmers practice farm breeding with natural mating. So inbreeding is a seeming problem. The average milk production per animal per year is around 2,200 liter for cow and around 1,500 liter for buffalo. However, the fat and SNF contents of the buffalo milk is relatively high, higher by 10-20%, expressed in the farmers term as "thick" fetches better price in the local market and the cooperative where the price of the milk is set according to fat and SNF contents. The mean lactation period for cow is 300 days and more than 300 days for buffalo. Many of the dairy animals are at 2nd and 3rd stage of calving but there are fairly similar shares of animals at 4th, 5th and 6th stages, at times going to 7th and 8th as well. The first calving is after the age of 24 months, not much different from DIY province.

Most of the cows are fed individually three times a day with proper doses of fodder and concentrates. Milking cows are given more concentrates to produce more milk and steaming up is done with more nutritious feed to build up fat lost during the lactation required to provide for growth of fetus and regeneration of mammary glands, consequently sustain high milk production. Concentrates are procured from the cooperative where as most of the roughage fodder are self produced. In case of Chitwan, the animals are fed in-group and generally twice a day. Milking cows are given more concentrates, including the home made ones in lump sum using a bucket or any farm measures to make a difference. Steaming up though not done accurately farmers are conscious of the necessity to look after calving and milking animals more carefully and do try to make a difference.

Most of the dairy activities are carried out at homestead area and by the female family labor. They hire male labors to perform milk delivery and other activities when the family labor is not available due to peak seasons of crop farming (Sleman), and the family members being involved in other job (Bantul and Yogyakarta). In case of Chitwan, male and female family members do the dairy activities almost equally. But there is a division of labor, females collecting fodder, feeding and cleaning the animal and the animal shed and more of males milking and milk delivering.

Milk selling is the main source of income in dairying. In Sleman all the milk is sold to cooperative, which also becomes the daily installment payment of their loan to purchase cow and payment for concentrates, other inputs and various services rendered to them by the cooperative. In Bantul and Yogyakarta, only evening milk is sold to cooperative. The morning milk is sold locally directly to the neighborhood in a better price than the cooperative, thus make more profit. Earnings from the milk selling has the biggest share in dairying, constituting more than 60% in Bantul and Yogyakarta and nearly 50% in Sleman. Earnings from selling animals, calves and cow constitute more than 30% in Bantul and Yogyakarta and more than 40% in Sleman. Rest is earnings from manure sold and evaluation of self-used.

In Chitwan too milk selling is the main income of dairying farming and forms about 90% of gross income in small farm and around 80% in medium and in large farms. Rest is mainly earnings from manure sold and evaluation of self-used. But some also have selling of cows, buffaloes, calves and bullocks. Here, fairly large share of milk produces is self consumed, as well, benefiting the family members' health directly. The share of self-consumption of milk is around 20% among small and medium farms but almost half in the case of large farm. Thus, the average milk consumption per capita here is 103 kg per head per annum, much higher than the national average of 48 kg and FAO recommended amount 58 kg. This figure seems to be very low in DIY province and in Indonesia as a whole. In fact, comparing to Nepalese people Indonesians are non-milk drinkers.

Variable cost, whose main components are labor, fodder, concentrate, constitutes 90% of total production cost of dairying in DIY province. About 40% of the cost is labor that includes evaluation of self-labor at market price. About 30% is the cost of purchased concentrates and 16-18% is the cost of fodder, inclusive of self produced ones evaluated at the market price, as well. The fixed cost that constitutes 10% of the total cost is made up of tax, depreciation of assets including animal and insurance of the animal.

In case of Chitwan, it is not feasible to evaluate fixed cost hence all the production cost is variable cost. Labor and feed cost inclusive of evaluation of self labor and self supplied feed each constitute about 50% of total cost in small and medium farms where as it is 60% and 35% in large farm. Besides, there are some running costs of veterinary and electricity cost.

The total production cost is around 75% of the gross income in Sleman and 84% in Bantul and Yogyakarta. Thus, the net income per household from dairying is, about \$297 in Sleman, \$423 in Bantul and \$370 in Yogyakarta. When evaluation of return to self supplied inputs of labor and fodder is also appraised, the net return to farm became more than double to \$618, where as in Bantul it also jumps to \$790. In Yogyakarta since the self-labor and feed were less there was no much difference between the two. This

net return to farm as the earning from dairy has the share of 35% in total household income in Sleman, 20% in Bantul and 11% in Yogyakarta.

In case of Chitwan, the total production cost is around 80% of the gross income in small and medium farms. This share is more than 90% in the case of large farm. Thus, the net income per household from dairy farming is, about \$177 in small farm, \$250 in medium farm and \$41 in large farm. When evaluation of return to self supplied inputs of labor and fodder is also appraised, the net return to farm became \$549, \$674 and \$469 in small, medium and large farms, respectively. When evaluation of self consumed milk is added to the net return to farm will become \$656, \$820 and \$636 in small, medium and large farms, respectively. This net return to farm as the earning from dairy farming has the share of more than half in total household income in small farm, around half in medium farm and around one fourth in large farm.

In DIY province, improvement in roughage fodder specially to feed during its scarce season by making silage has not been introduced yet, while the animals were prone to diseases like mastitis and foot and mouth disease break at times. The problems of silent heat and non-conceiving are commonly recognized as the problems of infertility in the region. They are some of the limitations in the development of dairying. In case of Nepal in addition to these limitations there is also a need to improve the in breeding problem to maintain the quality of animal and feeding method to properly manage the nutritional health of the animal and get better performance in milk production and reproduction. Further, the concept of animal insurance though already in practice in Indonesia has not penetrated the farmers in Nepal.

In case of cooperative role in dairying, it seems the practice in Indonesia is one door policy where farmers are totally taken care of from loan to technical support and supply of all the inputs total service. This makes the milk producers much easy to deal with the complicated procedural paper works. Since milk selling to cooperative which also becomes payment for inputs and services and installment repayment of loan the book keeping on the part of producers become much simple, a benefit and a great relief for the producers. This is also something that Nepal can learn from Indonesia.

On the other hand shareholding membership of the primary cooperative in the local vicinity of the farmers seems to be an incentive for many to start dairy farming, consequently increasing the people who get engaged in dairy farming, thus enabling the policy makers to achieve their double targets of generating self employment in rural region to address disguised unemployment or under employment and increase the milk production to meet the growing demand simultaneously. Indonesia could adopt this system to be integrated with the current cooperative system, say for example with Warga Mulya in DIY province and hence hopefully increase more people engaging in dairying, perhaps in Sleman and also achieve the similar policy targets better.

(Some if the information in this paper has been also incorporated in earlier articles co-authored by Sulastri and Maharjan (2002) and (2005) and Singh and Maharjan (2003) and (2005) given in the reference list. Author wishes to thank both the co-authors for consenting to use the information partially here)

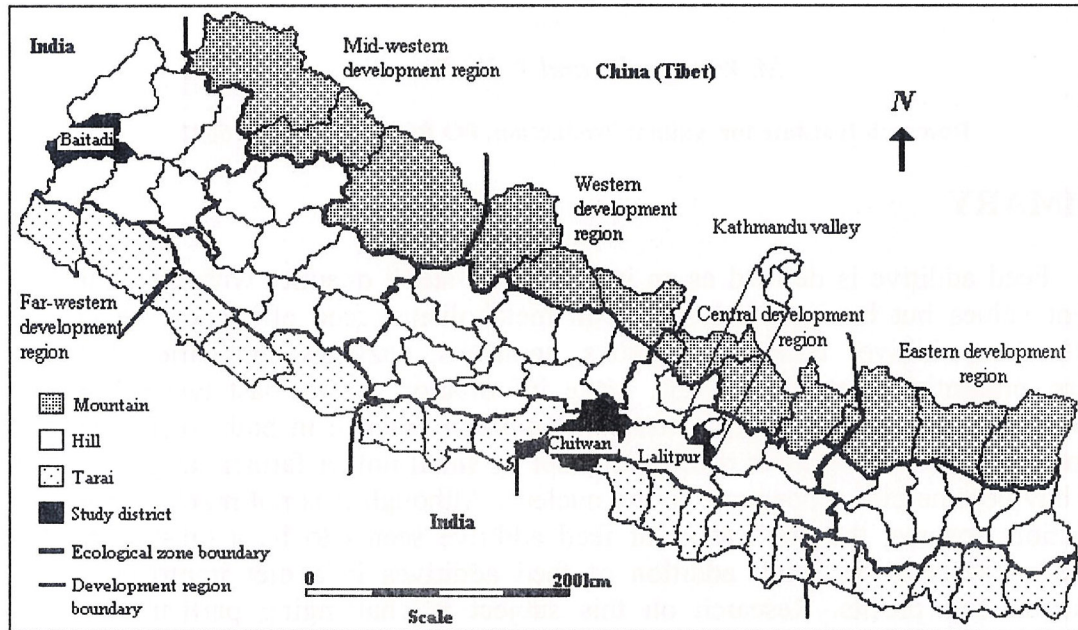
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Annex Maps



Adopted from: ICIMOD(1997) & Maharjan (1995)
Figure 1.1: Map of Nepal with Ecological Zone, Development Region and Study Districts

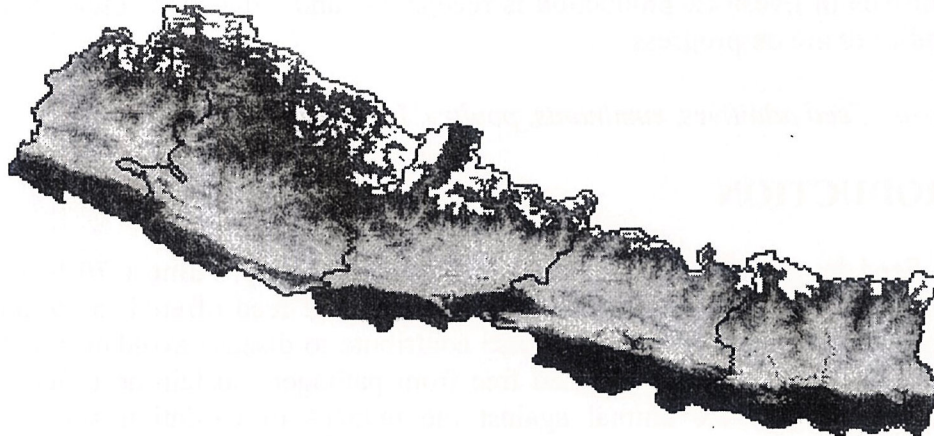


Figure 1.2. Map of Nepal with Elevation of Mountain, Hill and Tarai