Role of Dairy Farming in the Rural Economy of Sikkim

A Thesis Submitted

To

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In Partial Fulfilment of the Requirement for the

Degree of Doctor of Philosophy

By

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DECLARATION

Date: 30.11.2022

I, Narendra Kharel, hereby declare that the research work embodied in the thesis titled **"Role of Dairy Farming in the Rural Economy of Sikkim"** submitted to the Sikkim University for the award of the degree of Doctor of Philosophy in Economics, is my original work and it has not been submitted earlier to this or any other University for any degree.

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CERTIFICATE

This is to certify that Thesis titled **"Role of Dairy Farming in the Rural Economy of Sikkim"** submitted to the Sikkim University for partial fulfilment of the degree of Doctor of Philosophy in the Department of Economics, embodies the result of bonafide research work carried out by Narendra Kharel under my supervision. No part of the thesis has been submitted earlier to this or any other university for any degree.

All the assistance and help received during the course of investigation have been duly acknowledged by him.

I recommend this thesis to be placed before the examiners for evaluation.

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"Role of Dairy Farming in the Rural Economy of Sikkim"

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Narendra Kharel

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LIST OF ABBREVIATIONS

AGDP	Agricultural Gross Domestic Product
AH	Animal Husbandry
AI	Artificial Insemination
AMUL	Anand Milk Union Limited
Avg.	Average
BAC	Block Administrative Centre
BPL	Below Poverty Line
CCM	Compendium on Cooperative Movement
CRS	Constant Return to Scale
DCS	Dairy Cooperative Society
DDC	Dairy Development Corporation
DEA	Data Envelopment Analysis
DI	Dairy Income
DOA	Department of Agriculture
DOH	Department of Horticulture
DRS	Decreasing Returns to Scale
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
gm	Gram
GOI	Government of India
GPU	Gram Panchayat Unit
GSDP	Gross State Domestic Product
Ha.	Hectare
HH	Household
HHs	Households

HMG	His Majestry's Government
ICAR	Indian Council for Agriculture Research
ICIMOD	International Centre for Integrated Mountain Development
IDC	Indian Dairy Corporation
INGO	International Non-Government Organization
IRS	Increasing Returns to Scale
Kg	Kilogram
LRMP	Land Resource Management Programme
MCC	Milk Collection Centre
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act 2005
ml	Millilitre
MPCS	Milk Producer's Cooperative Society
Mt.	Mount
Mtr.	Metre
NB	Note Before
NDDB	National Dairy Development Board
NGO	Non-Government Organization
No	Number
OBC	Other Backward Class
PCI	Per Capita Income
Rs.	Rupees
SC	Schedule Cast
SIMFED	Sikkim State Cooperative Supply and Marketing Federation
SLDC	Sikkim Livestock Development Corporation
SMU	Sikkim Milk Union
SNF	Solid Non-Fat

Sq.	Square
ST	Schedule Tribe
UN	United Nation
USDA	United States Department of Agriculture
VDC	Village Development Committee
Viz.	Namely
VRS	Variable Returns to Scale
VS	Veterinary Service
wef	With Effect From
&	And

Abstract

Livestock activities are an important part of the rural economy with new technology and methods in dairy farming. Farming dairy and mountain crops can boost income. Rural areas rely on dairy farming. Even in industrial belts where non-farm jobs pay more, dairy farming is being practised. Transhuman and community management grazing systems no longer exist, and there is a new trend of making cross-bred and exotic cattle more productive. Attempt to preserve local breeds is still underway though!

Use of Artificial Insemination to improve breeds, market milk production, animal health, dairy development, and how rural urban economy are linked through dairy farming. Sikkim Milk Union and dairy cooperatives, rising cost of feed, fodder, and vet costs are all covered.

This thesis uses first-and second -hand information. Primary data originate from a systematic survey, while secondary data are already written about. SPSS and other statistical programmes have been used to analyse the data.

Mountain livestock is significant. It helps food supply, family nutrition, farming, soil productivity, asset saving, and family income. Global warming affects dairy farming. In alpine locations, it causes more disasters, a worsening ecosystem, and problems of wild animal ingress into habitable land. Dairy farming improves a population’s age, income, education, etc. Sikkim’s dairy industry contributes 17% to GDP. It helps the poor’s economic status by enhancing their education and health care, which is important for their physical and mental wellbeing. Men and women can farm dairy. Everyone can practise dairy farming, saving hidden costs. Dairy farming is a risk-free way to gain money. Even illiterate persons can succeed in the dairy business. Men and women both milk cows. Families of all sizes farm dairy. Dairy farming helps them build their homes

and also help reduce the amount of barren land. Dairy farmers diversify to generate more money. Livestock provides 85% of a rural family's income. Cheesemakers save money.

From 1978 to 1980, India expanded Operation Flood to Sikkim. The proposal linked the state's rural and urban areas to India. This led to dairy cooperatives, which supported the countryside and the metropolis. Families with more than two cows have milk year-round; those with less experience dry months. Every family used some quantity of milk per day for household consumption, regardless of number of cows. A dairy farmer sells 7 litres of milk daily to households, collection centres, local businesses, and faraway markets. First, milk money pays for the cow's fundamental necessities. It is used to grow the herd, pay family expenses, and cover other costs. Before SMU, rural milk producers made little money. After the GOI started Operation Flood and formed SMU in the state, rural farmers could make more money due to a stable milk market and dairy cooperatives. Farmers in the study area reported a few milk farming problems like lack of workers and low milk prices. Long-term, consistent government interference can help dairy farmers in the state.

Chapter 1

Economics of Dairy Farming in the World and India

In this chapter, the subject of research has been introduced, a statement of the problem has been presented. The broad research objectives and research questions of the study are listed. The significance, limitations and the organization of the research study are also included.

Livestock Activities in Rural Economies – An Introduction

Dairying and livestock herding occur in most countries across the world. In 2021, the major milk-producing countries were in the European Union (145.7 million MT), followed by the United States (102.6 million MT) and India (96 million MT) (FAO, 2022). As these countries belong to varied climatic zones, this illustrates the widespread potential of dairying and livestock activities across the world, irrespective of location.

India has had a long tradition of animal husbandry, which is an intrinsic part of the rural economy (Roy and Singh, 2008). The contribution of dairying to the farm economy has been most significant in terms of income and employment generation (Delgado, 2005 and Thornton, 2010). Cooperative dairying in rural India after independence has left a profound impact on socioeconomic development. Apart from land and water resources, livestock holdings are a major productive resource for the rural economy. While providing draught power and organic fertilizers for transportation and crop production, livestock assets are also an important measure of rural wealth. Meanwhile, the consumption of milk foods adds animal protein to human diets (Rosegrant, 2009).

Livestock activities have always played a vital role in the rural economy of India. As a highly labour-intensive activity, dairy farming is a viable livelihood alternative for farmers because of low production cost. Access to new technological innovations, along with the creation and development of infrastructural facilities has given a considerable boost to dairy development. Renewed Government focus on animal health and quality-breeding practices have also contributed to the further development of dairying activities. Apart from new employment and income generation, the impact of these has also been felt in terms of the improved quality of life in rural areas in India.

The dairy sector in India underwent a major transformation after the launching of the Operation Flood programme in 1970, which triggered the 'White Revolution' by vastly expanding milk production in the country. As one of the largest dairy development schemes in the world (Atkins, 1989), Operation Flood was hugely successful in India. The national dairy programmes ought to build on the success of the Kheda District Cooperative Milk Producers' Union (KDCMPU) that had been established in 1964 in Kheda district, Gujarat. The National Dairy Development Board (NDDB) was founded in 1965 as the agency to oversee this, followed by the Indian Dairy Corporation (IDC) in 1970. The main purpose of the countrywide dairy development programme was to encourage the proliferation of dairy-producer cooperatives to boost domestic milk production, and to increase the supply of quality milk to large urban markets (Atkins, 1989).

In three phases between 1970-1994, Operation Flood eliminated the chain of middleman who had earlier organised the collection and marketing of milk from rural areas to urban areas. The new marketing system was organised around the testing of milk quality at the point of purchase, followed by milk processing at modern chilling plants built to high hygienic standards. Seed-funding for the dairy development programme in India was sourced initially from the European Economic Community (EEC), and then from the World Bank in between 1974-1996 (Atkins, 1989).

Mixed farming systems are livelihood systems in which crop farming is combined with the rearing of livestock. Mixed farming is generally practised in highland and mountainous regions. Mountain farmers generally practise mixed crop agriculture and livestock farming to multiply their combined sources of income (Robinson, *et al.*, 2011). The natural resource endowments of mountain regions contribute directly to mountain livelihoods, and indirectly support the livelihoods of several downstream communities (Tulachan, *et al.*, 2000). Dairy farming is thus an important activity in mountain regions, where it is closely intertwined with farming systems. Through livestock farming, farmers living in remote mountain regions can practise self-sustaining livelihoods without having ready access to outside markets and inputs. Livestock holdings also act as wealth assets for rural populations. Smallholders of livestock obtain quick returns from dairying, and value-added dairy products like cheese and yogurt provide higher revenues to farmers. Sufficient justification consequently exists for making dairy farming the new basis for sustainable and viable rural livelihoods in mountain regions.

In dairy economics, the costs incurred are in the two forms of explicit costs, and implicit or invisible costs. The explicit costs of dairying can be attributed to the direct market values paid for purchased inputs, materials, and services, like cattle and feedstock purchases, wages of hired labour, transportation, and veterinary and animal health services. On the other hand, invisible costs are not incurred directly, and their value must be imputed through the principle of opportunity costs. Implicit dairying costs include the use of unpaid family labour services for feeding, bathing, and tending to cattle. Although such labour services are un-priced, their implicit cost can still be valued in terms of the alternative wage earnings foregone by the family members who are engaged in unpaid dairying activities. Their foregone labour earnings represent the opportunity cost of farm labour. Similarly, the valuation of the manure inputs generated through dairy farming for on-farm use is also regarded as an implicit value that reduces the need for alternative purchased fuel and fertilizer inputs. When manure is sold, it has an explicit value. The same pro rata cost valuation can also be used to value the direct use of manure in manuring the farmer’s own land.

In addition to the cultivation of crops, India's agricultural sector is also responsible for the rearing of livestock, which is an important aspect of the country's economy. It has emerged as a new source of employment opportunities, and it has become an essential part of the efforts that are being made by the agricultural business to diversify. Additionally, it has become an important element of the efforts that are being made by the agricultural industry to diversify (Khan, *et al*., 2009). It is abundantly obvious that dairy farming plays a crucial role in the economic well-being of individuals in rural areas who do not have access to land and who are poor. This is the case because dairy farming provides a source of income for these people. This is for dairy farming offers these folks an additional source of income as an alternative (Pandey and Pathak, 1997). As a direct consequence of the dynamic and diverse livestock systems, those who control only a little amount of land as well as those who do not have access to land are provided with the opportunity to take part in sufficient safety nets. Because there are so many different livestock production methods, we can take use of this opportunity (Yadav, 2012). In addition, dairy farming has been identified as a strategy that may be used to bring about socioeconomic development in rural communities. This has led to increased interest in the practise. This acknowledgment is a direct result of the fact that dairy farming is gaining an ever-increasing number of followers. According to Mathur and Mathur (2000) People who live in rural areas have gained more autonomy as a direct result of the formation of dairy co-operatives, which have also contributed to an overall improvement in the quality of life in rural areas. Dairy co-operatives have also played a role in improving the overall standard of living in rural areas (Bandhyopadhyay, 1996). The expansion of the dairy industry in India is significantly aided by the Dairy Development Board, which also plays an important role in the expansion of the dairy industry in India. The Dairy Development Board, Dairy Co-operatives, and Village Milk Societies all play an important role in the expansion of the dairy industry in India. This, in turn, adds to the expansion of economic options available to people living in rural areas across the country. Village Milk Societies have been of tremendous assistance to the expansion of the dairy sector in India, which has also benefited considerably from their contributions. In India, dairy cooperatives are organised in line with a hierarchical model that is comprised of three tiers of operation. This model is used to determine the organisation of the cooperatives. These tiers are comprised of lower levels, which include the federations at the state level, the district milk unions at the county level, and the dairy cooperative societies at the village level (Huria and Achaya, 1980).

Milk production is a significant contributor to the state of Sikkim's economy, which is known for its abundance of natural resources such as forests and wildlife. Sikkim is also known for its beautiful landscapes. The state of Sikkim is characterised by its hilly terrain and is well-known for the wealth of natural resources that it possesses. The climate, the composition of the soil, and the types of plants that grow in the region surrounding a dairy farm are the key factors that are responsible for determining whether the farm will be profitable. When it comes to managing a dairy farm, relief is the single most important thing to consider, and this is especially true in mountainous regions all over the world. In addition, the government has made several adjustments in order to support the growth of the dairy industry as well as animal husbandry as a whole. These alterations were done to improve the economy. Most dairy farmers are now in a position to profit from the infrastructure and the policy framework that have been granted to them by the government as a result of the efforts that have been put forth by the government on their behalf. There are a variety of extra factors that come into play, one of which is the assistance offered by the government in the form of market and institutional assistance. This is only one of the many more factors that come into play. People who live in impoverished conditions and do not have access to sufficient land resources or other forms of income production are finding that dairy farming in rural areas has become an important source of livelihood generation because it offers employment opportunities. This is because dairy farming requires fewer resources than other forms of income production. In addition, the significance of several other methods of income generation is growing all the time. Milk and milk products are in high demand all over the state as a direct result of the continuous expansion of the state's urban and industrial centres. This demand is driven by population increase. The Milk Producer's Cooperative Societies (MPCS) and milk unions of the state each play an essential part in this regard. These organisations collaborate with a wide range of milk societies located in various regions of the state to produce a unified milk distribution network. The purchase of milk helps to an ever-growing rise in the socioeconomic status of milk producers who are members of these milk societies. This rise is due to the milk’s producers' ability to sell more milk because of their increased sales. This expansion is a result of these milk producers' improving socioeconomic situation, which is the primary driver of this improvement (Pant *et. al.,* 2019).

Statement of the Problem

As an adjunct form of farm-based activity, animal husbandry forms the backbone of the rural economy of India, with more than two-thirds of the population depending on crop production and livestock rearing, against a mere 3% in developed countries. With the launching of Intensive Cattle Development Projects (ICDP) by the Government of India in 1964, a programme for crossbreeding of non-descript Indian cattle with exotic bloodlines commenced. ICDP has helped India consolidate its first position globally in terms of annual milk production. However, problems are faced by some states because of the lack of an overall national breeding policy and appropriate strategy. Absence of proper programme guidelines has led to undesirable results in smallholder dairy units where indigenous breeds have been upgraded to higher exotic grades without a defined crossbreeding programme (Singh, 2016).

Over two-thirds of India's livestock assets are held by landless and marginal farmers. In the mountain state of Sikkim, the dynamic interaction of the animal husbandry agricultural sector is even more pronounced. Livestock and dairy farming a premium sector in the rural economy of Sikkim, in terms of poverty alleviation and total employment generation. The total holdings of livestock in Sikkim are a measure of the state's prosperity. For Sikkim's villages, where agricultural holdings are small and fragmented and collective and cooperative farming is non-existent, cattle-rearing forms a vital lifeline. Agriculture and livestock development programs are taken up in tandem by the Sikkim Government to rejuvenate the farm economy of the state (DESME, 2006).

Animal husbandry activities, therefore, play an important part in the effort to improve rural living standards in a predominantly rural economy like Sikkim. The livestock economy supplies rural families with quality nutrition in the form of milk, meat and eggs. Sikkim accordingly has diversified livestock holdings of cattle, buffaloes, yaks, goats, sheep, pigs, and poultry birds.

Table 1.1: District-wise Area, Population and Livestock Holdings in Sikkim

District	Area (sq.km)	2011 Human Population		Cattle	Buffaloes	Yaks
North Sikkim	4,226	43,709		14,305	19	3,710
East Sikkim	954	2,83,583		47,266	39	2,369
West Sikkim	1,166	1,36,435		41,625	794	141
South Sikkim	750	1,46,850		37,494	40	-
All Sikkim	7,096	6,10,577		1,40,690	892	6,220
District	**Sheep**	**Goats**	**Pigs**	**Ponies**	**Backyard Poultry**	**Farm Poultry (Layers + Breeders)**
North Sikkim	234	9,410	3,793	324	31,122	1,400
East Sikkim	212	34,259	8,077	102	1,18,939	18,722
West Sikkim	1,234	37,640	9,987	99	1,11,809	1,005
South Sikkim	1,004	29,561	8,460	11	1,75,775	42,000
All Sikkim	2,684	1,10,870	30,317	536	4,37,645	63,127

Source: Adapted from Sikkim 19th Livestock Census 2012

From the table 1.1 it is seen that maximum number of cattle exists in East Sikkim district, closely followed by West and South Sikkim districts. In the high-altitude district of North Sikkim, where the number of yaks is highest, the holding of cattle is relatively low. A large part of the North Sikkim is snow-covered, uninhabited and too high for grazing. The high cattle holdings in East Sikkim are due to the existence of maximum number of human populations here. Buffaloes are reared mainly in West Sikkim where the dry climate is best suited for them. My research will specifically examine the economic role of dairy farming in the rural economy of Sikkim.

Dairy farming is a farm-based activity based on the production of milk and other milk-products, which can be used in processed forms. Dairying extends the livelihoods and nutritional security of rural families, elevating the economic status of milk producers, while improving child nutrition. Dairying provides crop-farmers with organic manure for improving soil fertility and crop-yields. The draught power of cattle is used in plough cultivation for sustainable farming. Crop-farmers in Sikkim's rural areas also sell milk and cultivate fruit, vegetables, and other cash-crops to augment family income. Meanwhile, the crop-residues from agriculture are used widely as fodder resources.

Because of the considerable gap between attainable and actual performance figures in dairying, huge scope exists for improving livestock productivity. The gap between attainable and realised milk yields ranges from 25-75% for different cattle species in different parts of the country (Birthal, *et al*., 2012). Several existing constraints that presently hinder dairy farming in India are enumerated below:

Table 1.2: Dairying Constraints in India

Rank	Constraints
VII	Inadequate knowledge about balanced cattle feeding
XIII	Non-availability of land for fodder cultivation
XIV	Lack of year-round availability of green fodder
VIII	Inadequate availability of quality green fodder
XI	Low availability of dry fodder
I	High feed and fodder costs
X	Low milk productivity in local cows/buffaloes
XX	Lack of organized milk marketing facilities from villages
II	Low fat-content in milk of crossbred cows
IV	Low prices for milk of crossbred cows
V	High mortality of male calves
IX	Problem of disposal of male calves
III	Problems in disposing of old unproductive cows
XV	Improper housing facilities leading to infection-risk
VI	Incidence of reproductive disorders among dairy animals
XVIII	Lack of adequate veterinary facilities
XVI	Poor quality of breeding bulls at village-level
XII	Problem in detecting heat of female buffaloes
XIX	Inadequate artificial insemination facilities
XVII	Relative low conception rate through artificial insemination

Source: Adapted from Dhindsa, et al., (2014) Dairy farming is also constrained when increasing incomes from non-farm work opportunities rise to the point where dairy farmers find wage-work to be more remunerative than rearing a small herd of cattle (*ibid.*).

In recent times, the Government of Sikkim has restricted the foraging cattle in forest areas, to halt forest degradation. This has limited the on-site fodder availability for foraging cattle and increased the farmer's need to invest in the cash-purchase of pre-prepared fodder like *hay kuti*, *bear chokra*, *peena*, *gai ko dana*, etc., imported from other areas within and outside the state. Government dairy development schemes do not always reach all dairy farmers, because of nepotism and political favouritism. Many rural residents who would be willing to adopt dairy farming, lack the monetary resources to buy high-yielding hybrid milch cows. Those who incur debt to buy hybrid cows are unable to clear these debts if their cows die due to climate unsuitability or inadequate fodder intake. The new owners lack of awareness about proper cattle feeding and healthcare. Absence of proper veterinary facilities is also a big hindrance to dairy farming.

In Sikkim today, while there has been a reduction in the number of households practicing dairy farming, aggregate production of milk is increasing day by day. This phenomenon has possibly resulted from the practice of dairy farming on a large scale by a few affluent dairy farmers, using cross-bred cattle. Holders of marginal cattle herds have however been unable to subsist dairying alone, and have therefore opted for allied livestock farming of poultry, pigs, goats, etc. The proposed research study shall also try to find how dairy farming in Sikkim may be made sustainable by if allied livestock farming, in a situation where dairy farming is being constrained by decreasing fodder and water availability.

Dairy farming has not performed optimally in all regions of Sikkim. Dairy farming is not considered a primary livelihood activity and has a subsidiary role in rural areas, where crop-agriculture is the prime livelihood. Livestock rearing has a complementary role within the farm economy, as a source of organic manure and draught power. Although several Government loan and subsidy schemes have sought to encourage dairy farming in the state, the crossbreeding and breed improvement programmes have not been as successful. Retail milk prices are also not regulated in conformity to the rising costs of cattle feed, fodder, and veterinary services.

Objectives of the Study

The main objectives of the study were:

i) To examine the role of the livestock economy in mountain regions and the effects of climate change in dairy farming in mountain economy.

ii) To study the Socio-economic profile of dairy farmers and their pattern of milk production, technical efficiency, consumption, marketing, and income utilization system.

iii) To study the role of dairy cooperatives and Sikkim Milk Union in supporting dairy farmers in the state.

iv) To assess the linkages between the rural and urban economy created by dairy farming in Sikkim and to identify the constraints on dairy farming perceived by dairy farmers in rural Sikkim.

Research Questions

The principal research questions to be examined in the proposed research study are listed below:

i) What is the role of the livestock economy in mountain regions and does the climate change has any impact in dairy farming in mountain economy?

ii) What is the Socio-economic profile of dairy farmers and how is their pattern of milk production, technical efficiency, consumption, marketing, and income utilization system?

iii) What is the role of dairy cooperative and Sikkim Milk Union in supporting dairy farmers in the state?

iv) Are there any linkages between the rural and urban economy created by dairy farming and what are the constraints on dairy farming perceived by dairy farmers in rural Sikkim?

Significance of the study

The analysis and the inference obtained from the data collected from a small area shall be replicated suitably and applied to the whole state of Sikkim. It shall be useful in identifying and suggesting the policy maker's most suitable proposals/ideas for uplifting the rural economy of Sikkim through dairy farming. The drawbacks in the practice of dairy farming shall also be helpful for identifying corrective measures to improve the existing policies of dairy farming and areas related to it. Hence, this type of research study is useful for the development of the society.

Limitation of the Study

This research is not an exception to the rule that all research must have a constraint or restriction to be carried out. Although the researcher has put in a complete and honest effort, the present investigator believes that there are some limitations to the study because of the limitations of time, energy, manpower, finance, and other resources. These limitations include the following:

- Only one district of Sikkim was visited on the ground for the primary survey (i.e., South Sikkim). For this study, two sub-divisions from South Sikkim were looked at. In the dairy farmers, only people who can read and write have been interviewed. Four GPUs were chosen from two sub-divisions. Each GPU has had 30 samples taken from it. Only farms that make milk have been chosen.
- No in-depth research was done in this study. It was done on a small scale.
- No comparisons were made between different castes.
- This study is only about a few things about dairy farmers. So, it might not cover everything a dairy farmer needs to know.
- This study solely covers the study area.
- Data collected regarding economic aspects of dairying are only approximate as no proper record regarding the income and expenditure in dairy farming had been maintained by the dairy farmers in the study area.
- This study only looks at cows. No other animals that give milk, like yaks, pigs, sheep, goats, buffalo, etc., have been added.

Organization of the study

Based on the present research study and its survey findings, this thesis is presented in the nine chapters outlined below.

Chapter 1: Economics of Dairy Farming in the World and India

This chapter has introduced the research ideas that have been discussed, along with a statement of the problem, the research objectives, research questions, significance of the study, limitations of the study and organization of the research study.

Chapter 2: Conceptual Framework and the Review of Literature

This chapter provides an overview of the conceptual framework of the research and a comprehensive review of literature. The review of literature is further segregated into four different categories, i.e., global state of livestock farming, relationship between agriculture and dairy farming, Indian dairy farming studies, and dairy farming in mountain regions. At the end of this chapter the existing literature gaps have been presented.

Chapter 3: Research Methodology and a Brief Description of the Study Area

This chapter provides the outline of the research methodology adopted, and the design of the research study, including a descriptive introduction to the study region.

Chapter 4: The Economy of Sikkim

This chapter provides an overview of the rural-urban human population and livestock holdings in Sikkim. House settlement and livestock holding in the rural areas of Sikkim covering all districts with special focus on South Sikkim. Status, evolution of agricultural agroforestry, grassland based rural livelihoods (both present and past) altitude, rainfall, agriculture, forests, and pastoral resources in Sikkim with special focus to South Sikkim. Evolution of dairy farming system in Sikkim (before and after) merger in Indian union and dairying policies and practices. Also, the chapter provides an overview of the geophysical attributes and socioeconomic settings of South Sikkim which especially pertain to its livestock economy. Besides climate and elevation zoning, and extent of pastoral land available, it covers the dairy farmers of the region and their individual livestock holdings.

Chapter 5: Mountain livestock economy and climate change implications on dairy farming

This chapter provides an overview on the role of livestock economy in the mountain regions. Also, the effects of climate change in dairy farming in mountain economy have been elaborated. This chapter fulfils objective number 1.

Chapter 6: Socio-economic Profile of Dairy Farmers

This chapter deals with the socio-economic conditions, including production, technical efficiency, consumptions, marketing and income utilization system of the dairy farmers in the rural economy of Sikkim. This chapter fulfils objective number 2.

Chapter 7: Role of Dairy Cooperatives and Sikkim Milk Union in Sikkim

The chapter deals with the role of dairy cooperatives and Sikkim Milk Union in supporting dairy farmers in the state has been focused in detail. This chapter fulfils objective number 3.

Chapter 8: Rural Urban Linkages through Dairy and Constraints of Dairy Farmers in Sikkim

Based on primary survey data, this chapter analyses the linkages between the rural-urban economy created by dairy farming in Sikkim. Also, the constraints of the dairy farmers in the rural economy of Sikkim have been dealt with. This chapter fulfils objective number 4.

Chapter 9: Conclusions and Policy Recommendations

The final chapter reviews the summary and inferences obtained from the overall research study, and makes suitable policy recommendations, within the limited perspective of the study. Future directions further research on dairy farming issues has been suggested.

At the very end of this thesis, a comprehensive reference has been presented, with relevant accompanying annexes.

Chapter 2

Conceptual Framework and the Review of Literature

This chapter gives an overview of the research's conceptual framework and a full review of the literature. The review of the literature has been divided into four different categories viz: the global state of livestock farming, the relationship between agriculture and dairy farming, studies of dairy farming in India, and dairy farming in mountain regions. At the end of this chapter the existing literature gaps have been presented.

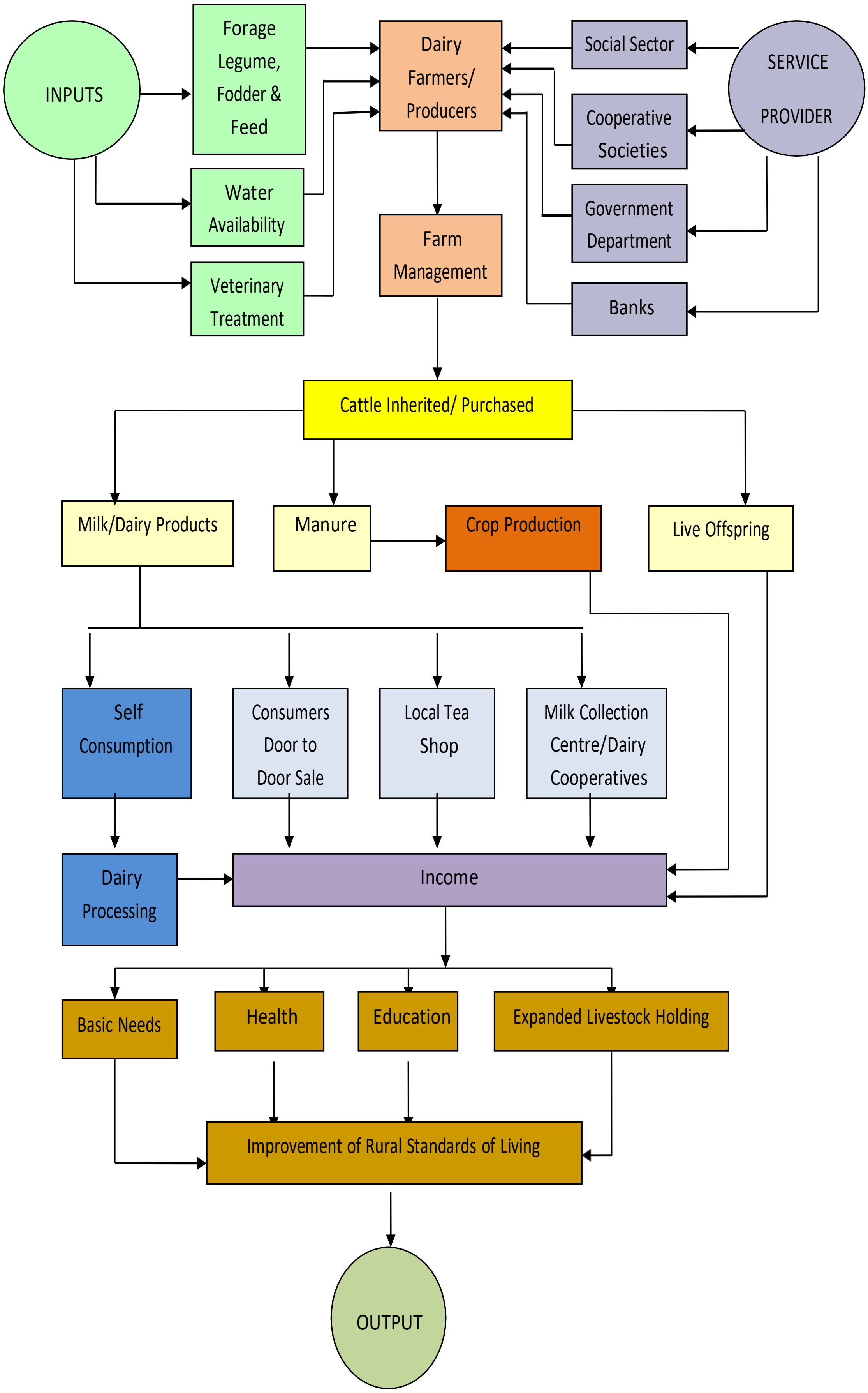
Conceptual Framework of Research

The existing research on the economics of dairy farming, as reviewed, has pointed towards several interdependent factors that link the livestock economy to the rural economy, and dairy development in the overall rural development process. The potential points of linkage between dairy production and marketing activities in the rural economy and the downstream livelihoods and incomes derived by dairy farmers are displayed conceptually in the schematic chart below. Farmers venturing into dairy farming in mountain regions need to secure adequate access to basic dairying inputs like foraging pastures, other feed and fodder, water resources and veterinary treatment. The initial stocking of cattle herds is done either through outright stock purchase, or by obtaining loans and cattle from various service providers like friends and relatives, dairy cooperatives, government agencies and banks. After access to these inputs is assured, the dairy farmers acquire cattle herds through outright purchase, loan-purchase and/or through inheritance of stock from other dairy farmers.

Dairy farmers then need to build cattle shed at suitable locations vis-à-vis their homes and nearby foraging pastures. The milk, dairy products and dairy by-products like manure can either be self-consumed by the dairy-farming household or sold for profit. Similarly, the live offspring produced on the dairy farm can either augment the farmer's own cattle herd or can be sold or distributed to form the nuclei of other dairy herds. The use of manure as organic fertiliser augments crop yields and crop output on the farmer's own land or on the lands of other crop farmers who have purchased manure. All these multiple income streams contribute to aggregate farm income, which is used to provide the farm household's basic needs of food, clothing, and shelter, and supports household expenses on health and education of family members. The part of farm income that is reinvested into dairy farming, expands the livestock asset holding and the wealth of the dairy-farming household.

The study proposes to examine several relevant features from this framework, which are commonly found in mountain regions.

CONCEPTUAL DAIRY-LINKAGE FRAMEWORK



Review of Literature

Most studies in the research literature on the economics of dairy farming focus on the development of livestock farming, dairying and the production and marketing of milk. Other studies also explore the socioeconomic characteristics of dairy farmers and the problems faced by dairy cooperative societies. Some of this literature is reviewed below.

Global State of Livestock Farming

Analysis of dairy farming in the United States had examined the changing relationship between milk prices and production costs as distance from the production area increases. The price of milk and total cost of production from 1974 to 1980 was estimated as a function of distance from the upper Midwest by ordinary least square regression method. It was observed that milk prices and production cost increased with the distance of production areas of the upper Midwest, but the increases were less than the transportation costs (Emerson, 1981).

The marketing behaviour of dairy farmers has been analysed in a World Bank study, Decisions on the market sale of dairy products was found to depend on factors like extent of the market area and market facilities, number of points of sale and storage capacity, as well as travel time from point of production to the market. Different economic models are used to identify the principal factors that affect dairy marketing decisions, and investment in market facilities and infrastructure are found to be important in developing countries like India (Shilpi and Deininger, 2007).

Emphasising the need for complete and reliable cost-benefit data, evaluation of nutrient management systems at dairy farms in Tennessee in the U.S. was carried out. The nature of construction and installation costs, annualized costs and stability of cost/ return relationships for different nutrient systems were found to be related herd-sizes. Nutrient values and losses under storage were measured for different nutrient management systems through sensitivity analyses of during storage and varying nutrient values, after application to land. Stronger environmental regulation was recommended for the dairy farm sector to achieve better nutrient management systems (Morgan and Keller, 1987). Farmers' perceptions of livestock, agriculture and natural resources in the rural Ethiopian Highlands are discussed. Ethiopian farmers have adopted livestock a major component of their lives to ensure survival and economic security. Milk production was unimportant. Traditional production systems in rural areas were heavily reliant on animal draught power. Thus, the keeping of cows was mainly as a breeding stock for the next generation of male draught animals. However, stock-density on community lands had become considerably high, leading to overgrazing and degradation of pasture. Water shortage became a big problem during drought periods, when water access for livestock was drastically restricted. While Ethiopian livestock farmers wished to secure greater access to water and understood the need for affordable supplementary feed, they failed to gauge the consequences of overgrazing and the need of the community to manage existing natural resources sustainably (Tschopp *et al.,* 2010).

The mixed crops with livestock are a farm type with lower chance of income reduction. Huge fluctuation over time occurs in a farmer's income due to fluctuations in prices and yields. These are caused due to natural phenomena such as draught, heavy rain, frost, and animal diseases which in turn lead to an even greater price fluctuation (Vrolijk and Poppe, 2020). An animal cannot produce optimum by feeding a grass alone, it needs to be fed the necessary concentrated as well (Alviawati, *et al.,* 2016).

The paper reviews the challenges, opportunities, and prospects of dairy farming in Ethopia and suggests that a careful planning in dairy policy in a prime requisite for creating appropriate and demand driven technologies to achieve a sustainable dairy farm development. The challenges were categorised as technical challenges (Health and Reproductive problems), institutional challenges (Inadequate extension and training services) and policy and socio-economic challenges (Environmental problems and Marketing linkage problems). Opportunities (High livestock generates resources, Employment opportunities, Different production system, Presence of service providers, Availability of access services and land inputs, High income generation, and Presence of individual knowledge). Prospects (Getting access to services and inputs that could promote dairy production and productivity is high and It promotes the motto of government policy in creating employment opportunities at household level (Guadu and Abebaw, 2016).

The paper shows the relation between consumption of dairy products and risk of Parkinson's Disease. It revealed that those who intake of calcium and protein nutrients from dairy sources are at a higher risk of Parkinson's Disease than those who obtain these nutrients from non-dairy sources. Surprisingly, consuming calcium supplements was not associated with risk of Parkinson's Disease (Chen, *et al.,* 2007).

In recent years there has been a trend in reduction of intake of dairy products, especially milk and an increase in the consumption of soda and snacks among children and adolescents in the United State. The paper reveals that an increase in the consumption of dairy products may help protect overweight people from being obese and developing Insulin Resistance Syndrome (IRS) which are the main risk factors associated with type 2 diabetes and cardiovascular disease in the United States (Pereira, *et al.,* 2002).

When cattle are mating, AI is an important part of the process of avoiding the transmission of venereal illnesses and injuries among the animals in the herd. As a consequence of this, maintaining correct breeding records, which is an integral part of efficient herd management, is made much simpler. (Hafez, 1993: Roberts, 1986: Rodring, 2000).

There are large regional discrepancies in the amount of awareness and uptake of artificial insemination (AI), despite the fact that it is a viable technique to increase the natural ability of dairy animals. Despite this, many farmers are unaware of the technology, which is a problem (Foote, 2002).

In recent years, several emerging and transitional economies have experienced significant economic growth. As the earth's population, urbanisation, and individual wealth rise, so does the demand for protein, which is shifting from plant to animal sources. In developing countries, the market for animal - based foods is predicted to nearly triple by 2030. (FAO, 2002).

When raising cattle, the producer takes the use of a male's abundant sperm in order to hasten the progression of genetics and enhance the effectiveness of reproduction. Numerous bulls collectively produce enough sperm each year to supply 40,000 breeding units (Bearden, *et al.,* 2004).

Dairy cow management should use as little modern technology as possible, especially on small farms. These issues can be resolved if rural, impoverished farmers are encouraged to utilize AI. In countries that have a lot of money, AI has improved cattle productivity. However, in developing countries, it is less commonly employed, and the outcomes are less than outstanding (Butswat and Choji, 1995).

Heat stress in animals, of which dairy cows are especially susceptible, could be exacerbated by a rise in average temperatures. Livestock production costs would rise when measures to reduce the effects of heat stress, such as the installation of shaded buildings, cooling systems, and dietary adjustments, were implemented (Key *et al.*, 2014).

When dairy manure is in excess, as it often is, it can have a negative impact on the ecosystem, according to research. The technology aids in the recycling of manure nutrient content within the natural environment and stops them from polluting surface and ground waters (Horn *et al.*, 1994).

Most smallholder farmers in Kenya use zero-grazing dairy systems, according to research. Cattle being fed freshly cut grass and feed while tethered in a shed. When picked wisely, tree fodder is a rich source of high-grade nutrients like proteins and minerals. Some thrive in both wet and dry conditions and produce at roughly the same rate. The space required to cultivate them is less, therefore they can be cultivated in neglected urban spaces (Paterson *et al.* 1998).

The animal agriculture produces 8 to 10% of global anthropogenic emissions. Life Cycle Assessment (LCA) assesses the carbon footprints of specific items by accumulating and assessing their inputs, outputs, and environmental impact throughout their existence. This study found that lactating animals contribute most to GHG emissions (Geough *et al.*, 2012).

Research conducted in South Ethiopia sheds light on the dairy production system and its limitations. The farmers there, mostly raised both crops and livestock. The majority of heads of households had only an elementary education or lower. Primarily, there was a dearth of available acreage, followed by a lack of available feed, an ineffective artificial insemination service, and a lack of available water (Bereda *et al.*, 2014).

Relationship between Agriculture and Dairy Farming

The study had shown how livestock farming could accelerate agricultural growth and reducing rural poverty in India. Livestock production had come to account for a larger share of the value of agricultural output than food grain production. In India, where nearly three-fourths of the population lived in rural areas and 69% depended on agriculture and allied activities for their livelihood, agricultural growth was necessary for ensuring national food security and alleviating rural poverty and disparity. Agricultural growth had to be sustained in a manner that included the rural poor. For this, diversification was needed in the agricultural production portfolio, by including livestock farming as a core activity for enhancing agricultural growth and reducing rural poverty.

Livestock had always been an integral and important component of the agricultural economy in countries like India, contributing to growth and development in many ways. Livestock activities stabilised the regular income of farm households. Livestock assets were a natural capital that could be reproduced quickly to generate wealth, thus taking on the financial role of “a living bank with the offspring as an interest”. Livelihood security of farm households was improved by diversifying farming risks and buffering against climate shocks to crop production. Livestock production was in fact more stable than crop production, and hence a more sustainable source of agricultural growth (Birthal and Negi, 2012).

Evolutionary change in dairy farming systems across the world today, compared to those practised in the past, has been highlighted. In the Southern Hemisphere, when dairy farming had longer duration and lower grazing intensity, the need for nitrogen fertilizer supplementation was previously low. The intensity of dairy farming has been increased in modern times by greater use of supplementary feed, irrigation, and nitrogen fertilizer. When practised on the dairy farms, this has led to the growing importance of forage legumes. Since the incorporation of clover content into dairy diets has thus been found to maximise milk production, the benefits of using white clover as a forage legume and fodder plant are recommended for intensive farming systems in Southern Hemisphere countries like New Zealand and Australia. The cost of supplemental nitrogen fertilizer is much higher compared to the commodity prices realised for milk. Dairy farmers can improve management practices by raising clover legumes on pastures. Novel grazing management systems optimise the benefits of both natural grass and legume fodder (Woodfield and Clark, 2009).

Reporting on practical aspects of dairy farming provides a clear idea about the available breeds of cattle, their milk yield capacity, etc. The maintenance of hygiene and health of dairy animals is required for productivity, along with provision of an optimum area for housing dairy animals. Under viable dairy farming, livestock reproduction also must be optimally managed a growing need also exists to shift from conventional to organic dairy farming (Singh *et al.*, 2010).

The paper throws light on the usage of the hydroponic technique in growing green fodder crops such as cowpea, barley and alfalfa. These are ready for harvest in 8 days from planting using hydroponic techniques. It is useful in arid and semi-arid regions which are water scare regions where a shortage of green fodder exists. The seeds of barley are available comparatively at lower prices these making it the best choice which further reduces the cost of hydroponic fodder production (Karaki and Hashimi, 2011).

Within the context of the study region, dairy farming holds a significant amount of importance. Rural communities get the support and resources they need to be successful in all aspects of their lives from dairy farming techniques, which make up the backbone of these communities. Traditional agriculture in this state has always included cattle farming, and dairy farming is also very important because it can be used to make money. Cattle farming has long been one of the state's most important agricultural activities. These days, dairy farming is becoming increasingly popular in Sikkim, and thanks to the diligent efforts of the state government, both the number of farmers and the amount of milk produced have skyrocketed to unprecedented levels (Rai, 2022).

One of the fastest-growing agricultural subsectors in developing countries is livestock farming. Agriculture is responsible for any more than one-third of the GDP in all of the countries. It is predicted that this will soon overtake crop yields as one of the most significant agricultural segments in terms of value added (FAO, 2006).

One of the most important aspects of organic farming is the production of organic milk and other dairy products. Because it provides the customer with a sense of security and helps safeguard the environment, it is one of the industries that are experiencing rapid expansion (Mahesh, *et. al.*, 2013).

The production of dairy products is an industry that has a significant amount of untapped potential, as it presents opportunities for both employment and financial gain. The collection of manure, the cleaning of sheds, the feeding and watering of animals, the grazing and cutting of grass, the milking, the sale of milk, and the manufacturing of dairy products are all newly available employment opportunities (Ramachandran, 2004).

The semi-arid region of Rajasthan is investigated who discovered that dairy enterprise supplied the most employment (338 man-days) while crop farming gave the least (219 man-days). Additionally, grain farming generated 64.81 percent of the family's income and dairy farming contributed 35.19 percent (Sharma and Sharma, 2004).

Indian Dairy Farming Studies

The major features of the dairy activities in South Asia are outlined which presents a SWOT (strengths, weakness, opportunities and threats) analysis of the dairy sectors in Bangladesh, Pakistan, Sri Lanka, Nepal, and India. However, the focus of this study is in the position of AMUL in India, which has rightly been regarded as a boon for smallholder dairy farmers. The inclusion of dairy products in the new world trade regime has presented new challenges and opportunities for small livestock holders, opening the possibility for dairy exports from the South Asian countries. New needs have risen for government to direct, coordinate and regulate dairy development activities, to maintain a level playing field for all dairy stakeholders. Equitable and sustainable development of dairy farming requires an appropriate space for smallholder dairy development through appropriate state-sponsored policies and programmes (Singh and Pundir, 2005).

Many critical issues affecting dairy development in India are considered which sought to examine the limitations on dairy development when there is insufficient pastureland. In agrarian countries, where the existing symbiosis between dairying and agriculture needs to be preserved, the price of milk has to be maintained at a level that suits both milk producers and consumers. To sustain dairy development, it is of utmost importance to regulate the so that it is attractive and suitable to both producers and consumers (Huria and Acharya, 1980).

The study had compared the relative profitability of local breeds of cattle and buffaloes in India. Gradual replacement of indigenous dairy breeds by improved crossbreeds was recommended, supplemented by balanced feed and higher focus on animal health (Raya, 1988).

Various cattle development programmes like the Key Village Scheme, the Intensive Cattle Development Programme, Operational Flood, etc., have been launched periodically in India. The achievements of these programmes have been assessed. Along with the reasons why some of their successes were short lived. While regional comparison of Indian cattle breeds reveals several noteworthy milk breeds, draught breeds, and general utility breeds, the crossbreeding of cattle has improved milk yields as well as draught power. Provision of superior quality fodder and animal healthcare needs to be made alongside regulated agricultural development to maintain fodder availability (Chakravarti, 1985).

Dairy development programmes were launched in India with the principal objectives of boosting milk production in rural areas and improving nutritional standards among marginal farmers and agricultural labourers. The study shows how these objectives were being met by dairy development programmes in the Bangalore milk shed area in Karnataka state. It was inferred that while the introduction of crossbreeds had improved milk production, dairy farmers from lower income groups were generally unable to buy the expensive crossbred cattle. The terms and conditions on which dairy loans were available were less favourable to farmers in these groups. When crossbreeds were bought, their full potential could not be realised because of inadequacy in feed and animal care. As low-income farmers kept cattle mainly for draught power, they feared that the crossbreeding through artificial insemination (AI) adversely affected the draught power of the cattle crossbreeds (Nyholm *et al.*, 1974).

Three different regions in Gujarat with different orders of water scarcity was studied to examine how virtual water trade is carried out indirectly via the milk trade. Virtual water was defined in the study as the volume of water required to produce a package of commodities and services. The three Gujarat regions studied were (a) the water-scarce

Mehsana and Banaskantha in North Gujarat; (b) the water-scarce Saurashtra region in Rajkot district; and (c) the water-abundant Central Gujarat region. In dairy production, large volumes of embedded or virtual water are traded in the form of dry feed and concentrates like *amuldan, rajdan, sagardan* etc. While crop production was the main source of livelihood in water-abundant regions; dairy farming was a more important livelihood in the water-scarce region where crop production had a secondary role. Adoption of drip irrigation in water-scarce areas was found to save 43% of irrigation water in case of alfalfa fodder cultivation in the water-scarce Banaskantha district in North Gujarat. Importing virtual water in the form of feed and fodder produced elsewhere could reduce the burden on irrigation resources in the dry water-scarce regions of Saurashtra and North Gujarat (Singh *et al.*, 2004).

The problems and constraints of dairy farming in four villages in Fatehgarh Sahib district of Punjab were studied to list and identify interventions to be used in the upliftment of the dairy enterprise in the state. The main constraints on dairy farming observed in the study were the high cost of feed and fodder, the low-fat content in cow's milk and the lower price fetched by the milk of crossbred cows, reproductive disorders and the high mortality of male calves, and problems in the disposal of old or disabled cows that were unfit for breeding. The study highlighted the need for the Government to initiate steps that encouraged dairy owners to replace low yielding cattle and buffaloes with high yielding buffaloes and crossbreed cows. Steps also needed to be taken by the Government to increase the aggregate area under fodder crops, and to induct the latest dairy technologies. Improved animal health services and a strong veterinary extension programme were also recommended to expand dairy enterprise in Punjab (Dhindsa *et al.*, 2014).

Dairy farmers, most depended on locally available cereals for making concentrate mixture which they fed to milking cows only. Dry and unproductive cattle were not fed concentrate mixtures in the Kumaon Hills of Uttaranchal. These feeds were made from wheat grain as a major ingredient added to it were rice, barley thungara (minor millet) maize and pulses (namely bhatt, soyabean and gahat) in different combinations to form various types of concentrate mixtures (Singh, *et al.*, 2004).

Microfinance schemes using Self Help Groups have undoubtedly helped the marginal farmers with a continued and easy access to credit (Karmakar, 1999; Shylendra, 1999). The loans were primarily used for the purchase of livestock, goats and fishing nets (Feroz and Chauhan, 2010).

In India, the economic losses due to number of constraints in dairy production were Constraints in land availability for expansion of feed and fodder, Deterioration of common grazing land both qualitative and quantitative (Jodha, 1992), To increase milk production, it is imperative to identify the livestock constraints and quantify the losses caused, Several biotic, abiotic and socio-economic factors lead to constraints in dairy production, Sufficient housing and scarce water are the major management related problems for all types of dairy animals (Birthal and Jha, 2005).

Because the rate of artificial insemination is so low in underdeveloped regions, the potential for animal development has not been realised. When farmers have access to greater technological and organisational resources, artificial insemination will be more successful (Verma, *et al.*, 2012).

The production and sale of dairy products are an essential component of the Indian economy. It is a venture in which they participated without any difficulty. It allows them to make the transition from earning a subsistence income to earning a business income through the sale of milk. The progress made in this industry has a direct impact on the improvement of their standard of living and the reduction of poverty in rural areas (Hemme, *et. al.,* 2003).

The dairy industry has the potential to significantly boost the economy of rural India as a whole. One of these types of small industries that can give marginal farmers with prospects for gainful work is the dairy farming business. For sustainable development to occur, there must be a healthy balance between the growth of agriculture and allied industries (Dhanabalan, 2009).

The bulk of the most vulnerable members of the population in India is involved in dairy farming, which helps them to maintain their livelihoods. It complements the crop growing as an enterprise and is tightly connected with agricultural output (Datta, *et. al.*, 2010).

During the lean season, milk supplied to consumers directly by producers was of higher quality at an average price of Rs. 5.68 per litre than that sold to Halwai and vendor at Rs. 4.75 and Rs. 4.04 per litre, respectively, according to a study conducted in the town of Karnal, Haryana, to ascertain deterioration in milk quality during the marketing and to estimate real margins in milk trade (Verma *et al.*, 1997).

The paper evaluated the economics of manufacturing ghee, full cream milk, standardised milk, toned milk, double toned milk, skimmed milk, and ice cream (processing alone). The investigation was conducted in a Haryana ISO-9002 dairy plant. All good, save double-toned milk, are produced above breakeven. Double-toned milk shows a loss. The study suggests that the quantity of double-toned milk production should be boosted at least to the necessary break-even level to minimise losses, if there is a market demand for this product or if its resources might be reallocated to other profitable goods (Chauhan *et al.,* 2006).

The paper revealed that the lack of cooperative infrastructure was the main reason why middlemen were so common in this area. Most of the time, the middlemen gave money to milk producers who needed it and bought milk at a low price all year long. It was said that small producers cornered 75% of the market surplus of what they made. A study that was done in Maharashtra's Jalgaon and Kolhapur districts found similar things (Shah, 2000).

In this study the costs and profits of milk production for local and crossbred cattle were calculated separately. The total cost of maintenance, including both fixed and variable costs, was calculated. The net cost was found by taking the gross cost per milking cow per day and dividing it by the average amount of milk each breed produces per day. The net return was found by taking the gross return and taking away the gross cost (Bhowmilk, 2006).

The role of water and fodder as critical constraints to livestock development in semi-arid areas has been analysed. The study elaborates how the equity and sustainability impacts of watershed interventions in semi-arid watersheds can be improved by targeting investments which increase their livestock production potential. The critical determinants for sustainable livestock farming in semi-arid areas were located, average rainfall, and market access, with that livestock intensity (measured in ACU/ha) being correlated positively with rainfall. Greater dairy production took place in locations with access to milk routes and chilling plants. In the semi-arid areas, livestock production depended critically on common property resources like forests, common lands, and village water-storage tanks. All these resources also needed to be used in sustainable coordinated ways. Establishment of controlled grazing improved fodder availability on common lands. This was therefore an important method of increasing the livestock productivity of semi-arid watersheds (Puskur *et al.*, 2004).

The crossbreeding of cows for increased milk production was an important dairying intervention. Different technical studies in the available dairying literature on how crossbreeding is carried out for developing new dairy crossbreeds have explained the optimum proportion of gene inheritance required to obtain new crossbreeds with the desired qualities and high milk production. These qualities include reduced first-calving age, shorter calving intervals, increased lactation duration, and higher milk yields, etc. Under crossbreeding programmes, indigenous cattle are mated with exotic breeds to develop desirable crossbreeds. Thus, while Holstein crosses are reputed for superior growth and production, Jersey crosses have better reproductive efficiency. In terms of milk yields, however, the Friesian crosses are the best crossbreed (Singh, 2016).

Dairy Farming in Mountain Regions

The relationship between agriculture and livestock husbandry across the Himalayan region was discussed comparatively in a survey report. Most of the agrarian population across the Himalaya comprises small and marginal farmers, whose livelihoods are based on agriculture in conjunction with the rearing of cattle, sheep and goats as livestock through social forestry. The income from diversified cropping activities hardly suffices to meet the daily needs of rural families. In this situation, livestock husbandry assumes a special significance in the Himalaya, contributing in between 47% to 56% of the total income of farm families, according to survey reports (Kumar and Sood, 1999).

Farmers around the urban markets and in areas where the Nepal Dairy Development Corporation (NDDC) collects milk may sell more than half of their production. The formal dairy sector comprising of NDDC, and private dairies marketed 20 thousand and 5-8 thousand tonnes respectively. Dairy farmers in remote rural areas must use informal marketing channels. They may sell raw milk to tea shops, etc., or may process it into various milk-based products which can be preserved and consumed by their households or sold to private vendors at a later period. A considerable amount of ghee is produced by the informal dairy sector, of which as much as 8.5 thousand tonnes of ghee are exported to India. However, there is a lack of information on milk processing and trade. Under the age-old practice of Transhumant Pastoralism (THP) which has been traditionally practised in mountain regions, livestock herders make seasonal migrations with their animal herds to different elevations and agro-ecological zones for pasturing from temporarily established livestock camps or '*goths'* (in Nepali). The decline of this practice in contemporary times is explored. Loss of transhumance has been the result of several contributing factors, including demographic change, outmigration of people from rural areas, growing government restrictions on grazing in forest lands, and climate change. The status, opportunities and hindrances to transhumance were analysed through a detailed case study of Ghermu VDC (village development committee) in Lamjung District, Nepal, based on qualitative research among residents (Gentle and Thwaites, 2016).

The farming systems that sustain livestock production in Sikkim were examined. The study observed that enormous potential existed in the state for livestock farming as an effective means for bringing favourable change in rural areas and improving the socioeconomic positions of marginal and small farmers. The limitations of the existing livestock farming system were also discussed critically, along with the scope for introducing improved livestock systems that were more appropriate for the social, cultural, and economic conditions prevailing at different specific locations in Sikkim (Balaram, 1998).

Dairy sector in hilly regions holds greater significance because of the limited livelihood opportunities for rural households available here. They depend on rainfall for agriculture as irrigation facilities are very limited. Other factors like meagre input-output production system, small and fragmented landholdings in uneven terrain, migration of male members in pursuit of off farm employment has led to the rural population opts for dairy farming as a livelihood to enhance their standard of living (Baral and Bardhan, 2016).

Pastorals graze livestock on pastoral grounds. Until 1998, pastoralists used the designated forest areas for livestock grazing, but the government of Sikkim's 1998 conservation strategy resulted in the elimination of pastoralism as these rangelands were vital to their livelihood. It cuts household income by 50% compared to pre-ban periods. The once self-sufficient pastoralists now rely on government subsidies or the MGNREGA, and a few who opted for ecotourism were crippled when the tourism business stopped during the COVID 19 pandemic (Singh, *et al*, 2021).

Agriculture's livestock sector has grown at one of the fastest rates, particularly in developing countries (Delgado, *et al.*, 2009).

Farmers who raise dairy cattle have been looking for alternatives to raising bulls just to breed their cows. This is because the world's population is growing, which means that there is less land available for cattle production. Artificial Insemination has become a good option as a way to get infertile. It is a perfect and cheap way to change the genes of animals, and it is a key part of making cows produce more milk (Noakes, 2009).

Establishing new animal breeds by artificial insemination (AI) is one of the earliest and most refined ways for creating new animal breeds without mating (Wilmut, 1979).

At the moment, the demand for dairy products has reached a point where it will remain stable at a higher level than it did during the time before the Covid-19 outbreak (Adams, *et. al.*, 2021).

The financial viability of dairy production in the Phulbari village Chitwan District of Nepal was looked at in the study. Due to its potential to reduce poverty, dairy products should be commercialised with appropriate production and marketing adjustments (Timsina, 2010).

The principle of Willingness to Pay (WTP) among different dairy farming groups was examined. In the case of mountain farmers in terms of landscape quality, ecosystem services and for sustainable mountain farming. In times of agricultural crises, mountain areas can suffer from farm abandonment due to issues like remoteness, small farm-size, low productivity and poor land quality, extreme weather, weak infrastructure, high transport cost. With the disappearance of transhumance and community management of grazing systems, younger people are leaving farming areas for work elsewhere. A multifunctional approach has been recommended in which agriculture is analysed as a multi-output activity producing both private and public goods, as well as environmental services like food and fibre, as well as agricultural landscapes, farmland biodiversity, soil functionality and water quality, etc. Consumers' WTP is measured via the Contingent Valuation Method (CVM) and revitalized plan and policies are recommended for adoption by mountain farms (Mazzocchi and Sali, 2016).

Existing Literature Gaps

The role of dairy farming in rural economies has been studied at various levels, ranging from global to village levels. The existing studies have focused closely on technical aspects like dairy farm management, artificial insemination and breed improvement, milk production and marketing, fodder management, animal health, dairy development and so on. Little light has been shed, however on the relation between the availability of pastoral land and fodder self-sufficiency which would be required to support the higher nutritional needs of crossbred cattle in Sikkim. The present study proposes to fill this literature gap. Critical assessment will also be made about whether the policy of ban on entry of cattle into forested lands in Sikkim has benefitted the farmers of the State.

Chapter 3

Research Methodology and Brief Description of the Study Area

This chapter provides the outline of the research methodology adopted, and the design, limitations of the research study, including a descriptive introduction to the study region.

Research Methodology:

To fulfil the objectives a survey-based methodology was used for this research study. A detailed questionnaire survey was carried on the sample villages which were surveyed in the two South Sikkim subdivisions was selected based on the relative dominance of dairy farming activity. A multi-stage stratified sampling design was adopted to select a representative sample of survey respondents, from whom the data was collected by canvassing a structured survey-questionnaire among the selected dairy farmers. In keeping with the objectives of the study, a mix of methodologies was used, invoking both formal and informal procedures to extract relevant quantitative and qualitative information. This research design is used for descriptive reporting of the study as well as for analytical interpretation of data.

Secondary Data Sources:

The secondary source of data is also important in this present research study. The most important sources of secondary data comprise publications of the State and Central Governments. These include the State statistical profile, human development report, data from cooperative societies and the Sikkim Milk Union, as well as Government reports on agriculture, livestock, forestry, and animal husbandry. Various secondary data publications are also available in electronic and book from the National Dairy

Development Board, different NGOs/INGOs, books and journals, research dissertations and reports, as well as periodical publications. Other secondary data from successive Population Censuses, Livestock Censuses and Socioeconomic Census reports was analysed along with data in other Government publications, after applying comparability corrections.

Primary Data Sources:

In any research work primary source of data is very important. Primary data for the study was collected through field surveys conducted among selected farming households in the study area using questionnaire methods as well as participant observation. Identification of the study locations and subdivisions where dairy farming is practised for the proposed primary surveys was done based on secondary data obtained from the State and All-India Livestock Census reports. The primary surveys would include a combination of dairy households and other farming households not currently engaged in dairying, so that a representative village sample is obtained. In this research study both qualitative and quantitative information were used for the detailed analysis of the stated objectives. It is fact that the primary data has the close proximity with realism and hence greater emphasis has been laid to them.

Period of Primary Survey

The primary data for the field survey was collected during 2019-2020.

Sampling Design and Sample Size

The district of South Sikkim has been chosen purposefully for the proposed research study. Dairy farming activities in the two South Sikkim subdivisions of Ravangla and Namchi were taken up in the detailed study, with stage-wise sample selections for the primary study being made from Ravangla block in Ravangla subdivision and Namthang block in Namchi subdivision. In Namthang block there are eight GPUs from which two GPUs i.e., Tangzi Bikmat and Chuba Phong were purposefully chosen. Similarly, from the Ravangla block out of five GPUs, two GPUs viz. Kewzing Bakhim and Ralong Namlung were purposefully chosen. Thirty samples each have been collected from the four chosen GPUs.

The table below depicts the multi-stage sampling design for the primary surveys.

Table 3.1: Sampling Design for the Study

<table>
<tr><th>Study Region</th><th>Study Districts</th><th>Selected Sikkim District</th><th>Selected South Sikkim Sub-divisions</th><th>Selected Sample Block</th><th>GPUs in Selected Blocks</th><th>Sample GPUs</th><th>Dairy Farming Households</th></tr>
<tr><td rowspan="2">Sikkim</td><td rowspan="2">North Sikkim
East Sikkim
West Sikkim
South Sikkim</td><td rowspan="2">South Sikkim</td><td>Namchi</td><td>Namthang</td><td>1. Namthang Maneydara
2. Kateng Pamphok
3. Turung Mamring
4. Tangzi Bikmat
5. Rateypani
6. Perbing Dovan
7. Chuba Phong
8. Nagi Karek</td><td>Tangzi Bikmat
Chuba Phong</td><td>30 from each GPU = 60 households</td></tr>
<tr><td>Ravangla</td><td>Ravangla</td><td>1.Ravang sangmo
2.Kewzing Bakhim
3.Barfung Zarung
4.Ralong Namlung
5.Borong Phamthang</td><td>Kewzing Bakhim
Ralong Namlung</td><td>30 from each GPU = 60 households</td></tr>
<tr><td colspan="7">Total Sample Size</td><td>120 households</td></tr>
</table>

Source: Adapted from Statistical Journal, GOS, 2015.

Sampling Techniques

It is not possible to go to collect primary data from each dairy farming household. So, it becomes necessary to take the help of sampling techniques. In this present research study, the convenience sampling technique was adopted to draw the sample.

Procedure of Data Collection

Before administrating the tools (source) upon the subjects, the researcher tried to express the purpose of the study and gave assurance to keep the responses strictly confidential. The primary data collection should minimise the inaccuracies caused by non-response and mis-response of the respondents, lack of accounting practice in households of the majority of our un-educated members in the family makes themselves not in a position to give enough details. Primary data were collected from the sampled households. The field survey was done personally, and interviews were taken to the one adult/senior family member of the family and collected the key information. The field diary was maintained to record the necessary information which was not included in the questionnaire. To get more reliable and accurate information farmers from other sectors of the economy were also interviewed for the data analysis.

Data analysis and Presentation (Study Database)

The information obtained from observation, discussion, and questionnaire-interviews with respondents was statistically tabulated, using the master table prepared from the questionnaire schedule. All secondary as well as primary data was processed and analysed by using relevant statistical and econometric tools (like percentage, frequency, average, deviations, correlation, regression, etc.) the choice of methods was based on the availability and range of data. Presentation of study findings included some cartographic tools like charts and graphs, which provided a clear exposition of the study findings. Different constraints were identified using Rank methods with mean score procedures. To identify this Rank, on a three-point scale, with 1 indicating least severe difficulty, 2 indicating severe difficulty, and 3 indicating most severe difficulty, the common obstacles that dairy farmers face during dairy production and marketing have been discussed. Similarly, to identify the usefulness of role of livestock in the mountain economy, varied uses of livestock were ranked with mean score procedures. To identify this Rank, on a three-point scale, with 1 depicting least useful, 2 depicting useful, and 3 depicting most useful. Also, the effects of climate change have also been ranked through a mean score procedure on a three-point scale, with 1 reflecting least serious, 2 reflecting serious, and 3 reflecting most serious. It was finally possible to rank these 11 constraints, 12 effects of climate change and 12 different roles of livestock in the mountain region based on their weighted average score. All the above findings have been analysed purely based on the response obtained from farmers during primary survey.

Concepts and Definitions

Cost of Production: Production costs include land, labour, capital and management. It represents production factor costs. Dairy farming production variables include dairy cows, land, cowshed, dairy cans, trollies, vehicle, fodder and concentrates, labour, water, power, medicines, etc. (Guthrie and Wallace, 1969). Production expenses are variable, total, average, and marginal costs. Fixed costs aren't affected by output. They must be paid without producing. Volume affects variable costs which rise with output, fall with none. Output-based variable costs. Total Cost=FC+VC. Long-term manufacturing costs are all variable. Short-term expenses may be steady. Average cost is the total cost divided by output amount, whereas the marginal cost is the additional unit cost. Depending on output, input costs, and productivity, a firm's marginal cost may be decreasing, steady, or expanding (Frakt and Piper, 2014). Livestock expenses, land and cowshed costs, machinery and equipment costs, etc. are fixed costs in dairy farming because they must be spent even with 0% milk yield. Fodder, concentrates, labour, water, energy, veterinary bills, and other expenses are variable because they are not incurred at zero production and often increase with milk production. Long-term, production parameters and expenses are variable based on loss or profit.

Revenue: Microeconomics also emphasises revenue. Total Revenue includes Average and Marginal Revenue. Total Revenue (TR) is the amount paid by purchasers and received by sellers of a good, computed as the price of the good times the quantity sold (P x Q). Total Revenue is a producer's profit before deducting costs and taxes. Total Revenue divided by total output represents output price. AR=TR/Q=P Average Revenue equals output price.

Profit: Profit is a positive gain from business operations or investment after expenses. Profit=Total Revenue minus Total Cost. Research on dairy farming's significance in the rural economy may also consider family size, age, gender, occupation, dairying experience, financial aid, herd size, and farmer education. Include various applications of dairy cattle for income and the farmer's output distribution mechanism.

Analytical Tools

To support the objectives, both qualitative and quantitative analyses have been conducted. The following are examples of analytical instruments:

Descriptive statistic: To gain a better understanding of the role that dairy farming plays in the rural economy of Sikkim in general and South Sikkim in particular, straightforward descriptive statistics have been utilised. These statistics include the mean, the standard deviation, diagrams, and graphical analysis.

Data Envelopment Analysis and Logit Analysis: To evaluate the technical efficiency (CRS and VRS) of dairy production in the study area DEA approach has been used. Also, Logit analysis has been carried out to study the factors affecting adoption of Artificial Insemination in cattle of the study area.

Test statistic: (t-test, Chi-square and ANOVA). In addition to using straightforward descriptive statistics, the tests and the analysis of variance

(ANOVA)technique have been utilised in order to investigate the relation with dairy income and the other variables as well as to investigate the socio-economic status of dairy producers.

Econometric Analysis:

A detailed examination of the data that was obtained from the field, also known as primary sources, has been undertaken as part of the present study. This analysis has been performed as part of a multiple regression analysis, which can provide additional information and details. The multiple regression analysis has been carried out to investigate the factors that influence dairy revenue in the farming households that were sampled for this study. The following straightforward regression model has been adapted to serve this purpose. In addition to the tests that have been described above, a straightforward regression analysis has been conducted in order to assess the overall/total milk income per kilogramme of milk produced in South Sikkim dairy farms.

Y- dependent variable

X_i -independent variable

z- independent variables (assume)

$b_1X_1 + b_2X_2 +...+ b_zX_z$ is the linear combination of all independent variables.

Regression equation:

$Y= b_1X_1 + b_2X_2 + \dots + b_zX_z + a$

Where, a is a regression constant.

X_1 — The size of the farm as measured in terms of the number of cows

X_2 - The productivity per hour for each individual who is employed.

X_3 – Feed costs on a per-cow basis

X_4 – Milk production, in kg, per cow

X_5 – Cost of milk to purchase per kilogramme on the market.

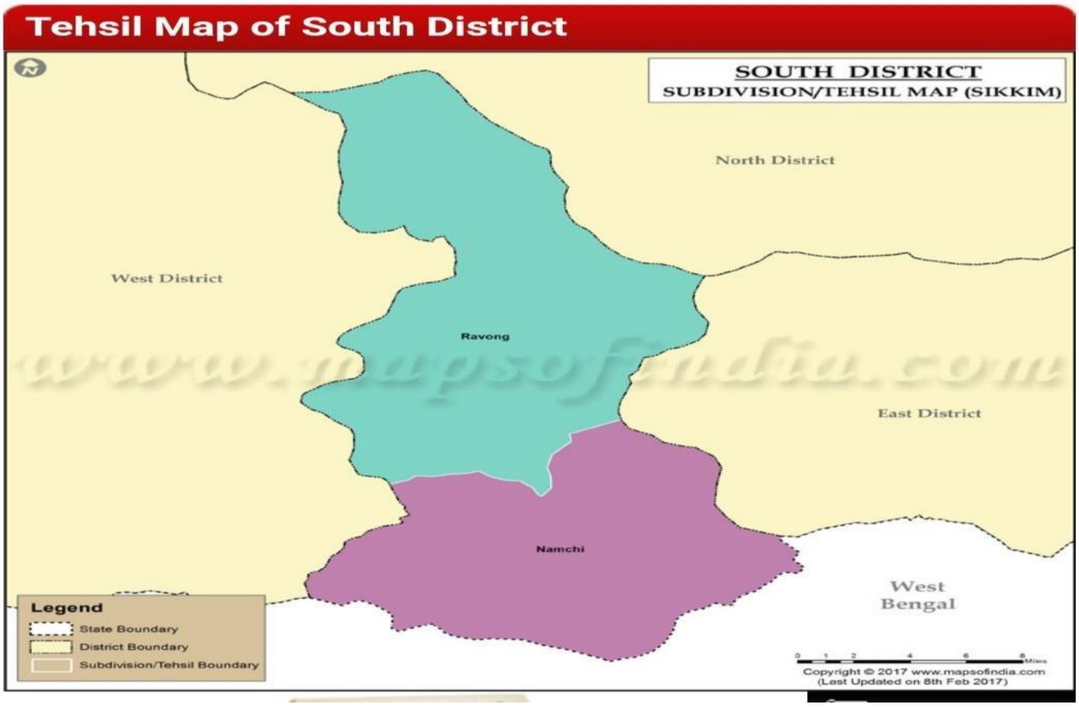
Rank method: In addition to the aforementioned factors, the rank method was utilised to conduct an analysis of the ranking of the dairying restrictions, livestock usefulness and climate change effects that are present in the rural economy of Sikkim.

The study region and its description

The study region is the mountain state of Sikkim. The state of Sikkim comprises the six districts at present of North, South, East, West, Soreng and Pakyong districts from which the agrarian district of South Sikkim has been taken up for detailed research study, as a typical example of a predominantly rural district with relatively moderate elevations and a large farming population. Primary data from the two subdivisions have been collected from selected villages at two different elevations through sample survey methods. Maps of Sikkim and the study area are presented below.

Map 3.1: Map of Sikkim

Map 3.2: Map of Study Area (Sub-Division)



3.3: Map of GPUs

Chapter 4

The Economy of Sikkim

This chapter gives an overview of the rural-urban population and livestock holdings in Sikkim, including house settlement and livestock holding in the rural areas of Sikkim covering all districts with a special focus on South Sikkim, the status and evolution of agricultural agroforestry, grassland-based rural livelihoods (both now and in the past), altitude, rainfall, agriculture, forests, and pastoral resources in Sikkim with a special focus on South Sikkim. Before and after India joined the union, the dairy farming system in Sikkim changed, as did its policies and practises. Also, the chapter gives an overview of South Sikkim's physical and socioeconomic features, especially as they relate to its livestock economy. In addition to climate and elevation zones and the amount of pastoral land available, it talks about the dairy farmers in the area and the animals they own.

The Economy of Sikkim: Sikkim at a Glance

Sikkim is one of the smallest mountainous states of India, it is a very beautiful state known for its natural beauty also renowned as an organic state of India. It is the 22nd state of the country which came into existence on 16th May 1975, prior to which it was a kingdom. Sikkim is a little highland state in the Eastern Himalayas of India that covers a total area of 7096 square kilometres. The state is known for its advantageous location with the total of 4 districts, 16 sub division, 31 block administrative centre, 176 gram panchayat unit, 989 panchayat ward, and 7 municipal corporation/ nagar panchayat/nagar palika (Tourism Department, 2004) it constitutes 0.22 percent of the total geographical area of India without flat piece of land of any extent anywhere (Lama, 2001) it is the least populated state of the country having a total population of

6,10,577 with 86 density of population, sex ratio 890 females per 1000 males, child sex ratio 957, literacy 81.4, total workers 308138 and main workers 230397 with flora Rhododendron Niveum (State Tree) and Dendrobium Nobile (Nolile Orchid) (State Flower) and fauna Lesser or Red Panda (State Animal) and Blood Pheasant (State Bird) respectively (Statistical Journal, GOS, 2015). The principal languages of the state are Bhutia, Lepcha and Nepali. The state is governed by a special provision in the constitution of India; it is also the eighth member of the North-Eastern Council. The lofty mountains, perennial glaciers, lush green hills, valleys and rich bio-diversity constitute the magnificent watershed. It is enriched with the traditional and cultural heritage (DESME, 2006-2007). Sikkim is surrounded by three different international borders that are about 114 km long from north to south and 64 km long from east to west. It is surrounded by the Tibetan plateaus to the north, the Chumbi valley of Tibet and Bhutan to the east, and the Darjeeling district of West Bengal to the south. (Joshi, 2004) and the Federal Democratic Republic of Nepal in the West. It lies in the North-Eastern Himalayas between 27^0 00’46’’ to 28^0 07’48’’ North Latitude and 88^0 00’58’’ to 88^0 55’25’’ East Longitude (Statistical Journal, GOS, 2015). As a part of the inner range of the Himalayas, the state doesn't have any plains or open valleys. Instead, its elevations range from 270 to 8583 metres above mean sea level consisting of lower hill (altitude ranging from 270-1500 metres), middle (altitude ranging from 1500-2000 metres),and higher hills (altitude ranging from 2000-3000 metres), alpine zones (altitude above 3900 metres with vegetation), and snow bound land (very High Mountains without vegetation and with Perpetual Snow cover upto 8580 metres), the highest elevation 8583 metres, being the top of the Mt. Kangchendzonga, the third highest peak of the world. The state gets between 2000 and 4000 mm of rain every year. The two biggest rivers in the state are the Tista and the Rangit, which flow from

Cholamu Lake and Rathong Glacier (Statistical Journal, GOS, 2015). According to Sura's YB (2005), the river Tista is a perennial river that receives its water from rain and snow. Because it is home to over 300 different kinds of rare orchids, this state is sometimes referred to as a "botanist's paradise." The terrain in Northern Sikkim is characterised by a series of precipitous escarpments, but the landscape in Southern Sikkim is flatter, more open, and more agriculturally developed (Joshi, 2004). For the convenience of state administrative work, the state is divided into four districts i.e., South, West, North and East (Registrar General of India, 1989) and (at present two more Districts have been added i.e., Pakyong and Soreng District). Other statistical details have been presented in Annexure for reference.

Rural-Urban human Population and livestock population in Sikkim

Population: Nepali, Lepcha, and Bhutia are the three major ethnic groups in Sikkim. According to the 2011 Indian census, Sikkim's total population is 610577. According to the 2011 census, Sikkim's rural and urban populations are as follows:

Table 4.1: Rural-Urban Population

State/District	Rural Population	Urban Population	Total Population
North	39065	4644	43709
East	161096	122487	283583
South	125651	21199	146850
West	131187	5248	136435
Sikkim	456999	153578	610577

Source: Adopted from Sikkim Statistical Journal, GOS, 2015, Census of India, GOI

Table 4.2: Decennial Population Growth in Sikkim, 1901-2011
(Growth rate in percent per 10 years)

Sl. No.	Year	Total Population	Growth Rate (%)/10 years
1	1901	59014	-
2	1911	87920	48.98
3	1921	81721	-7.05
4	1931	109808	34.37
5	1941	121520	10.67
6	1951	137725	13.34
7	1961	162183	17.76
8	1971	209843	29.38
9	1981	316385	50.77
10	1991	406457	28.47
11	2001	540851	33.06
12	2011	610577	12.89

Source: Dimension of Census Operation 2001, Adopted from Sikkim Statistical Journal, GOS, 2015, Census of India, GOI

According to the data presented in the table 4.2, the highest recorded rate of population growth occurred between the years 1901 and 1911, while the period between 1911 and 1921 saw a significant decrease. The result of the first world war was this falling off in population. On the other hand, the period between 1971 and 1981 saw an exceptionally high rate of population growth. This could be attributed to Sikkim's incorporation into the Indian Union as well as the subsequent increase in migration brought on by large-scale development projects within the state.

Administratively, the state is broken up into four different districts: the North, South, East, and West districts. Following the south, the west, and the northern districts in terms of population density is the state capital region, which is also the district with the highest population. There is a significant disparity in population density between the four districts. The population density in the north district is extremely low. As a result of the land covering most of it, the mountain has an elevation of more than 5,000 metres above sea level. The following table provides an in-depth look at the area of Sikkim's districts as well as the state's population density.

Table 4.3: District-wise area and Density of Population in Sikkim 2011 (Per sq.km.)

District	Area (sq. km.)	Total Population	Density
East	954	283583	297
West	1166	136435	117
North	4226	43709	10
South	750	146850	196
Total of Sikkim	**7096**	**610577**	**86**

Source: Adopted from Sikkim Statistical Journal, GOS, 2015

Table 4.4: Livestock Population:

Particular	Census 1977	Census 1997	% (increase/ decrease)	2007	2012	% (increase/ decrease
Cattle	157546	143024	9.22 (-)	169829	140690	17.15 (-)
Buffaloes	5438	1970	63.77 (-)	1536	892	41.92 (-)
Sheep	16104	5023	68.79 (-)	4879	2684	44.98 (-)
Pigs	18595	26975	45.05 (+)	38930	30317	22.12 (-)
Goat	88986	82980	6.83 (-)	110120	110870	0.68 (+)
Poultry	220927	219552	0.62 (-)	255882	437647	71.03 (+)
Yak	3995	4731	19.67 (+)	6468	6220	3.83 (-)

Source: Department of Animal Husbandry, Livestock, Fisheries and Veterinary Services, GOS.

The following tables 4.5 to 4.9 give the quantitative information of all the districts of the state of Sikkim with special focus on South Sikkim/Study area. It includes Total Livestock Population of Sikkim, District-wise Livestock Population of Sikkim (Rural and Urban), Livestock Population of Study Area (South Sikkim), Sikkim State (District-wise Distribution of Urban Livestock Population), Distribution of Veterinary Institution and Other Infrastructures, and Comparative of Livestock and Poultry in 2007 and 2012 Livestock Census and its annual growth and percentage change in Sikkim State:

Table 4.5: Total Livestock Population of Sikkim:

Sl. No.	Particulars	Rural	Urban	Total
1	Total number of households	83995	31412	115407
2	Household having livestock	68071	3982	72053
3	Household having cattle	51156	365	51494
4	Total number of cattle	139777	913	140690
5	Household having buffaloes	418	1	419
6	Total number of buffaloes	873	19	892
7	Household having sheep	585	7	590
8	Total number of sheep	2658	26	2684
9	Household having goats	28414	294	28705
10	Total number of goats	109859	1011	110870
11	Household having pigs	17649	314	17953
12	Total number of pigs	29572	745	30317
13	Household having yaks	520	0	520
14	Total number of yaks	6220	0	6220
15	Household having backyard poultry	38672	1223	39889
16	Total number of backyard poultry	432038	5607	437645
17	Total number of poultry farms and hatcheries	18	1	19
18	Total number of pet dogs	19799	3796	23595
19	Total number of stray dogs	5744	1458	7202

Source: Sikkim State 19th Livestock Census-2012, GOS.

Table 4.6: District-wise Livestock Population of Sikkim (Rural + Urban):

Sl. No.	Livestock	District				Total
		North	East	West	South	
1	Cattle	14305	47266	41625	37494	**140690**
2	Buffaloes	19	39	794	40	**892**
3	Yak	3710	2369	141	-	**6220**
4	Sheep	234	212	1234	1004	**2684**
5	Goat	9410	34259	37640	29561	**110870**
6	Pig	3793	8077	9987	8460	**30317**
7	Ponies	324	102	99	11	**536**
8	Dog (Pet)	2002	11417	4675	5501	**23595**
9	Rabbit	353	127	28	65	**573**
10	Backyard Poultry	31122	118939	111809	175775	**437645**
11	Farm Poultry (Layer + Broiler)	1400	18722	1005	42000	**63127**

Source: Sikkim State 19th Livestock Census-2012, GOS.

Table 4.7: Sikkim State (District-wise Distribution of Urban Livestock Population):

Sl. No.	Livestock	District							Total
		North	**East**			**West**	**South**		
		Mangan	*Gangtok*			*Gyalshing*	*Namchi*		
		MNP	***GNN***	***SNP***	***RNP***	***GNP***	***NNP***	***JNP***	
1	Cattle	91	577	2	16	101	118	8	**913**
2	Buffaloes	19	0	0	0	0	0	0	**19**
3	Yak	0	0	0	0	0	0	0	**0**
4	Sheep	1	25	0	0	0	0	0	**26**
5	Goat	86	669	27	11	121	79	18	**1011**
6	Pig	62	374	0	21	125	100	63	**745**
7	Ponies	0	0	0	0	0	0	0	**0**
8	Dog (Pet)	105	2604	159	86	198	258	386	**3796**
9	Rabbit	0	45	2	6	0	8	0	**61**
10	Backyard Poultry	445	3294	134	64	962	642	66	**5607**
11	Farm Poultry (Layer + Broiler)	0	0	631	0	0	0	0	**631**

Source: Sikkim State 19th Livestock Census-2012, GOS.
Note: MNP- Mangan Nagar Panchayat, GNN- Gangtok Nagar Nigam
SNP- Singtam Nagar Panchayat, RNP- Rangpo Nagar Panchayat
GNP-Gyalshing Nagar Panchayat, NNP- Namchi Nagar Palika
JNP- Jorethang Nagar Panchayat.

Table 4.8: Distribution of Veterinary Institution and Other Infrastructures:

Sl. No.	Institute	North	East	West	South	Total
1	Veterinary Policlinic	-	1	-	-	**1**
2	Veterinary Hospital	4	5	4	3	**16**
3	Veterinary Dispensaries	5	14	17	16	**52**
4	Stockman Centre	7	25	16	15	**63**
5	Semen Production Centre	-	-	-	-	**-**
6	No. of AI Centre	6	60	45	22	**133**
7	No. of Poultry Breeding Farms	1	3	1	2	**7**
8	No. of Hatcheries	-	1	-	1	**2**
9	No. of Rabbit Breeding Farms	1	-	-	-	**1**
10	No. of Pig Breeding Farms	2	1	2	2	**7**
11	No. of Yak Breeding Farms	1	-	-	-	**1**
12	No. of Rinderpest Check Posts	-	2	1	1	**5**
13	No. of Registered Slaughterhouse	-	1	3	1	**4**
14	No. of Milk Processing Plants	1	1	1	1	**4**
15	No. of Liquid Milk Plant	1	1	1	1	**4**
16	No. of Milk Chilling Plants/ Cooling Plants	6	49	83	55	**193**

Source: Sikkim State 19th Livestock Census-2012, GOS.

Table 4.9: Comparative of Livestock and Poultry in 2007 and 2012 and its annual growth and percentage change in Sikkim State:

Species of Animals	18th LSC (2007)	19th LSC (2012)	Percentage Change	Annual Growth
Exotic/Crossbred Cattle	72,974	126576	(+) 73.45	(+) 14.69
Indigenous Cattle	61,899	14114	(-) 77.20	(-) 15.44
Buffalo	243	892	(+) 267.08	(+) 53.40
Yak	5225	6220	(+) 19.04	(+) 3.80
Sheep	2536	2684	(+) 20.52	(+) 1.16
Goat	91995	110870	(+) 20.52	(+) 4.10
Pig	32250	30317	(-) 13.99	(-) 2.79
Backyard Poultry (Fowls and Ducks only)	116743	437637	(+) 274.87	(+) 54.97

Source: Sikkim State 19th Livestock Census-2012, GOS.
Note: LSC- Livestock Census

Table 4.10: NAIP in Sikkim

Number of Artificial Insemination (AI) Done, Farmers Benefited and Animals Inseminated under Nationwide Artificial Insemination Programme (NAIP) in Sikkim (2018-2019 to 2020-2021)			
	Achievement under NAIP		
Country/State	Total No. of AI Done	Total Farmers Benefited	Total Animals Inseminated
India	35191367	18850548	28775905
Sikkim	19285	11408	17785

Source: Lok Sabha Unstarred Question No. 3036, Dated on 22.03.2022.

The table 4.10 shows the achievement under NAIP in the state of Sikkim alone as well as of the whole country India. The % of total farmer benefitted and the total animals inseminated is approximately 54% and 82% respectively in the whole country whereas in the state of Sikkim the total farmer benefitted is 59% and total animals inseminated are 92% showing that the state Sikkim is performing better in NAIP.

Land Utilization: The statistics on how land is used shed light on the possibilities as well as the constraints that face agricultural expansion in every given area. The information that is gathered from natural resources and forests can be used to develop strategies for increasing production while maintaining the integrity of the environment and the ecosystem. The following is a breakdown of the statistics about the use of land in Sikkim:

Table 4.11: Land use pattern in Sikkim

Type of Land Use	Area of Land in Hectare	Total Surface Area (%)
Forest	254520.40	36.15
Barren	180238.40	25.40
Total operated area (including net area shown, fallow and cultivate waste)	109065.52	15.37
Pasture	72946.88	10.28
Land put on agriculture uses	85364.88	12.03
Miscellaneous trees and groves	5463.92	0.78
Total	709600.00	100.00

Source: Bureau of Economic and Statistics (BES), 2000, GOS.

Only 194430.40 hectares out of the total land area of the state are suitable for cultivation; this is equivalent to around 11 percent of the total land area of the entire state. The quantity of land that is covered by forests has grown thanks to the efforts that have been made by the government over the years to safeguard the environment. These efforts have resulted in an increase in the total land area. Another substantial portion of the area, which accounts for around 25.40 percent, is incapable of supporting human habitation and is unfit for any other use as a result of being covered with snow during the whole year.

Table 4.12: A brief profile of land elevation (Sikkim):

Type of Land	Level of Elevation
Lower Hills	Altitude ranging from 270 to 1500 metres.
Mid Hills	Altitude ranging from 1500 metres to 2000 metres.
Higher Hills	Altitude ranging from 2000 metres to 3000 metres.
Alpine Zone	Altitude above 3900 metres with vegetation.
Snow Bound Land	Very High Mountains without vegetation and with Perpetual Snow cover upto 8580 metres.

Source: Adopted from Sikkim Statistical Journal, GOS, 2015

Agroforestry System of Sikkim: In Sikkim, it has been felt that the preponderance of steep terrain and denuded lands suggested that the development of sound land use systems should be based on the concept of mixed plants. This is for steep terrain makes it difficult to grow single species of plants. This occurs because land that has had its vegetation eradicated is more likely to be eroded than land that slopes and still has some vegetation remaining, which increases the likelihood of this happening. It is essential to doing this task in conjunction with the cultivation of trees, annual and perennial plants, and livestock to provide an atmosphere that is comparable to the one that can be found in nature. In this part of the world, where there is an abundance of precipitation, the goal is to generate a cover of vegetation that is both perennial and unchanging in its look. This is the purpose. If this goal is kept in mind, agroforestry has the potential to become a mode of land use that is sustainable not only in terms of the environment, but also in terms of the economy. This may be accomplished if the potential of this approach is takes advantage of. Land users in Sikkim have a wealth of environmental knowledge because of their involvement with the land because of the lengthy history of the region because of the fact that the land has been used by humans for a long time. This is because the residents of Sikkim have worked the land and left their marks on it. This knowledge allowed them to develop a wide variety of practices, many of which, after being put to the test over extended periods of time, were found to be useful in the management of land resources to produce biological goods to fulfil a variety of needs, ranging from food to shelter. They were able to do this because they had acquired the knowledge that allowed them to do so. They were able to do this task because they had previously gained the knowledge necessary to do it successfully. As a result of having access to this information, they were able to fulfil a diverse range of wants, including the need for nutrition and housing, in addition to other prerequisites (Pradhan, *et al.*, 2004).

Ecological Sustainability: (Agri-silvi system, Silvo-pastoral System in Existing Forests, for Wastelands and Horti-pastoral Systems): Within the context of the Agri-Silvi strategy, the cultivation of tree species that can perform the twin responsibilities of providing sources of food and energy is accorded a significant level of importance. The time of the year that begins in October and continues through March is known as the "lean period," and it is during this time of the year that fodder trees become an important supply of green fodder for animals. There is a possibility that the natural forest land that surrounds the settlement could give opportunities for agriculture, particularly the growing of shade-tolerant forage grasses. This opportunity exists for the natural forest area is surrounded by the settlement. According to the findings of research on the shade tolerance and productivity of grasses, the hybrid of napier and bajra known as NB 21 produced the largest quantity of dry matter at 3-5 tonnes per hectare (t/ha). This information was gleaned from studying the grasses. After that was a mixed forest in the mid hills composed of Alnus nepalensis and Schima wallichii, which produced the second highest quantity of dry matter. The utilisation of silvo-pastoral systems in the hills, which are productive ways to utilise wastelands for the purpose of extending the availability of green forage during the dry winter months through the utilisation of tree leaves, is one way that it is possible to achieve conservation of natural resources such as land and water. These systems are productive ways to utilise wastelands for the purpose of extending the availability of green forage during the dry winter months through the utilisation of tree leaves. The utilisation of tree leaves in silvo-pastoral systems is a fruitful technique to make use of unused areas for the goal of increasing the supply of green fodder during the dry winter months. This is accomplished by using the leaves of the trees. The successful accomplishment of this objective will be made possible by the utilisation of silvo-pastoral management systems. In a similar fashion, horticultural and pastoral systems have been utilised to develop food crops such as maize, rice-bean, ginger, turmeric, and soyabean, in addition to fodder crops such as golden timothy grass, dall grass, and rice-bean. This has allowed for a wider variety of food and fodder crops to be produced. As a direct consequence of this, there is now a greater diversity of plant species being cultivated (Pradhan, *et al*., 2004).

Climate and Soil: Agricultural production of vegetables can take place at altitudesas high as 2,000 metres above sea level, and it can be found all the way up to the foothills. The higher the altitude, the more stable the climate and the better the soil. This is because the soil contains a plethora of different types of nutrients, which is the root cause of the observed occurrence. The climate of the region is determined by the geography of Sikkim, which can range from tropical to subtropical to temperate, depending on where you are in the state. Depending on the time of year, the weather in Sikkim can be classified as belonging to any one of these three types of environments. Barriers to production have been erected because of the significant amount of precipitation that has fallen, the high humidity that has been present, the hailstorm that has been occurring, the cloudiness, and the frost. This is a direct result of the circumstances that have been present up until this point. The pH of the soil in the state of Sikkim ranges from 4.5 to 6.0, indicating that it is of the acidic type. This range reveals that the soil is acidic. The amount of organic matter that is present in the soil at any time can range from zero to a significant amount, depending on a variety of circumstances. This can happen for several reasons (2 to 5 percent). Both sandy loam and fertile loam soils may be found all over the territory of the state; both soil types are great to produce vegetables and can be found all over the territory of the state. A location that is free of disease, abundant in organic matter, and has enough drainage is perfect for the creation of vegetable nurseries since it provides the best conditions for plant growth. These three elements are an indispensable prerequisite for the growth of robust plants (Pradhan, *et al*., 2004).

Altitude: It is a wonderland that has been blessed with the natural beauty and abundance that it possesses, ranging from icy cold deserts to flowering alpine meadows to lush green forests and emerald mountain lakes. It is a land that has it all. Most of the state of Sikkim is comprised of mountainous terrain, with an average elevation of 300 metres and reaching a maximum of 8,500 metres at Kangchendzonga peak (Gazetteer, 2013).

Rainfall: The state receives between 2000 and 4000 millimetres of rain every year. Two of the state's biggest rivers, Tista and Rangit, originate from Cholamu Lake and Rathong Glacier (Statistical Journal, GOS, 2015).

Agriculture of Sikkim: (Pre and Post Merger Period)

Prior to the merger in 1975, farmers were unsure of their property rights, had limited access to publicly funded resources, and relied mainly on antiquated technologies. Significant advancements have been made in this sector over the course of the past forty years. Because of the state's physical features, such as terrace cultivation, extreme concentration in landholding patterns, low cropping intensity due to mono-cropping, outmoded technologies of production, inadequate thrust on agriculture in terms of investment and planning, and a lack of infrastructure support in transportation, communication, irrigation, technical research, and agricultural development, agriculture in Sikkim was backward before the state's merger with India in 1975.

In the years that followed the merger, one of the primary objectives was to deliver a complete range of support services with the intention of restoring economic stability to the peasantry. Agricultural inputs like as seeds, fertilisers, and moderate irrigation, in addition to incentives for horticulture and cash crops, were all a component of this initiative. Because of this, agricultural development in Sikkim has advanced tremendously over the course of the last four decades despite the state's restricted amount of land that is suitable for cultivation. Agriculture has been successfully transformed from a subsistence endeavour into a commercially viable endeavour thanks to the expansion of high-yielding and improved types of seeds to cover more land; the increasing use of pesticides and fertilisers; and the development of areas under double or triple cropping (Sikkim HDR, 2001)

Forest and Environment of Sikkim: Of 1997, the woods covered 44.9 percent ofthe entire land area in Sikkim, but they only covered 19.4 percent of the total land area in India. The Sal Forests in Sikkim's Teesta, Rangit, and Rishi valleys cover a total areaof 8500 acres and are located at an elevation of between 700 and 3000 feet above sea level. The middle and upper hills of this region are covered by broad-leafed forests that span an area of 45000 acres. The 45,000 acres are covered by the evergreen forests that can be found in the valleys of Lachen, Lachung, and Dombang.

Most forest fires are started either by accident or on purpose by local villagers who are attempting to cultivate new grass for their animals. The prevention of forest fires can be accomplished in a variety of ways, some of which include the construction of fire watchtowers, the improvement of wireless communications, and the deployment of specialised firefighting teams that are outfitted with the necessary equipment during the season when forest fires are most likely to occur. Sikkim is experiencing an increase in the frequency of natural disasters such as landslides and floods. The Himalayas, which are a younger mountain range, contribute to the increased seismic activity and landslide risk in the state. Because steep hill slopes are extremely sensitive to any kind of geo-environmental change, landslides can be caused by an unexpected rainfall (Sikkim HDR, 2001).

Evolution of dairy farming system in Sikkim (Before and after merger in Indian union)**:** Although dairy farming has been practised in Sikkim for a significant amount of time, it is not known when exactly this activity first got started. The dairy farming industry is what distinguishes the mixed farming system seen in alpine regions. Farming cows and other dairy animals to produce milk and various other dairy products is a popular practise in certain regions of the State (such as paneer and churpee).

Before very recently, the people of Sikkim were oblivious to the significance of milk gathering and selling. In 1970, a private company made efforts to collect milk in and around the capital of Sikkim. These efforts were unsuccessful. They supplied milk to the military cantonment in Sikkim, which was located there. This company went out of business for several different reasons, one of which being that they were unable to make the payment on time. As a result of the corruption, the milk producers decided they could no longer be trusted to deliver it. Keeping this in mind, the state administration implemented a tiered plan for the development of a producer's cooperative under the

Himul model. The idea was not as successful as intended because to the gap in prices charged by the government and private collectors. The amount of collection centre and containers that were made available by the government was not sufficient. The transportation system was not nearly as developed as it is today. The relationship of cooperation between the government and the producers eventually turned into a transaction with only one party benefiting. As a direct consequence of this, milk farmers in Sikkim continue to struggle with various marketing challenges.

In 1975, the year that Sikkim was officially included into the Indian nation, the administration that was in power in Sikkim at the time floated the concept of forming a cooperative milk union in the state of Sikkim. It's possible that the achievements that had been made in the state of Gujarat served as a source of inspiration for them to do so. As a direct consequence of this fact, Dr. V. Kurien, who served as the chairman of the National Dairy Development Board (NDDB) in the past, was questioned about his viewpoint on the issue in question. Dr. Kurier provided his approval for the formation of "Anand Pattern" cooperative organisations in Sikkim after having discussions with individuals who were appointed to positions of authority within the state's governing authorities. The work done by the spearhead team in the east, west, and south regions of the state's NDDB began in the year 1978. Before this change, the business was overseen by the Sikkim Livestock Development Corporation (SLDC), which had its beginnings in 1977 and oversaw administering the existing dairy industry in the state. The National Dairy Development Board (NDDB) and the Government of India initiated the Operational Flood-I (OF-I) plan during the school year 1979–1980 with the intention of improving milk marketing and dairy-related operations by using the Anand Cooperative Model as a template. In 1982, as a component of OF-II, the state of Sikkim implemented a plan that was very comparable to the one being discussed here. This ultimately resulted in the formation of the Sikkim Cooperative Milk Producer Union Ltd., a federal organisation for primary milk farmers in the state of Sikkim. The first day of operation for the cooperative producers' union was July 1, 1980. It had been registered in line with the state cooperative statute of 1978 prior to this date, and it had previously taken over the project from NDDB. As an apex level organisation of milk producer cooperative organisations at the village level, it started doing business for the first time in November of 1981. This company had two tyres in its inventory.

During the NDDB's operation flood programme, which was implemented in the wake of the devastation caused by the floods, the Sikkim Milk Union (SMU) was established with the assistance of financial aid from IDC and technical supervision from the NDDB. Establishing a milk union has as its primary goal the improvement of the socio-economic conditions of the rural producing members to provide a market for milk produced in rural regions and to supply fresh milk of standard quality to consumers in urban areas. This is done to provide a market for milk produced in rural regions and to provide a market for milk produced in rural regions.

The SMU contains a total of three processors within its architecture. In comparison, the Karfector at the Jorethang plant has a daily capacity of 5,000 litres, whilst the milk chilling centre in Gyalzing has a capacity of 4,000 litres. The unit of measurement for both capacities is the litre. In addition to this, it began selling milk at the Siliguri market, which was the location of its location. The Sikkim milk supply union has organised a network of cooperatives for the aim of collecting extra milk from local farmers and distributing it to markets such as Gangtok. The Sikkim milk supply union has built this network. It is the responsibility of 173 of these cooperatives Societies to collect around 9500 gallons of milk each day. One of the milk cooperatives that was established because of the recent provision of financial assistance by the Indo-Swiss Project to the western region of Sikkim to facilitate the development of milk cooperatives is currently operating effectively.

Profile of Study Area:

Table 4.13: South District (Study Area) at a Glance

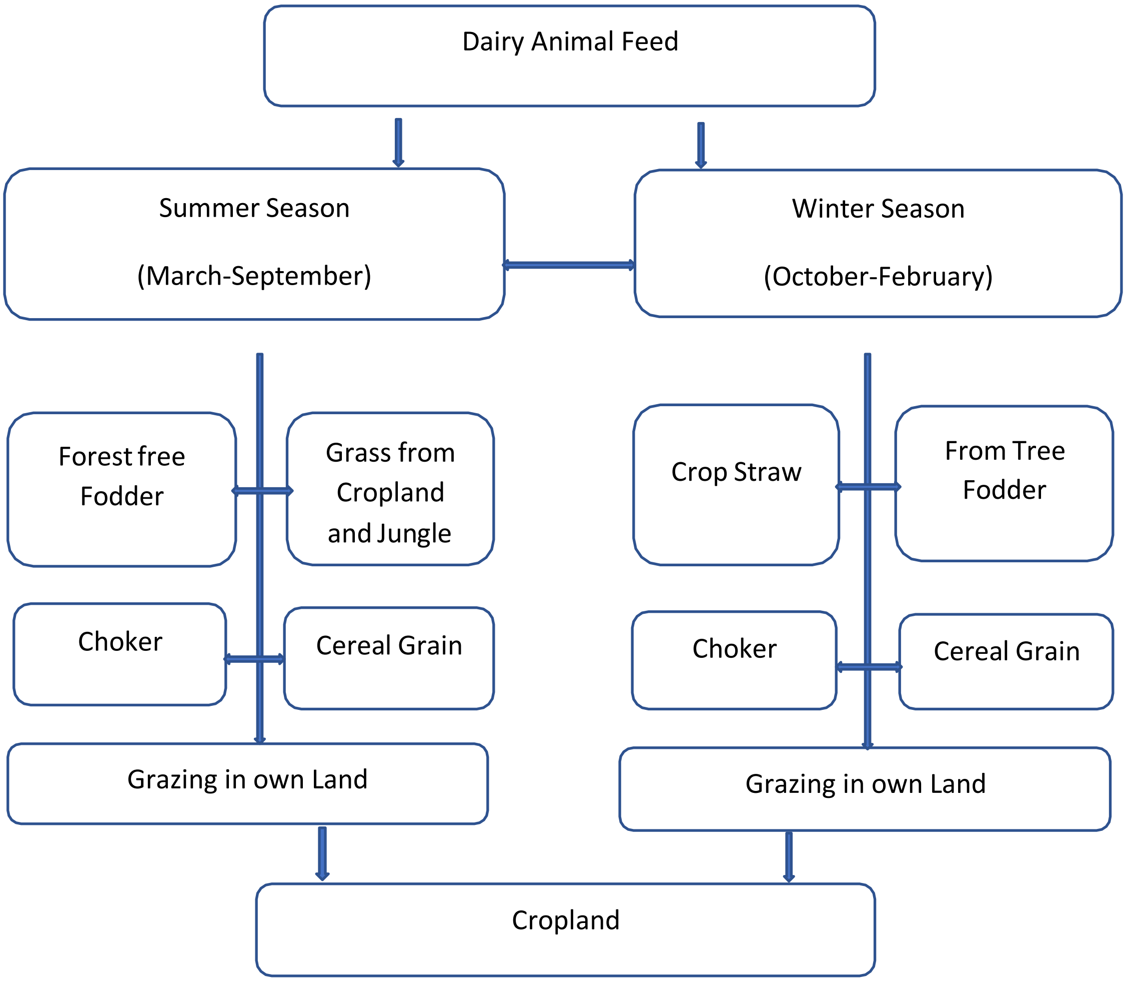
Sl. No.	Items	District
1	Area	750
2	Sub-Division	4
3	Block Administrative Centre	8
4	Gram Panchayat Unit	47
5	Panchayat Ward	271
6	Municipal Corporation/ Nagar Panchayat/ Nagar Palika	2
7	Population (Census 2011)	146850
8	Density of Population (person/sq.km)	195.8
9	Sex Ratio (female/1000 males)	915
10	Child Sex Ratio	953
11	Literacy (Census 2011)	81.4
12	Total Workers	74753
13	Main Workers	50898
14	Decadal growth of Population (2001-2011)	11.65

Source: Population and demographic indicators, Census 2011, Statistical Journal, GOS, 2015

General Introduction of the study area: The research site is located on a hilly incline. The study area's elevation ranges from 400 to 2000 metres above sea level, making for a year-round climate that is mild. In the study area, there is a mixture of farm and forest land. Most places on the planet have some form of agriculture or human settlement. There is a lot of dense forest on the hillsides, but there are also agricultural terraces where cardamom, ginger, and potatoes are grown. In the study area, small amounts of rainfall during the winter months. The Tista and Ranjit rivers are the two main rivers in the study area. It also serves as a district border, separating east and west Bengal, as well as a state border. As the study area is in a forested area, it is home to a wide range of species, including Utttis (Alnus Nepalensis), Chilouni (Schime Wallichi), Mauwa (Engethardtis Spicata), Alusre (Betula Alnoides), Katus (Castonotsis Indica), Malato (Macaranga Denficulato), as well as other more high-al Farmers and villagers are not allowed to collect fodder, wood for heating or other forest products from the reserved forest in the study area. As a result, there is a shortage of food for livestock during the winter months. The study area's location is shown on the map. Nepali is the primary language of communication among people from different ethnic groups. People in the village make a living primarily from farming and raising livestock. Other occupations include wage work, business, and service/employees. Agriculture, livestock farming, wage labour, trade and business, and employment in both the public and private sectors are the primary economic activities of the people who live in rural areas. Aside from agriculture, farming is the most common economic activity in the rural communities of the research region. People's livelihoods rely on it as a key source of income. Agriculture is dominated by the production of food crops. Livestock ranching has become a vital part of the agricultural industry. In relation to the land they occupied, the agricultural potentiality of the study area's villages isn't very high. They cultivate maize, millet, and other crops on terraces in the study area, which is located on a hillside. Farmers rely primarily on monsoon rain for agriculture because there is no good irrigation system.

The history of dairy farming in the study area indicates that dairy farming has always been a part of Sikkim state's traditional agriculture. Dairy farming is an important source of income for many families. There has been a rise in the popularity of dairy farming in Sikkim and the study area in recent years. Fresh milk has also been a driving force behind the development of milk cooperatives and milk collection centres in the rural economy. Commercial milk was not produced prior to the establishment of a dairy cooperative in Sikkim state. In the past, farmers kept dairy animals solely for their own consumption. In addition to producing their own dairy products, these farmers may sell a small amount of milk to a distant market, or they may only sell milk to local customers. Sikkim's government took action to help the state's rural poor by providing a year-round market for milk after the Anand Model-based Sikkim Milk Union was established in 1980. Farmers in the study region have been encouraged to go into dairy farming since the establishment of a milk collection centre there. Because they have a regular customer base, they can sell their milk at a reasonable price. Dairy cows of enhanced genetics have been introduced to farmers. There has been an increase in the amount of milk and its products being produced, as well as the introduction of scientific methods into dairy farming soon. All milking cows and buffaloes, as well as yaks, are considered dairy animals in the rural economy of the study region. However, there are no buffaloes or yaks in the study area; instead, cows are referred to as dairy animals or cattle. The primary milking animals are local and crossbred cows. The village's main source of income is milk production. By starting a dairy farm, people can improve their financial situation. Dairy animals, particularly those that are local or crossbred, are highly profitable. To improve the quality and quantity of their milk, dairy cows require a well-balanced diet. There are milk collection centres and markets that supply farmers with grain and feed for their dairy herds. Green grass is an important source of feed for cattle in the study area, as evidenced by seasonal animal feeding behaviours. The study area's livestock relies heavily on crop residue, which contributes half of the total needed. Rice straw, maize stover, and other crop residues are used as fodder because they contain a variety of nutrients essential to the health and productivity of dairy animals. Green fodder also increases the milk production of dairy animals, which is why dairy animals produce more milk during the summer. Dairy animals are fed in accordance with the seasons, as depicted in the flowchart below.

Seasonal feeding practices of dairy animals



Source: Field Survey, 2019-2020

Profile of Livestock Economy in South Sikkim (Study area):

Table 4.14: Livestock Population of Study Area:

Sl. No.	**livestock**	**Sikkim South District Sub-Division**		
		Namchi	**Ravangla**	**Total**
1	Cattle	21755	15739	**37494**
2	Buffaloes	5	35	**40**
3	Yak	-	-	-
4	Sheep	61	943	**1004**
5	Goat	18509	11052	**29561**
6	Pig	5562	2898	**8460**
7	Ponies	11	-	**11**
8	Dog (Pet)	4219	1282	**5501**
9	Rabbit	48	17	**65**
10	Backyard Poultry	140850	34925	**175775**
11	Farm Poultry (Layer + Broiler)	42000	-	**42000**

Source: Sikkim State 19th Livestock Census-2012, GOS.

Categories of Dairy Livestock of the study area: Cows, buffaloes, and yaks arethe primary milk-producing domesticated animals in Sikkim. Sikkimese cows (paharay gai) and improved breeds (cattle), such as Jersey, Holstein Friesian, Brown Swiss, Agrshire and Siri, are the most common types of cows found in the region. Crosses between Sikkimese and Jersey, Holstein Friesian, Brown Swiss, and Ayrshire Sikkimese. Two types of buffaloes exist: a) Local Buffaloes and b) Murrah Buffaloes. Yak/Naks/Chauries are the Tibetan Breed and the Sikkimese Breed.

Agriculture of the study area: Agriculture is the most important economic activity of the people in the rural village. It is a primary base of livelihood of the people. Food crops occupy the dominant position in agriculture. Livestock farming has been taken as an integral aspect of agriculture. The agriculture potentiality of this village is not high as compared to the land they occupied. The study area situated on hill slopes, because of this they practice terrace cultivation in which they cultivate maize, millet, etc. there is no irrigation facility. The villagers, mostly depend on monsoon rain for agriculture. Agriculture is still an important economic activity which contributes 45% of the state's GDP. This can be clear with the help of the table 4.15

Table 4.15: Crops Production [per ha (kg)]

Sl. No.	**Production of crops**	**Area Cultivated (ha)**
1	**Cereals**	
A	Rice	2340
B	Wheat	1500
C	Maize	13400
D	Finger Millet	1010
E	Barley	200
F	Buck Wheat	580
2	**Pulses**	
A	Urd	1700
B	Other Pulses	640
3	**Oilseeds**	
A	Rape seed/Mustard	1480
B	Other Oilseed	40
C	Soya bean	1400
Total		24290
4	**Yield Rate of Crops Cereals**	**Production per ha (kg)**
A	Rice	1400
B	Wheat	1300
C	Maize	1380
D	Finger Millet	950
E	Barley	1500
F	Buck Wheat	800
5	**Pulses**	
A	Urd	750
B	Other Pulses	1300
6	**Oilseeds**	
A	Rape and Mustard	750
B	Soya bean	820
C	Other oilseeds	500
Total		**11450**
7	**High Yielding Variety**	
A	Maize	5330
B	Paddy	970
C	Wheat	1480
D	Barley	8
E	Pulses	20
F	Soya bean	180
Total		**7988**

Source: Directorate of Economics, Statistics, Monitoring and Evaluation, Government of Sikkim, Namchi, South Sikkim, 2002.

The table 4.15 displays the crop yields. The production of cereal includes not only rice and wheat but also maize, finger millet, barley, and buckwheat as well. Urd, chickpeas, and soybeans are the three most prevalent varieties of pulses. Urd is one of the more uncommon types of pulses. To cultivate all these crops, a total of 24290 hectares (ha) of land is required. Buckwheat, rice, wheat, maize, finger millet, and barley all contribute to the overall production of 11450 kilogrammes of weight per hectare (ha). The overall area that the high-yielding variety was able to cover included not just soya bean, but also maize, paddy, wheat, barley, pulses, and other grains. According to the information in the table, even though maize is grown on a larger plot of land than barley is, it only yields about half as much.

Chapter 5

Mountain Livestock Economy and Climate Change Implications on Dairy Farming

This chapter offers a general introduction to the role of cattle in the economy of mountainous regions. Additionally, research has been done to investigate how the changing climate would affect dairy farming in mountain economy. This chapter accomplishes objective number 1.

Role of livestock economy in mountain regions: Sikkim's economy is based on farming, and agriculture is the main industry in the state. Over 64% of the people depend on agriculture for their living. Also, agriculture is a major source of employment and income (Joshi, 2004). Livestock, on the other hand, is the best way to make money. In general, livestock is the domesticated animals that are kept in a farming context to produce food, fibre, and other products. These creatures are often referred to as "farm animals." It's useful for maintaining a stable diet and income for families, increasing the productivity of land so that people can make a living off of it, ensuring the diversification and sustainability of agricultural practises, providing jobs for members of the community, celebrating milestones, elevating social standing, and more (Moyo *et al.*, 2010). The raising of cattle accounts for a considerable percentage of the Indian economy. Nearly 20.5 million people in total get their food from animals as their primary source of nutrition. The average percentage of a rural household's income that comes from livestock is 14 percent, but smallholder households earn 16 percent of their income from livestock. In rural areas, the rearing of livestock is the primary means of subsistence for more than two thirds of the population. According to the most recent available statistics, it also provides employment opportunities for around 8.8 percent of India's overall population. According to the USDA, the cattle industry is responsible for 4.11 percent of the overall GDP and 25.6 percent of the entire GDP generated by agriculture.

Livestock is commonly referred to as the "engine" or "backbone" of mountain economies because of its role in rural growth and progression. In addition to providing rural households with a supplementary income and food security in the form of meat, livestock also serves to lessen the susceptibility of rural livelihoods to the effects of natural disasters and other hazards. The livestock business plays a significant role in ensuring that the needs of the population are met about the consumption of animal proteins. This is accomplished through the provision of milk, eggs, and meat, all of which are components of the food basket. Milk can be purchased in quantities equivalent to 281 grams per person daily (Statistics, NDDB, 2011-2012).

Throughout history, farmers in the highlands have traditionally raised a small number of cattle, sheep, and goats as part of a wider agroforestry and agricultural system. According to the tradition, this was done in conjunction with the cultivation of food crops. The money that farmers receive from crop production is not sufficient to cover their fundamental requirements for survival and basic needs. Animal husbandry has been pivotal in this regard because of its utility as a tool for enhancing the economic and social standing of farmers and people from lower social classes (Themjung, *et al,* 1995). When growing crops in the field is not an option due to the terrain's difficulty and ruggedness, animal husbandry is required to be the principal source of revenue for farmers in certain locations. The raising of livestock in these areas makes a substantial contribution to the general economic well-being of the state (Balaram, 1998).

Mountainous regions are home to a wide variety of livestock, which plays an essential role in the region's economy, particularly in terms of the production of food. People in rural areas rely on them for assistance in a wide variety of facets of their lives; as a result, they are the "backbone" of rural communities.

The purpose of this objective is to look at the role of livestock in the economy of mountain areas, figure out what stops people from herding livestock, and make some policy suggestions.

The researcher has made an effort to provide a concise overview of the following topics, all of which are connected to the objective that was presented earlier.

• Describe the different types of land and how they are different from each other.

• What are mountainous places exactly? What makes it different from other parts of the world?

• What does an economy mean?

• What are the different kinds of economies?

• What is livestock? How does the livestock economy work?

• What kinds of ways can people make money in mountainous areas?

• Why is it important that people raise animals in the mountains?

There are primarily four different kinds of landforms that may be found on our planet: mountains, hills, plateaus, and plains. Minor landforms can be found all throughout the planet. Some examples of these include buttes, canyons, valleys, and basins. One of the physical qualities that make up the surface of the earth is called the terrain. A mountainous region is a type of landform that is distinguished by its elevation relative to the surrounding land mass or the level of the surrounding body of water. Due to their greater steepness compared to that of hills, the climate in these regions is unique from that of lower-lying areas and the flatlands that border them. The weather in this region is frequently characterised by brisk temperatures and wet conditions. The amount of oxygen in the air is reduced when one travels to higher elevations due to the thinner air found at these locations. Because of this, mountain environments become less conducive to the development of both plant and animal life. The plants and animals that are native to this area have developed in their own different ways, which gives them their individual character. Plateaus can be found at elevations that are at least 5000 feet higher than mountains, while mountains are defined as steep slopes that rise for more than 5000 feet in total elevation. The greater slope or gradient that characterises mountains can be used to differentiate them from the flatter plateaus that surround them.

Economy: An economy is the system through which a society allocates its scarce resources among its various production and consuming activities. In Greek, the word "economy" means "how to run a home." In economics, the making and using of goods and services are used to meet the needs of the people who live and work in a certain economy. When an economic system is based on the market, goods can move freely around the market based on supply and demand.

There are basically four different kinds of economies, which are;

Conventional economy: This is the most basic type of economic activity. It is based on traditional ways of doing things and old rules. It puts a lot of importance on the things and services that fit with their culture, beliefs, and history.

Command economy: In terms of how it is set up, this is the exact opposite of a free market economy. Power is centralised in one place, which is usually the government in this case. It happens a lot in China and other communist countries.

Market economy: The opposite of a market economy is a command economy. The people who take part in the economy and the laws of supply and demand make up the whole economy.

Mixed economy: This is a mix of a command economy and a market economy, like the one in India. It gives private businesses the freedom to work in the economy with as little government oversight as possible.

Table 5.1: Role of Livestock

Sl. No.	Role of livestock	Least Useful		Useful		Most Useful		Total F	Total %	Mean Score	Rank
		F	%	F	%	F	%				
1	Involvement of domesticated animals in food supply	11	9.17	13	10.83	96	80.00	120	100	2.71	III
2	Importance of livestock as a source of family income	17	14.17	10	8.33	93	77.50	120	100	2.63	V
3	Agriculture and the role of livestock in soil productivity	7	5.83	22	18.33	91	75.83	120	100	2.70	IV
4	Use of livestock for transportation	39	32.50	41	34.17	40	33.33	120	100	2.01	XI
5	Importance of livestock in agricultural traction	12	10.00	22	18.33	86	71.67	120	100	2.62	VI
6	Agricultural Diversification and sustainable agricultural Output	20	16.67	23	19.17	77	64.17	120	100	2.48	VII
7	Role in horticulture development	42	35.00	13	10.83	65	54.17	120	100	2.19	X
8	Role in floriculture development	46	38.33	3	2.50	71	59.17	120	100	2.21	IX
9	Environmentally Friendly agricultural production	11	9.17	10	8.33	99	82.50	120	100	2.73	II
10	Livestock for family and community employment	4	3.33	18	15.00	98	81.67	120	100	2.78	I
11	For ceremonial purposes	32	26.67	23	19.17	65	54.17	120	100	2.28	VIII
12	Other purposes	60	50.00	25	20.83	35	29.17	120	100	1.79	XII

Source: Field Survey, 2019-2020

Note: F- Frequency, %-Percentage

Involvement of Domesticated Animals in Food Supply: Domesticated animals such as cattle, buffalo, hens, sheep, goats, and yaks contribute to the economy by

supplying food items such as milk and dairy products, meat, eggs, and milk products. In addition to being a source of animal protein, livestock play an important role in family nutrition. The drinking of milk and milk products is extremely common in mountainous areas. Aside from that, buffalo meat and hen eggs, which are obtained from the same animals, are important sources of nutrition in mountainous areas. Where the availability of nutrition from other sources is limited due to the terrain's remoteness and inaccessibility, alternative sources of nutrition must be sought, and it is here that livestock fills the gap. From the field data it has been found that 80% of the dairy farmers perceived that livestock plays most useful role in food supply. Approximately 9% and 10% farmers reported that livestock involvement in food supply is least useful and useful respectively. In the overall study this role has been ranked III.

The importance of livestock as a source of family income: Livestock is a significant source of income for most highland households. Animals are sold for the purpose of generating revenue. In addition, in urban and peri-urban mountain regions where milk collection facilities are accessible, milk is the primary source of income for many people. In rural areas, a family's social standing is determined by their cattle ownership. The importance of livestock as a source of asset savings: livestock is raisedbecause it is also seen as an asset by those who live in mountainous areas. Live animalscan be sold at any time when the owner is in desperate need of money, whether for medical expenses or for the education of a child, for example. It serves as a security asset and can be valuable in times of low crop output, among other things. 77.5% dairy farmers in the study area perceived that livestock is the most useful source of family income. approximately 8% and 14% farmers reported it as useful and least useful respectively. This particular role has been ranked V in the study area.

Agriculture and the Role of Livestock in Soil Productivity: Farmers in hilly and mountainous areas continue to rely on traditional forms of manure to deliver nutrients for preserving soil productivity and fertility, which in turn helps to increase agricultural productivity. Because of the higher market value of organic products, cow dung and cow urine are being used extensively as organic fertiliser in organic crop production, resulting in increased profits for farmers and increased profits for the environment. Approximately 76% of dairy farmers in the study area reported that agriculture and livestock play the most useful role in soil productivity. Approx. 18% dairy farmers reported it has useful role whereas approx. 6% found role of livestock and agriculture in soil productivity least useful. Its role has been ranked as IV in the study area.

The Use of Livestock for Transportation: In the past, horses and mules were used to transport numerous goods of use in hilly and mountainous areas where road connectivity was lacking or vehicle availability was limited, such as in the case of the United Kingdom. Yaks and mules are still used for transportation in mountainous locations in remote areas of the country today. The role of livestock for transportation was ranked XI in the study area. Approx. 34% dairy farmers revealed that livestock plays useful role in transportation. Approx. 33% reported its role as most useful in transportation. However, approx. 32% reported livestock role as least useful in transportation.

The importance of livestock in agricultural traction: Oxen and buffaloes are the most used livestock for farm power. Contemporary agricultural equipment cannot be used in the mountainous region because the lands are typically small, fragmented, and steeply terraced, making it impossible to use the modern agricultural equipment. As a result, male animals are used to prepare grounds for cultivation in the mountainous region. Approx. 72% dairy farmers in the study area perceived the role of livestock in agricultural traction as more useful. Nearly 18% found it useful and 10% found it as least useful in agricultural traction. Its overall ranked in usefulness of livestock in the study area is VI.

Agricultural diversification and sustainable agricultural output are made possible by livestock. Small farmers benefit greatly from agricultural diversification since it allows them to raise their revenue significantly. Changing cropping patterns or diversifying into other non-farming income-generating activities such as cattle, horticulture, and floriculture are examples of what is meant by diversification in agriculture. A portion of the acreage is utilised for traditional farming, while the remainder is used for non-farming activities such as livestock and other livestock. This transition has aided farmers in obtaining a better/additional income and raising their level of living, even in mountainous areas. It encourages synergy and harmony betweencrops and cattle. The data collected from the study area reflected that approx. 64% dairyfarmers opined that the role as useful for agricultural diversification and sustainable agricultural output. Nearly 19% dairy farmers believed its role as useful and approx. 17% believe that the role of livestock here is least useful. This particular role has beenranked VII in the overall ranking in the usefulness of livestock in the study area.

Role of Livestock in horticulture: Plants used in horticulture include fruits, vegetables, and ornamental plants. Horticulture is a field of agriculture that deals mostly with garden crops, such as fruits, vegetables, and ornamental plants. The name comes from the Latin hortus, which means "garden," and colere, which means "to cultivate." Although it applies to all types of garden management in general, it is most used to refer to large-scale commercial manufacturing. Horticulture is a very small industry, falling between home gardening and outdoor farming in terms of scale, however, all forms of cultivation are organically linked. Livestock contributes to horticulture by supplying a variety of inputs such as drought power and manure. It also makes use of forages and feed that would otherwise be unfit for human consumption. From the field observation it has been found that 54% of the dairy farmers perceived that livestock plays most useful role in horticulture development. Approximately 35% and 11% farmers reported that role of livestock in horticulture development is least useful and useful respectively. In the overall study this role has been ranked as X.

Role of Livestock in Floriculture. Flower farming is a branch of horticulture concerned with the cultivation of flowering and attractive plants for use in gardens andfloristry, which is a subset of the floral industry. Flower farming is also known as floriculture. In the study area the role of livestock for floriculture development was ranked IX by the dairy farmer. Approx. 59% found its role as the most useful, approx. 38% found it least useful and a meagre approx. 3% found its role as useful.

Need for agricultural diversification:

i) It lessens the impact of risk on farmers' livelihoods.

ii) Because there is a greater number of people participating than with traditional crops, there are more employment opportunities.

iii) Since it is commercial farming, it delivers larger returns to the farmers than traditional agriculture.

Environmentally friendly agricultural production: This term refers to agricultural production that does not cause harm to the environment, agricultural crop quality and biodiversity. It contributes to the long-term stability of food production and quality by reducing the demand for and requirements for agricultural chemical inputs to control the system, rather than increasing them. It contributes to greenhouse gas reduction using mostly organic matter and the decrease of pesticide use in order to increase the nutrient content of soil and to ensure the safety and quality of food. For households in mountainous regions, livestock keeping is a critical component of food security and nutrition, as well as a means of achieving sustainable agricultural production. Livestock keeping contributes to agricultural production by providing organic manure for improving soil fertility and providing the draught power required on farms. The use of cattle has no negative impact on the environment, in contrast to the use of chemical fertilisers and tilling machinery. The role of livestock for environmentally friendly agricultural production was ranked very high in the study area. It was ranked as second in the list. Approx. 83% dairy farmers reported the role as most useful, nearly 8% as useful and almost 9% as least useful.

Using livestock for family and community employment: Most people in mountainous regions rely on agriculture for their livelihood, but because agriculture isseasonal and does not provide them with year-round employment, they turn to livestock for employment during the lean agricultural seasons. Dairy farming, out of all livestock production, has the most potential for creating new jobs. Even in mountainous areas, Dairy Co-operative Societies (DCS) have provided community employment opportunities. The employment opportunities created are not limited to milk producingfarmers but are available to anyone who is involved in the Milk Producers Co-operativeSociety (MPCS), including local vehicle dealers, feed suppliers, and members of the general public who rent out their homes to serve as collection centres, among others. The information/data collected from the study area revealed that the dairy farmers perceived that the livestock played the most important role for family and community employment. It was ranked 1^{st} by the farmers. Approx. 82%

dairy farmers shared that livestock played the most useful role in family as well as community employment.

Approx. 15% found it as useful and a very few almost 3% found that livestock was least useful for employment.

For ceremonial purposes: Livestock plays an important role. Different mountain communities each have their own breed of livestock that is mandatory to be raised for ritual purposes. According to the Hindu faith, cows are regarded sacred, and no puja is possible without the inclusion of cow excrement and the use of gaumutra (i.e., cow urine). The amount and kind of cattle that a person possesses plays an important role in determining his or her social standing. It serves as a barometer of his riches. Almost 54% of dairy farmers in the study area perceived that livestock played the most useful role for ceremonial purpose. Nearly 19% believed its role as useful andapprox. 27% believed its role as least useful for ceremonial purposes. The dairy farmers ranked this role as VIII in the study area.

Conclusion: After everything has been said and done, the conclusion that can be drawn is that livestock plays a significant role in the mountain region. It is rightly called the backbone of Mountain Economy as in addition to being the most reliable source of making money it also supports in the food supply and family nutrition of the rural population. It is a means of subsistence for the great majority of smallholder s' inthe mountain region. Livestock is only the source of draught power which supports in agriculture diversification in this rugged terrain. Thus, Livestock has been found to playa vital role in the growth and progress of the rural population in mountain region. Keeping livestock helps increase output for the vast majority of smallholders' businesses. Although there are a few obstacles associated with the livestock in the mountains, the demand for it and the supply of it are so strong that they outweigh and triumph over the obstacles to support the economy (Kharel, 2022). Lastly, the said objective has been fulfilled by examine the role of livestock economy in mountain region. Though data has been collected from only two sub-division in South Sikkim. However, its implications can be applied to the whole of the state and also to the entire country as well as to the world at large.

Effects of climate change in dairy farming in mountain economy. Another objective of this research project is to gain a deeper and more comprehensive understanding of the implications that climate change will have on the dairy business in mountain economies. The term “climate change” refers to the alteration that takes place in the climate system of the ‘earth’, which in turn leads to the creation of new weather patterns that continue to exist for an extended length of time after the initial occurrence of such patterns. These transformations are a direct consequence of the actions of human beings. This will be performed by the study of the effect that climate change has on numerous natural phenomena, such as drought, cloud burst, wild forest fire, glacier formation, changes in river courses, landslide, hailstorm, snowfall, storm, and so on and so forth. All these natural occurrences, in turn, have an impact on the agricultural industry, as well as the health sector, which is an economic sector that encompasses both people and animals. The examination of the impact that climate change has on several natural events, such as drought, cloud, and storms, will be the means by which this goal will be accomplished. The natural world is being subjected to a greater number of unfavourable effects as a direct consequence of climate change than it is being treated to any positive consequences. It not only results in a general deterioration of the ecosystem's health but also in an increase in the number of times that natural disasters occur. The delicate equilibrium that exists between the region's flora and wildlife in their natural setting is suffering serious disruption as a direct result of the activities that are being carried out by humans in this area.

In mountain states like Sikkim, as well as in any other region, residents who live in the research area have a greater degree of expertise when it comes to elaborating on the effects of climate change because they will have witnessed its influence first-hand in their own lives. This is because residents who live in the research area are more likely to have experienced the effects of climate change. This is true regardless of the location being considered.

Agriculture is the primary means of subsistence for most of the inhabitants in Sikkim; hence, it serves as the key economic sector for the state. They use it as a method for producing manure for the purpose of improving the fertility of their agricultural lands to make up for the fact that the purchase and use of chemical fertilisers such as pesticides, herbicides, synthetic fertilisers, and genetically modified organisms has been prohibited in the state of Sikkim since the year 2003. This is since Sikkim became the first state in the world to be entirely certified organic in 2016, and they use it as a means of manufacturing manure. Many people who reside here engage in dairy farming as a means of deriving the greatest possible benefit from their property. Because of this, they are able to derive the greatest benefit possible from their agricultural production.

In 2016, Sikkim became the first jurisdiction anywhere in the world to receive complete accreditation as an organic state. This achievement made Sikkim the first organic state in the world. Since that time, the indigenous flora and wildlife have achieved a full recovery, improvements have been made to the production of food, and a growing number of tourists are making their way to this relatively small Himalayan state. Although cows are the most prevalent type of livestock kept by people who live in rural settings, a rural person's land may also be home to other species of animals. However, over the past ten years or so, dairy farming in the state of Sikkim has been negatively impacted because of the leasing out of agricultural lands to the numerous pharmaceutical businesses that have sprouted up in the state. This has occurred because of the fact that agricultural lands have been leased out to the numerous pharmaceutical businesses that have emerged in the state as a result of the state's decision to offer tax incentives to these businesses. In addition to this, because of an increase in population, the amount of agricultural land that is reachable on a per capita basis is continually decreasing day after day. It is anticipated that this pattern will carry on for some time. There are less big areas of land that are ideal for cattle to graze on as a direct result of industrialisation. This results in fewer cattle being able to be raised.

The availability of grazing area is becoming more and more limited. The practise of grazing cattle in forest areas has been ended as a direct consequence of the government of Sikkim placing a comprehensive prohibition on the practise of grazing cattle in designated forest areas, plantation zones, and water source areas. The practise of grazing cattle in forest regions has been discontinued as a direct result of this prohibition. As a result of this rule, the practise of grazing cattle in areas that have been declared as forest has become illegal. Grazing cattle in these places can no longer legally take place. In days gone by, residents in the area would drive their livestock all the way out to these grassy areas so that the animals could graze on the grass.

In 1998, the practise of grazing cattle on forest property was outlawed, ending a centuries-old practise that had been a source of aggravation and danger for locals (Forests, Environment and Wildlife Management Department, Government of Sikkim, Chapter-II: Schemes and Policies Implemented from 1995-96 till 2010-11). Because of this, the only choice that is open to the farmers is to raise only as many cattle as can be sustained by the forage that can be grown on their own lands or properties, or to raise only as many cattle as can be sustained by the ready-made forage that can be purchased from the market. Neither of these options is ideal, but they are the only ones that are available to the farmers currently. Although none of these alternatives presents the farmers with a perfect circumstance, this is the only option that they have at their disposal now.

Agriculture, even though it is an important source of state revenue because it is the source of green fodder, fuel, wood, medicines, raw materials, spices, various cash crop, etc. in the state, is declining at a faster pace due to the indiscriminate growth of pharma companies, hydropower projects, government buildings, etc. in the agricultural lands. This is happening even though agriculture is the source of green fodder, fuel, wood, medicines, raw materials, spices. The pollution that was caused by human activity, such as the creation of private factories and firms along riverbanks and agricultural lands, has stained the land and environment of the state, which had been pristine in the past but has since been contaminated by these activities. This contamination has occurred because of the activities that were described in the previous sentence. In the hills and mountains, natural disasters such as earthquakes, landslides, and flash floods etc. occur frequently and can be quite damaging. As a direct result of this, the environment has been subjected to a variety of alterations that are not ideal, including the following:

Table 5.2: Effects of Climate Change

Sl. No.	Effects	Least Serious		Serious		Most Serious		Total F	Total %	Mean Score	Rank
		F	%	F	%	F	%				
1	Forest Fire	7	5.83	17	14.17	96	80	120	100	2.74	III
2	Untimely Rainfall and Change in spring-shed water-flows	0	0.00	0	0.00	120	100	120	100	3.00	I
3	Change in glacier pattern, landslides and flash floods	21	17.50	34	28.33	65	54.17	120	100	2.37	VIII
4	Animal Venture	14	11.67	27	22.50	79	65.83	120	100	2.54	II
5	Health issues	12	10.00	39	32.50	69	57.50	120	100	2.48	VII
6	Hailstorm and Frosts	23	19.17	8	6.67	89	74.17	120	100	2.55	V
7	Snowfall	24	20.00	10	8.33	86	71.67	120	100	2.52	VI
8	Cyclone	90	75.00	15	12.50	15	12.50	120	100	1.38	XII
9	Change in Geo. distribution of Flora and Fauna	38	31.67	44	36.67	38	31.67	120	100	2.00	XI
10	Drought	19	15.83	10	8.33	91	75.83	120	100	2.60	IV
11	Earthquake	35	29.17	45	37.50	40	33.33	120	100	2.04	X
12	Disaster	27	22.50	31	25.83	62	51.67	120	100	2.29	IX

Source: Field Survey, 2019-2020

Note: F- Frequency, %-Percentage

Forest Fires: Sikkim is in the subtropical zone, far from the dry eastern Himalayan region where natural forest fires are more common. Some farmers and grazers are said to light fires in the forest in preparation for the upcoming rainy season to obtain better pasture for their livestock. Such a fire can be extremely destructive, and it can also decimate trees. Burnt vegetation and small faunal components disrupt the ecosystem's equilibrium. After a fire, the slopes are exposed to torrential rains, which cause a high rate of erosion and the loss of fertile topsoil. Many animal species have been wiped out by forest fires over the years. Devastating effects on dairy production are another consequence of forest fires. As a result, the amount of green fodder, grazing land, and woodlands that are available to feed the cattle is reduced. Additionally, they are responsible for the destruction caused by the burning of rubber pipelines, which has resulted in a shortage of potable water for both humans and livestock (Pradhan, *et al.*, 2004). The forest fire cases of Sikkim since 2002-2019 have been presented in table 5.3

Table 5.3: Forest Fire Cases Since 2002-2019

Calen-dar Year	No. of fire incidents in forest area	Forest area affected by fire (in ha.)	Estimated Loss (Loss of Timber)		Casualties		
(Jan to Dec)	Total	Total	Volume in cu.mt.	Value in lakhs	Human life	Cattle	wildlife
2002	32	170	2.00	1.00	Nil	Nil	Nil
2003	23	122	2.00	1.00	Nil	Nil	Nil
2004	21	118	2.00	1.00	Nil	Nil	Nil
2005	42	362	3.00	1.50	Nil	Nil	2
2006	58	408	3.00	1.50	Nil	Nil	2
2007	31	100	1.00	0.50	Nil	Nil	Nil
2008	42	328	2.00	1.00	Nil	Nil	Nil
2009	300	1303	20.00	3.50	Nil	4	4
2010	34	133	25 no. of Chewri bushes	1600 Rhizomos	-	-	-
2011	64	523.60	-	-	-	-	-
2012	21	21	96.5 ha.	4	-	-	Habitat Damaged
2013	74	272.30	Approx. 5000 saplings, Tree-350, Rhododendron-300 approx. and Ground bushes.	-	-	-	Habitat Damaged
2014	80	881	-	-	-	-	-
2015	103	502	-	-	-	-	-
2016	54	307.3	-	-	-	-	-
2017	62	328.71	-	-	-	-	-
2018	53	305.5	-	-	-	-	-
2019	45	412	-	-	-	-	-

Source: Forest and Environment Department, Government of Sikkim, 2018-2019.

Table 5.4: District wise Forest Fire Cases (Jan to Dec 2018 and Jan to Dec 2019)

District	**2018**		**2019**	
	No. of Incidents	Area Damaged (Ha.)	No. of Incidents	Area Damaged (Ha.)
South	41	219	11	230
West	5	23.5	14	81
East	6	61	20	101
North	1	2	Nil	Nil
Total	**53**	**305.5**	**45**	**412**

Source: Forest and Environment Department, Government of Sikkim, 2018-2019.

The sl. no. 1 of the above table 5.2 indicates that the climate change is affecting dairy farming adversely in mountain economy due to the forest fire. The survey in the study area has revealed that the forests fire as the III important effect caused by climate change. 80% dairy farmers opined that it is the most serious effect, nearly 14% said it to be serious and about 6% found it to be least serious. Similarly, table 5.3 reflect that the forest fire cases in Sikkim since 2002-2019 indicating the number of fire incidents in forest area along with the forest area affected by the fire in hectare. Likewise, table 5.4 shows that the district wise forest fire cases in Sikkim in between January 2018 to December 2019 of all the districts along with the number of incidents and area damaged in hectare.

Untimely Rainfall and Change in spring-shed water-flows: Farmers place a high value on predictable precipitation and look forward to it; nevertheless, when a significant amount of precipitation suddenly falls on them all at once, they experience a large degree of worry. In a similar vein, extended periods of drought that are characterised by a lack of rainfall typically produce huge financial losses for farmers. There is a significant dearth of lush pasture for the cattle to graze on as a direct and immediate consequence of the unexpected fall in output. When times are tough, it maybe challenging for a farmer to provide for his or her family while also taking care of thecattle that he or she raises at the same time. The sl. no. 2 of the above table 5.2 indicatesthat the untimely rainfall and change in spring-shed water-flows caused due to climate change is impacting dairy farming in mountain economy badly. The data collected from the study area revealed that the untimely rainfall and change in spring-shed water-flows as the most important cause and ranked it by the farmers at the top among other causes affected by climate change. 100% dairy farmers said that untimely rainfall and change in spring-shed water-flows due to climate change is vivid in the study area.

Changes in Glacier Pattern, Landslides and Flash floods: Glacier's cover large swaths of the Himalayas, which also pose environmental challenges. Ice melt waters from glaciers are an important source of erosion in the arid regions where vegetation is scarce. Sliding earth and rock down a mountain slope is known as a landslide. Landslides can occur when water from rain and melting snow seeps throughthe earth's surface at the top of an incline. ' Water seeps down into the valley from thesandstone below, where it encounters an inclined bed of shale. In areas with a hilly topography, the effects of climate change could trigger new precipitating factors thatlead to landslides. Pre-existing instability of the slope is exacerbated by high temperatures, which also accelerates thermal deterioration of the surrounding rocks. The high temperatures are causing a process called thermal degradation in the rockshere. The heat is the primary factor in this process. The additional effect of heavy rain is that it makes slopes less stable. The rain's weight is to blame for this phenomenon.The possibility exists that this could happen if a large amount of water falls at once. Fodder-producing regions are particularly hard hit by landslides, which exacerbate already dangerous conditions for travel. In addition, landslides that block highways and other routes make it much more difficult to transport milk in large quantities. As aresult, the transportation of milk becomes more difficult. An increase in temperature due to human-caused climate change causes smaller glaciers to melt more rapidly than they otherwise might. Increasing temperatures may speed up the development of desertification, which may have serious consequences if they occurred. This would be a really bad outcome. A direct effect of what has happened is that natural habitats that are adjacent to rivers will be affected. We can expect an impact because of these consequences.

Floods could be unleashed when natural dams built by ice break and release the water that has been kept back by the ice Behind the dams, this water has been preserved. No flooding has occurred thanks to the ice. When glaciers melt, rivers that were once supplied by them dry up, resulting in a shortage of water, which causes plant life to die. There will be no glaciers left if this cycle continues indefinitely (Pradhan, *et al.*, 2004). The sl. no. 3 of the above table 5.2 indicates that due to the Changes in Glacier Pattern, Landslides and Flash floods caused due to climate change, dairy farming in mountain economy is suffering. The Dairy farmers perception in the study area was that change in glacier pattern, landslides and flash floods was the VIII most common effect of climate change. Almost 54% of dairy farmers thought it to be the most serious effect, nearly 28% as serious and almost 18% as least serious.

Animal's venture: When wild animals need food, they will occasionally leave their natural settings and travel into human communities as well as agricultural districts in the hopes of finding something edible there. These forays into human communities and agricultural regions can occur anywhere in the world. When the animals are hungry, you can watch them engaging in this behaviour. It is essential that you steer away of these things because they provide a threat to the general health and safety of the community. It is in your best interest to avoid them. Animals such as monkeys and peacocks that make their homes in agricultural areas cause significant harm to agricultural productivity, which in turn leads to significant monetary losses for farmers. Animals that make their homes in agricultural areas cause significant harm to agricultural productivity. Animals that exhibit these characteristics are also capable of posing significant threats to the human health. Additionally, it is possible for these kinds of animals to transmit diseases to people. This issue, if not addressed and brought under control, will be one of the primary reasons why farmers are discouraged from continuing their farming efforts. The sl. no. 4 of the above table 5.2 indicates that Animals Venture is yet another nuisance caused due to climate change that is hampering dairy farming in mountain economy. Wild animal venturing into habitable land was seen as the II common effect of climate change as perceived by the dairy farmers in the study area. Almost 66% dairy farmers said that it is the most serious effect of climate change, nearly 23% of dairy farmers found it as serious and about 12% thought it to be the least serious effect.

Health: There are many ways in which the effects of climate change might present themselves, and they have the potential to be highly detrimental to the health of both people and animals. It is possible that these effects will manifest themselves in a broad variety of different ways depending on the circumstances. There is a correlation between the occurrence of severe weather and an increase in the number of people who suffer from respiratory and cardiovascular problems, in addition to the number of people who sustain injuries and die at an earlier age than they otherwise would if they had not been affected by the severe weather. This is because severe weather can cause people to become exposed to dangerous conditions that can cause them to become ill or even cause them to die. Further, Heat stress conditions, which can be caused by global warming, high air temperatures, an increase in the frequency of extreme weather events, and drought, may have a significant impact on the health and welfare of animals. This is because heat stress conditions can cause animals to become overheated. The sl. no. 5 of the above table 5.2 indicates that the rise in health issues in both humans and cattle's due to climate change is affecting dairy farming in mountain economy adversely. Health issues was ranked by the respondents of the study area as the VII important common effect of climate change. About 58% dairy farmers perceived it to be the most serious effect of climate change, nearly 33% perceived it as serious and a few of 10% believed it to be the least serious.

Hailstorm and Frosts: Sikkim experiences hailstorms and frosts on a regular basis. Hailstorms can cause extensive damage and complete crop failures in some years due to their high intensity and extent. In acute frost years, a wide range of crops are damaged at high altitudes. Few studies have found a strong correlation between the frequency of hailstorms and the amount of damage they inflict. Simple correlations and the coldest temperatures have been used to predict this. This link gives a good idea ofthe damage hailstorms inflict on a property. The findings of these various investigations all point to a connection between the two. It's possible that hailstorms could cause evenmore property damage soon if global warming causes the temperature to rise evenfurther. This forecast assumes that global temperatures will continue to rise as moregreenhouse gas emissions are released into the atmosphere. In the event of globalwarming, temperatures would rise. When it wipes out an entire harvest in a matter of minutes, this natural hazard has a lot of destructive power. Within minutes of anearthquake or flooding decimating crops, the extent of their devastation will become apparent. As a result, the damage occurs almost immediately (Pradhan, *et al*., 2004). The sl. no. 6 of the above table 5.2 indicates that untimely hailstorm and frosts are the effects of climate change which is hitting dairy farming in mountain economy hard. Hailstorm and frosts have been ranked as the V important common effect of climate change in the study area. Almost 74% dairy farmers said that it is the most serious effect

of climate change. However, a few of nearly 7% perceived it as a serious effect and about 19% said it is the least serious effect of climate change in the study area.

Snowfall: When the weather changes, so does where and how much snow falls. When there is a lot of snow, it stays on the ground for a long time. Because of this, there isn't enough grass for the animals that live at high altitudes, like the yak, to eat. A study that came out in December 2018 says that a lot of yaks in North Sikkim died of starvation. Also, when there is a big drop in the amount of snow that falls, this influences the snow-fed rivers, which could cause them to dry up. This, in turn, affects the agricultural areas that are near the rivers. This cycle keeps going. The sl. no. 7 of the above table 5.2 indicates that the untimely snowfall is also one of the effects of climate change which is badly affecting dairy farming in mountain economy. Change in snowfall pattern has been perceived and ranked as the VI important common effect of climate change in the study area. Almost 72% said that it is the most serious effect of the climate change in the study area whereas, nearly 8% and 20% dairy farmers believed that it is one of the serious and least serious effect respectively.

Cyclone: The impact of cyclones on small-scale farmers is devastating, resulting in major crop losses, food insecurity, and a reduction in their ability to earn money. A cyclone can cause extensive damage to infrastructure, flooding agriculturalareas and destroying crops, injuring livestock, threatening food security, and increasingthe incidence of water-borne diseases (Globally averaged tropical cyclone intensity isexpected to increase by 2-11 percent and the frequency of tropical cyclones to decrease by 34 percent, according to research published in Nature Geoscience in 2010 based onmodelling studies). The sl. no. 8 of the above table 5.2 indicates that cyclone is also aneffect of climate change which is affecting dairy farming in mountain economy. In the study area cyclone was perceived as the least common effect of climate change by the

dairy farmers. Almost 75% dairy farmers said it is the least serous effect in the study area and an equal 12.5% believed it to be serious and most serious effect of climate change.

Geographical distribution of flora and fauna: As a direct result of the changes that are taking place in the ecosystem, the geographical distribution of plantsand animals is becoming increasingly unpredictable, which may have implications for conservation efforts. This is the result of shifts in the environment immediately surrounding us. There are a lot of species whose natural environments are shifting, and for those species to continue existing, they will either need to figure out a way to adaptto their new surroundings or migrate to other portions of the earth where the conditionsare more favourable. As a direct result of climate change, a significant number of plantspecies that in the past were able to flourish and make their homes at a particular elevation are now unable to do so at that elevation. This is because climate change hasaltered the average temperature and precipitation patterns over time. This is sinceclimate change has brought about changes in the typical temperatures and patterns of precipitation over time. This is because the weather has been becoming increasingly unpredictable. It is difficult for small-scale farmers to find a solution to this problembecause of the restricted quantity of land and resources that are available to them. Thesl. no. 9 of the above table 5.2 indicates that the change in flora and fauna is causedbecause of climate change which is affecting dairy farming in mountain economy. Change in geographical distribution of flora and fauna was ranked as the XI commoneffect of climate change in the study area. Approx. 36% dairy farmers perceived it as a serious effect of climate change and an equal percentage of nearly 32% each consideredit as most serious and least serious.

Drought: Climate change harms animals. Much of the country's livestock lives outside, exposed to weather and heat. Farmers may need better housing or breeding. Pastures have needs. Climate change may require new forages. Some dairy land may become unusable. Global warming threatens biosecurity. Warmer temperatures propagate pests, weeds, and diseases. Drought raises feed prices and reduces agricultural water. Farmers face challenging decisions that can harm their health. Sikkimese farmers, especially dairy farmers, face drought. Sikkim's dairy cows eat grass, fodder crops, and hay. Sikkim's milk is upto 95% grain-fed. Dry conditions reduce dairy farmers' capacity to grow feed and effect feed supply and cost. Drought depletes farm and animal water. All dairy farmers pay for grain. In tough seasons, dairy farmers should prepare ahead. The dairy industry provides tools, information, and support to farmers. Drought can harm farmers' health and wellbeing because they must make tough decisions about cows, farm employees, and business. Safeguard each other and engage with industry and community.

Drought is a term used to describe a period in which there is a significant hydrological imbalance because of a regular lack of rain. Due to abnormally dry weather, water reservoirs are depleted, and agricultural crops are damaged. The severity of a drought is determined by the degree of water deficiency, the length of time it has lasted, and the size of the affected area. A dry spell or partial drought can be written off as a short-lived drought, a situation in which the amount of water available from the surface, the subsurface, and the atmosphere is consistently insufficient. In addition to affecting agricultural practises in a region, it also has a significant impact on the ecological balance of that region. To put it another way, there are number of ways to define it:

Meteorological drought: This occurs when the rainfall is significantly less than normal. The degree of aridity and the length of the dry season are two of the mostcommon defining characteristics.

There is an emphasis here on the impact that drought has in agricultural settings due to a decrease in precipitation, which is directly related to this topic.

As a result of a lack of rain, experts are investigating how this has affected the water cycle in the region. Soil moisture, stream, and groundwater flow as well as reservoir levels are all affected by climate change.

Socio-economic drought: A socio-economic drought is one that affects the supply and demand for a specific economic item, as well as the climate, hydrology, andagricultural characteristics of the areas currently suffering from a drought.

The sl. no. 10 of the above table 5.2 indicates that due to drought which is one of the effects of climate change is hampering dairy farming in mountain economy. Drought was regarded as the IV important common effect of climate change in the study area. Approx. 76% considered it as the most serious effect, approx. 8% as serious and almost 16% regarded it as the least serious effect.

Earthquake: In recent years, Sikkim has been hit by several mild earthquakes, the most significant of which occurred on September 18, 2011, and causedvery minor injuries and property damage. Sikkim is in zone IV of the most recent seismic hazard map, which indicates that preparation for crisis management due to earthquakes should be part of the normal development planning process. Every day,earthquakes pose a risk to the peace and tranquilly of people as well as to their progressand wealth (Pradhan, *et al.*, 2004). The sl. no. 11 of the above table 5.2 indicates thatearthquake is also triggered due to climate change, this too affects dairy farming inmountain economy. Dairy farmers in the study area perceived earthquake as the X important common effect of climate change. Approx. 38% dairy farmers thought it as a serious effect of climate change whereas approx. 33% perceived it as most serious effect and approx. 29% regarded it as the least serious effect of climate change.

Increase in frequency of Disasters: The changes in the climate of the entire planet make existing climate risk far more severe and multiply the likelihood of catastrophic weather events. Temperature increases in the atmosphere and the oceancause water levels in rivers and seas to rise, storms to become more violent and have higher wind speeds, severe droughts to last longer, and wildfires to become more frequent and widespread. It is possible for there to be flooding and heavy rain. The number of natural disasters caused by climate change has increased threefold during the past three decades. The sl. no. 12 of the above table 5.2 indicates that the increase in frequency of natural disasters is also caused due to climate change which is adversely affecting dairy farming in mountain economy. Increase in the frequency of disaster was perceived as the IX important common effect of climate change in the study area.Approx. 52% regarded it as a most serious effect, 26% as serious and approx. 22% thought it to be least serious. Similarly, table 5.5 indicates that the frequency of climatechange effects/major environmental challenges in the study area.

Table 5.5: Major environmental challenges faced by the farmers due to climate change in the study area

Sl. No.	Challenges	Frequency
1	Forest fire	Regular
2	Hailstorm and Frost	Regular
3	Flash flood	Occasional
4	Landslides	Regular
5	Cold wave	Occasional
6	Acid rain	Occasional
7	Seasonal water scarcity	Regular
8	Untimely rainfall and change in spring-shed water-flows	Occasional
9	Snowfall	Regular
10	Cyclone	Occasional
11	Drought	Occasional
12	Earthquake	Occasional
13	Disaster	Occasional

Source: Field Survey, 2019-2020

Conclusion: the climate change is regarded to do more harm or more specifically just harm to the planet earth, the dairy farming industry in Mountain Economies is notan exception! The dairy farming is suffering badly in mountain regions due to the various effects of climate changes like the untimely rainfall and change in spring-shedwater-flows, Animal venture, forest fires, landslide, draught etc. Similar climate change impacts have been perceived by local communities in the mountains of Nepal too (Gentle and Thwaites, 2016). Even if we are successful in putting an immediate halt tothe emission of all greenhouse gases, turning back the clock on the changes produced by climate change would take decades of effort. As a result, steps need to be made at every level to prepare for and adapt to the effects of climate change. Though a sampled data from two sub-division in South Sikkim has only been taken for the purpose of study yet this is a worldwide problem which is seen to give similar impact globally. Shift in patterns of land use, changes in croplands/cropping pattern, changes in extent of forest and fallow lands, shifts from agriculture to other rural occupations, outright out-migration, changes in livestock holding and herd-size are other effects of climate change in mountain region.

Chapter 6

Socio-economic Conditions of Dairy Farmers

This chapter deals with the socio-economic conditions including production, technical efficiency, consumptions, marketing as well as income utilization system of the dairy farmers in the rural economy of Sikkim. This chapter fulfils objective number 2.

Role of dairy farming in improving Socio-economic conditions among dairy farmers in rural Sikkim:

Socio-economic conditions include unemployment rate and job availability in a certain area. As towns grow, leaders and residents must balance fiscal, social, economic, and environmental goals. Socioeconomic factors help communities make decisions that promote long-term sustainability, including economic development, a healthy community, and social well-being. Socioeconomic conditions, assess how a development may affect present and future residents. Indicators used to measure the prospective socio-economic circumstances of a development include changes in community demographics, retail/service and housing market evaluations, demand for public services, employment and income levels, social structure, traditional practices, and community quality (Kharel, 2008).

This objective addresses the impact of dairy farming in enhancing the socioeconomic situations of the research area's dairy producers. Dairy farming improves socioeconomic conditions worldwide. Sikkim's dairy farmers have also suffered. Sikkim has an agrarian economy with a primarily rural population. About 75% and 2/3rd of the whole labour force rely on agriculture and allied sectors. With just 16% of the land accessible for cultivation, this sector contributes 17% of the state's GDP.

Animal husbandry deserves high priority in the state because it plays an important role in the economic uplift of the weaker section of society engaged in livestock rearing and processing animal products. Livestock wealth is an asset to farmers and provides nutrition, drought power, transportation, employment, and economic support. It gives jobs and nutritional support. It boosts their social standing.

Dairy farming's many benefits attract marginal and disadvantaged farmers. It creates income and jobs. Milk, dung, and milk products can be sold. It is eco-friendly and causes less pollution, skilled workers are not needed, demand for milk products is high, it requires less energy, the selling price of milk is fixed, so regular income is assured, and middlemen are not involved. Emergency relocation is easier. Dairy and livestock provide 50% of farmers' revenue.

Family Profile of dairy farmers in the rural areas of Sikkim:

(Special focus on South Sikkim- The study area):

India's second-tiniest state, Sikkim, lies nestled in the foothills of the Himalayas. There are four districts in Sikkim, namely East, West, North, and South districts. A total of 750 square kilometres, or 10.56 percent of the state's total size of 7096 square kilometres, comprise the study area in the South District. With a variety of elevations, South Sikkim is a drought-prone district. Despite these issues, the Dairy sector in the district is doing well. Samples were collected from 120 different residences. Each of the two South District Sub-divisions Ravangla and Namchi, had 60 homes selected for the study. Each of the 60 residences in each block was surveyed by two GPUs, resulting in a total of 120 households being surveyed. Ralong Namlung GPU and Kewzing Bakhim GPU under Ravangla Block and Chuba Phong GPU and Tangzi Bikmat GPU under Namchi Block were the two GPUs that were selected for use.

Table 6.1: Distribution of Age, Gender and Marital profile of Dairy farmers of South Sikkim

Area-Unit	Dairy Farmers	Average Age (yrs.)	Male Dairy Farmers	%	Female Dairy Farmers	%
RAVANGLA BLOCK	**60**	**51.2**	**54**	**90.00**	**6**	**10.00**
Ralong Namlung GPU	30	52.8	28	93.33	2	6.67
Kewzing Bakhim GPU	30	49.5	26	86.67	4	13.33
NAMCHI BLOCK	**60**	**50.4**	**54**	**90.00**	**6**	**10.00**
Chuba Phong GPU	30	50.5	27	90.00	3	10.00
Tangzi Bikmat GPU	30	50.3	27	90.00	3	10.00
SOUTH SIKKIM DT	**120**	**50.8**	**108**	**90.00**	**12**	**10.00**

Area-Unit	Dairy Farmers	Un-married Dairy Farmers	%	Married Dairy Farmers	%	Widowed Dairy Farmers	%
RAVANGLA BLOCK	**60**	**3**	**5.00**	**56**	**93.33**	**1**	**1.67**
Ralong Namlung GPU	30	2	6.67	27	90.00	1	3.33
Kewzing Bakhim GPU	30	1	3.33	29	96.67	-	-
NAMCHI BLOCK	**60**	**2**	**3.33**	**56**	**93.33**	**2**	**3.33**
Chuba Phong GPU	30	2	6.67	27	90.00	1	3.33
Tangzi Bikmat GPU	30	-	-	29	96.67	1	3.33
SOUTH SIKKIM DT	**120**	**5**	**4.17**	**112**	**93.33**	**3**	**2.50**

Source: Field Survey 2019-2020

In South District, majority of the dairy farmers were found to be middle aged about 50.8 years old. The average age of dairy farmers was recorded as 52.8 years and 50.5 years respectively in Ralong Namlung GPU and Kewzing Bakhim GPU of Ravangla Block. Almost similar figures were obtained from Namchi Block, i.e., 50.5 years and 50.3 years respectively from Chuba Phong GPU and Tangzi Bikmat GPU.

The participation of male members is way ahead of female members in dairy farming activities. Results have shown only a meagre 10 percent female participation in dairy farming against a huge 90 percent male domination in the dairy sector. The average marital profile shows majority participation of married people i.e., 93.33 percent, a few unmarried i.e., 4.17 percent and almost negligible i.e., 2.5 percent widow participation. It has been observed that in families where females support in household work, males are found to participate more in dairy farming and other allied activities. The above table can be represented graphically as under:

Figure 6.1: Distribution of Gender and Marital profile of Dairy farmers of South Sikkim

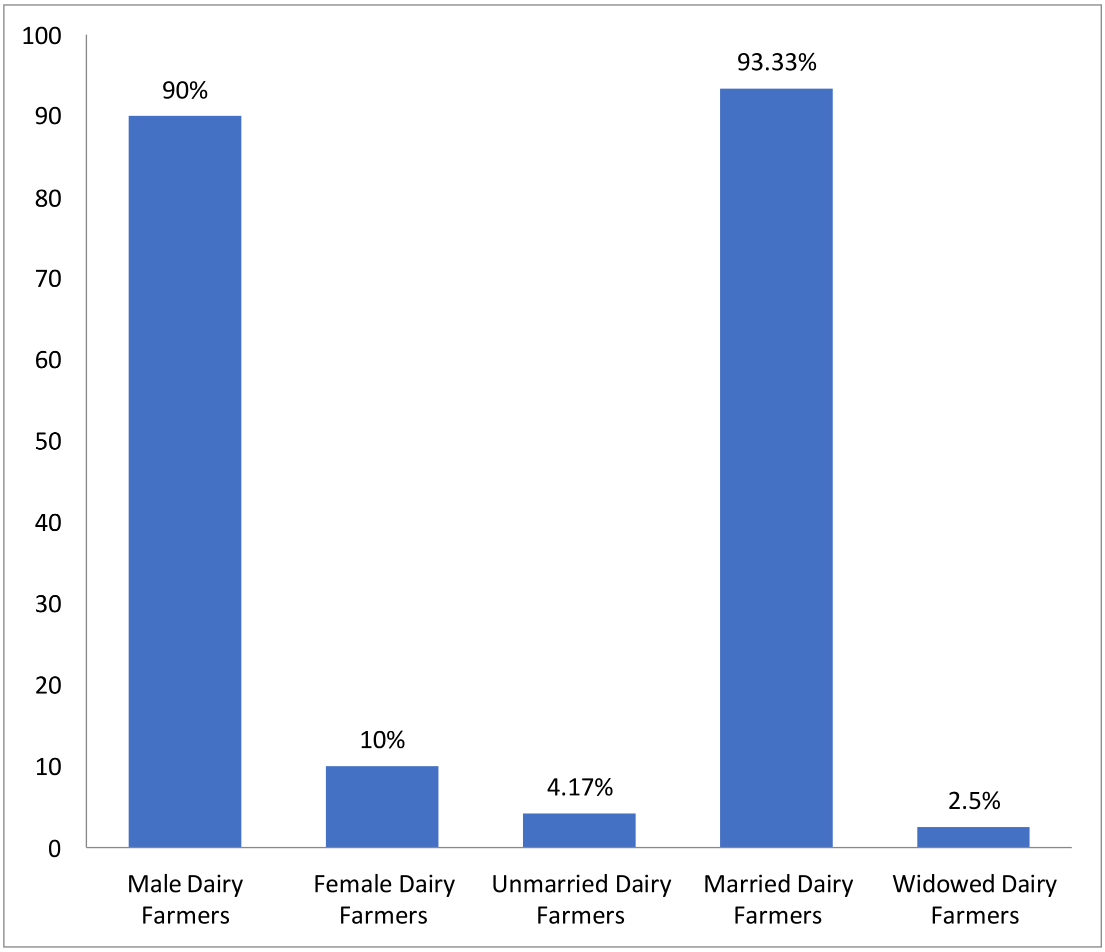


Table 6.2: Structure of Dairy Farming Families

Area-Unit	Total Dairying Families	Nuclear Dairying Families	%	Joint Dairying Families	%	Extended Dairying Families	%
RAVANGLA BLOCK	**60**	**22**	**36.67**	**35**	**58.33**	**3**	**5.00**
Ralong Namlung GPU	30	12	40.00	18	60.00	-	-
Kewzing Bakhim GPU	30	10	33.33	17	56.67	3	10.00
NAMCHI BLOCK	**60**	**30**	**50.00**	**29**	**48.33**	**1**	**1.67**
Chuba Phong GPU	30	10	33.33	20	66.67	-	-
Tangzi Bikmat GPU	30	20	66.67	9	30.00	1	3.33
SOUTH SIKKIM DT	**120**	**52**	**43.33**	**64**	**53.33**	**4**	**3.34**

Area-Unit	Total Dairying Families	Average Family Size	Average Children	Average Adult Members	Average Elderly Members
RAVANGLA BLOCK	**60**	**5.8**	**1.6**	**2.9**	**1.4**
Ralong Namlung GPU	30	5.7	1.2	2.9	1.6
Kewzing Bakhim GPU	30	5.9	1.9	2.8	1.2
NAMCHI BLOCK	**60**	**5.4**	**1.8**	**2.6**	**0.9**
Chuba Phong GPU	30	5.6	1.7	2.7	1.2
Tangzi Bikmat GPU	30	5.1	2.0	2.5	0.6
SOUTH SIKKIM DT	**120**	**5.6**	**1.7**	**2.7**	**1.1**

Source: Field Survey 2019-2020

The table 6.2 describes about the structure of the Dairy Farming families of South Sikkim. It has been observed from the sampled household of the two blocks i.e., Ravangla Block and Namchi Block that majority of dairy farming population more than half i.e., 53.33 percent lives in Joint family, less than half i.e., 43.33 percent live in nuclear family and a meagre 3.34 percent lives as Extended family in the South District i.e., in the study area. The data collected shows that 12 nos. and 10 nos. families of Ralong Namlung GPU and Kewzing Bakhim GPU under Ravangla Block are nuclear families, 18nos. and 17 nos. are Joint families, none of the extended dairy farming family was found in the Ralong Namlung GPU. However, only 3 such families were found in Kewzing Bakhim GPU.

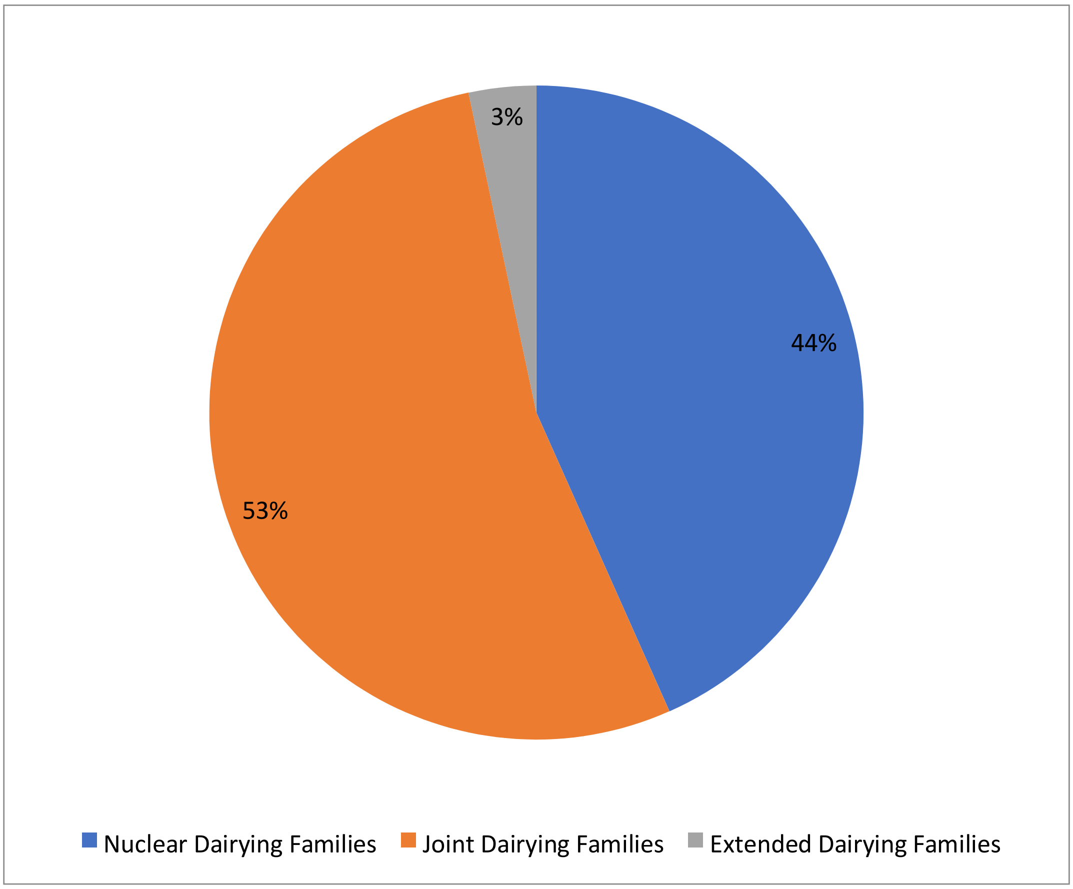
Similarly, 10 nos. and 20 nos. families of Chuba Phong GPU and Tangzi Bikmat GPU under Namchi Block are nuclear dairying families. 20 nos. and 9 nos. are Joint families. Chuba Phong records the highest numbers of Joint family practicing dairy farming. None of the extended dairy farming family was found in Chuba Phong GPU whereas only 1 household was found having extended dairy farming family in Tangzi Bikmat GPU. When we look into the size of family in dairy farming households, the average family size in Ravangla Block are 5.8 members i.e., approximately 6 members and 5.4 members i.e., approximately 5 members in Namchi Block.

Average number of children in Ralong Namlung GPU is 1.2 approximately 1 number whereas in Kewzing Bakhim GPU it is 1.9 approximately 2 numbers. Similarly, the average number of children in Namchi Block is no different it is also approximately 2. The exact numbers as per surveyed data is 1.8. The adult members in both the blocks are almost similar with 2.9 and 2.6 members respectively approximately 3 members. The elderly members having age above 58 years are slightly higher in numbers in Ravangla Block with an average number of 1.4 members approximately 1 number than in Namchi Block with an average of 0.9 members again approximately 1 number.

Interpreting the data for the South district of the study area, the average family size is 6 numbers with 2 children, 3 adults and 1 elder member. From this it can be concluded that adult members participate more in dairy farming followed by children and elderly.

This can be represented in pie chart as below:

Figure 6.2: Structure of Dairy Farming Families



Language: Sikkim/study region Nepali is the primary language of interethnic communication. The Nepali language is spoken by every ethnic group. Bhutia and Lepcha, on the other hand, speak their own dialects within their own communities, both in the study region and in the state.

Table 6.3: Linguistic Profile of Dairy Farmer Respondent

Area-Unit	TDF	MOTHER TONGUE							
		N	%	L	%	B	%	O	%
RAVANGLA BLOCK	**60**	**46**	**76.67**	**1**	**1.67**	**5**	**8.33**	**8**	**13.33**
Ralong Namlung GPU	30	20	66.67	-	-	5	16.67	5	16.67
Kewzing Bakhim GPU	30	26	86.67	1	3.33	-	-	3	10.00
NAMCHI BLOCK	**60**	**44**	**73.33**	**4**	**6.67**	**-**	**-**	**12**	**20.00**
Chuba Phong GPU	30	16	53.33	2	6.67	-	-	12	40.00
Tangzi Bikmat GPU	30	28	93.33	2	6.67	-	-	-	-
SOUTH SIKKIM DT	**120**	**90**	**75.00**	**5**	**4.17**	**5**	**4.17**	**20**	**16.67**
Area-Unit	TDF	**2ND LANGUAGE**							
		E	%	H	%	N	%	O	%
RAVANGLA BLOCK	**60**	**2**	**3.33**	**45**	**75.00**	**8**	**13.33**	**5**	**8.33**
Ralong Namlung GPU	30	-	-	24	80.00	5	16.67	1	3.33
Kewzing Bakhim GPU	30	2	6.67	21	70.00	3	10.00	4	13.33
NAMCHI BLOCK	**60**	**7**	**11.67**	**30**	**50.00**	**14**	**23.33**	**9**	**15.00**
Chuba Phong GPU	30	7	23.33	7	23.33	11	36.67	5	8.33
Tangzi Bikmat GPU	30	-	-	23	76.67	3	10.00	4	13.33
SOUTH SIKKIM DT	**120**	**9**	**7.5**	**75**	**62.50**	**22**	**18.33**	**14**	**11.67**

Source: Field Survey 2019-2020.
Note: TDF- Total Dairying Families, N-Nepali, L-Lepcha, B-Bhutia, O-Others, E-English, H-Hindi

The table 6.3 reflects the linguistic status of dairy farmers of South District in Sikkim. In almost all the four GPUs chosen, mother tongue Nepali speaking communities were seen in the majority. 20 HHs in Ralong Namlung GPU, 26 HHs in Kewzing Bakhim GPU, 16 HHs in Chuba Phong GPU and 28 HHs in Tangzi Bikmat GPU. In Chuba Phong GPU lesser number of households having Nepali as a mother tongue as compared to other GPUs was observed. 53.33 percent had their mother tongue Nepali whereas the rest of the HHs had other languages as their mother tongue viz. Gurung, Rai, Sherpa etc.

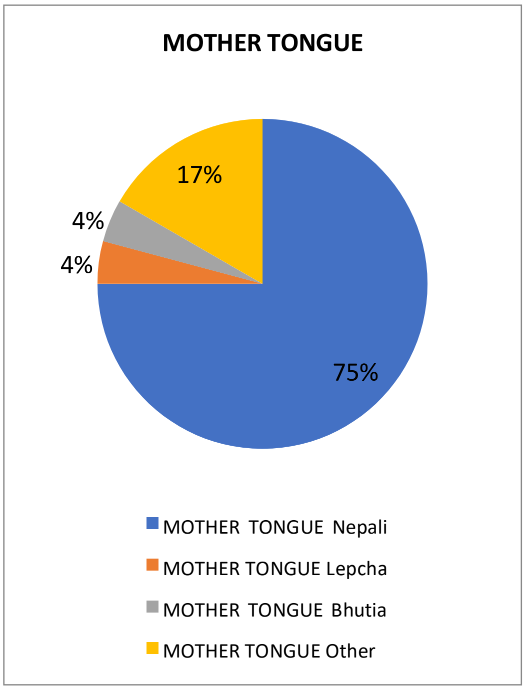
In Ravangla Block 3.33 percent population speaks the Lepcha language, 6.67 percent and 2 percent population in Chuba Phong and Tangzi Bikmat GPU of Namchi Block also have their mother tongue as Lepcha, nil in Ralong Namlung GPU. 16.67 percent of dairy farmers have mother tongue Bhutia in Ralong Namlung GPU. Rest all GPUs have no population having Bhutia as mother tongue. In total mother tongue Nepali contributes 75 percent whereas Lepcha and Bhutia language contributes 4.17 percent each. Other language speaking communities stands as 16.67 percent.

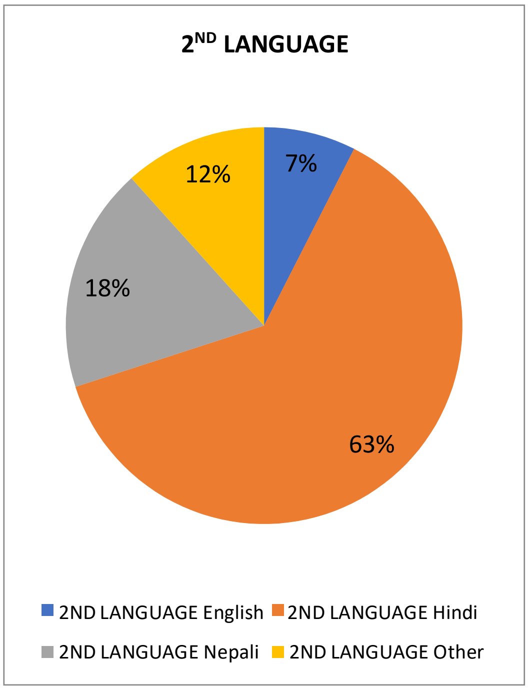
From the said table almost all the three major communities in Sikkim practice dairy farming but majority of Nepali community are mainly involved in it. Furthermore, the population whose mother tongue is Nepali have Hindi as their second language which contributes 80 percent and 70 percent of the population respectively in Ralong Namlung and Kewzing Bakhim GPU of the Ravangla Block, Similarly, 23.33 percent and 76.67 percent in Chuba Phong and Tangzi Bikmat GPU respectively in Namchi Block.

6.67 percent of dairy farmers were found to have English as second language in Kewzing Bakhim GPU. None were found in Ralong Namlung GPU of Ravangla Block. 23.33 percent of dairy farmers had English as second language in Chuba Phong GPU, none in Tangzi Bikmat GPU of Namchi Block. Again, population whose first language is Lepcha, Bhutia or others, their second language is Nepali. 16.67 percent and 10 percent population in Ralong Namlung GPU and Kewzing Bakhim GPU respectively in Ravangla Block, Similarly, 36.67 percent and 10 percent in Chuba Phong and Tangzi Bikmat GPU in Namchi Block.

On an average language other than Bhutia, Lepcha, Nepali and Hindi as second language consists of 8.33 percent population in Ravangla Block and 15 percent in Namchi Block, On the average it was found among second language constitutes Hindi 62.5 percent population, Nepali 18.33 percent, other 11.67 percent and English 7.5 percent. The above linguistic profile of dairy farmers' respondent can be presented in figure below:

Figure 6.3: Linguistic Profile of Dairy Farmer Respondent





The table 6.4 shows the religion distribution of the three major religions practised in Sikkim i.e., Hinduism, Buddhism and Christianity among the various dairy farmers in South Sikkim.

Table 6.4: Religion Distribution of Dairy Farmer Respondent of South District

Sl. No	Religion	Households	Percentage
1	Buddhist	25	20.8
2	Christian	3	2.5
3	Hindu	92	76.7
4	Other	-	-
5	SOUTH SIKKIM DT	120	100

Source: Field Survey 2019-2020

It is evident that most dairy farmers were Hindus who comprised a huge 76.7%, 92 HHs out of 120 HHs were Hindus comprising the Bahun, Chettri, Newars and SC community. Less than a quarter i.e., 21% Buddhist were found active in dairy farming activities only 25 HHs out of 120 HHs followed by Buddhism as their religion, the communities included Sherpa, Bhutia, Lepcha, Tamangs and Gurung, etc.

Merely 2% were seen practising dairy farming from the Christian religion, 3 HHs among 120 HHs surveyed, Communities included Rai, Lepcha and SC community who were the first generation in Christianity. No other religions like Muslim, Sikhs, Jains, etc. were found practicing dairy farming in the study area i.e., in South Sikkim.

Hindus are found to be more ahead in dairy farming activities as Cows are considered divine in Hinduism since the time of Lord Krishna. No religious activity among Hindus can be conducted without the presence of Cow starting from cow dung, gaumutra, its milk and the goddess Laxmi the gau mata itself. Buddhists and Christians are also involved in dairy farming to sustain their livelihood. They also practise other allied activities like agriculture etc. The pie chart below shows the percentage distribution of various religions among dairy farmers in the study area viz. South Sikkim.

Figure 6.4: Religion distribution of Dairy Farmer Respondent

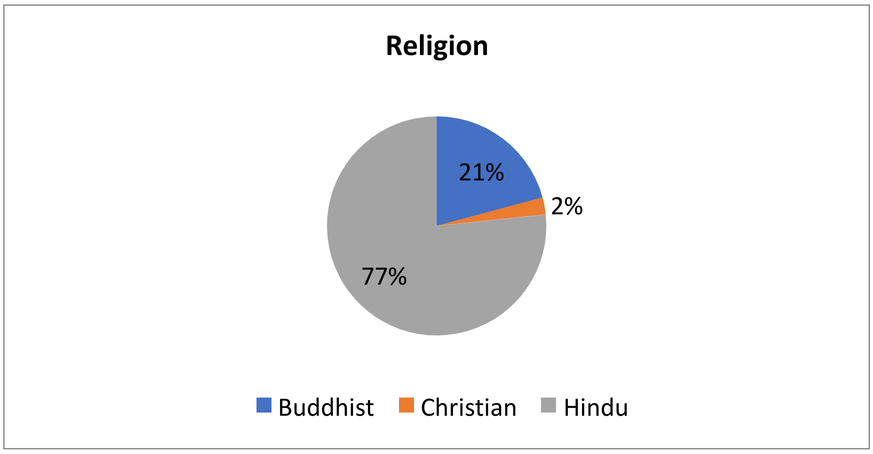


Table 6.5: Literacy Profile of Dairy Farmer Respondents

Area-Unit	TDR	I	FL	Upto Cl 5	Cl 6-8	Cl 9-10	Cl11-12	Above Cl12 (G)	O
RAVANGLA BLOCK	**60**	**3 (5.00)**	**11 (18.33)**	**21 (35.00)**	**13 (21.67)**	**5 (8.33)**	**1 (1.67)**	**3 (5.00)**	**3 (5.00)**
Ralong Namlung GPU	30	2 (6.67)	8 (26.67)	12 (40.00)	4 (13.33)	2 (6.67)	1 (3.33)	- -	1 (3.33)
Kewzing Bakhim GPU	30	1 (3.33)	3 (10.00)	9 (30.00)	9 (30.00)	3 (10.00)	- -	3 (10.00)	2 (6.67)
NAMCHI BLOCK	**60**	**1 (1.67)**	**6 (10.00)**	**20 (33.33)**	**8 (13.33)**	**10 (16.67)**	**6 (10.00)**	**5 (8.33)**	**4 (6.67)**
Chuba Phong GPU	30	1 (3.33)	5 (16.67)	6 (20.00)	6 (20.00)	3 (10.00)	4 (13.33)	1 (3.33)	4 (13.33)
Tangzi Bikmat GPU	30	- -	1 (3.33)	14 (46.67)	2 (6.67)	7 (23.33)	2 (6.67)	4 (13.33)	- -
SOUTH SIKKIM DT	**120**	**4 (3.33)**	**17 (14.17)**	**41 (34.17)**	**21 (17.50)**	**15 (12.50)**	**7 (5.83)**	**8 (6.67)**	**7 (5.83)**

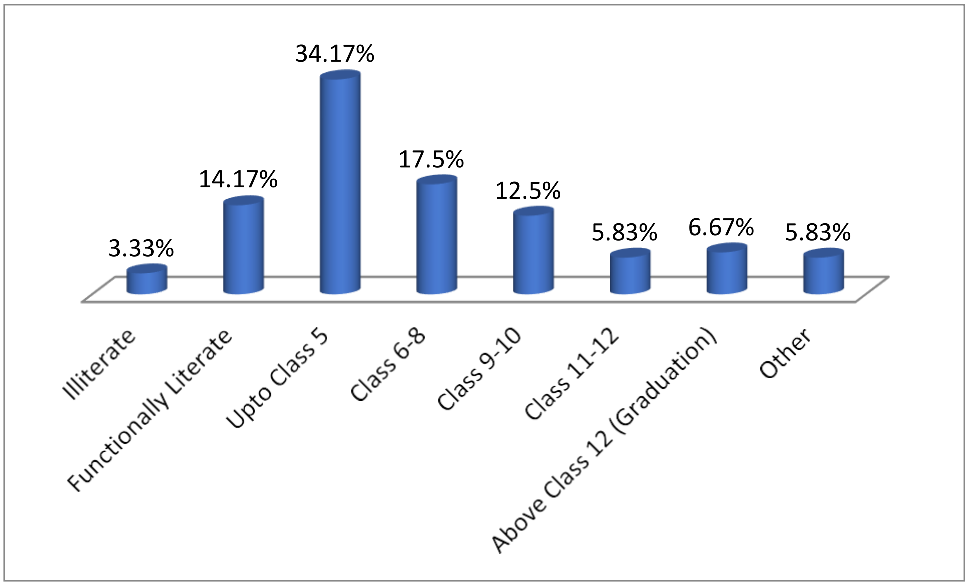
Source: Field Survey 2019-2020.
Note: Figure in Parenthesis is Percentage. TDR- Total Dairying Respondents, I-Illiterate, FL-Functionally Literate, Cl-Class, G-Graduation, O-Other.

Though literacy is not a prerequisite in dairy farming, even then, a study on the literacy profile was conducted in the study area. The table 6.5 reflects that barely 3.33% of dairy farmers are illiterate. 14.17% are functionally literate, meaning though they have not acquired any kind of formal academic degree, yet they have acquired little education/knowledge themselves to help them function as a dairy farmer. Majority of dairy farmers, i.e., 34.17% had acquired education qualification upto Primary level i.e., upto 5th standard. 17.5%, 12.5%, and 5.83% dairy farmers had studied upto grade 8th, 10th, and 12th respectively. 6.67% were found to have acquired a graduation degree and the remaining 5.83%, dairy farmers were found to possess higher professional degrees like Engineering, Vocational courses, Masters etc.

From the above, it can be concluded that people with varied literacy profile ranging from illiterate to higher degree holders were seen to be actively involved in dairy farming.

The column chart below depicts the literacy profile of dairy farmer's respondents in South Sikkim.

Figure 6.5: **Literacy Profile of Dairy Farmer Respondents**



The table 6.6 shows the distribution of family size among the dairy farming families in South Sikkim.

Table 6.6: Distribution of Family Size and Dependency ratio in Dairy Farming Families

Area-Unit	AFS	1-2 M	3-4 M	5-6 M	7-8 M	9-10 M	10+ M	DR
RAVANGLA BLOCK	**5.8**	**1 (1.67)**	**16 (26.67)**	**23 (38.33)**	**14 (23.33)**	**4 (6.67)**	**2 (3.33)**	**1.04**
Ralong Namlung GPU	5.7	1 (3.33)	7 (23.33)	13 (43.33)	6 (20.00)	3 (10.00)	-	0.97
Kewzing Bakhim GPU	5.9	-	9 (30.00)	10 (33.33)	8 (26.67)	1 (3.33)	2 (6.67)	1.10
NAMCHI BLOCK	**5.4**	**1 (1.67)**	**24 (40.00)**	**21 (35.00)**	**8 (13.33)**	**5 (8.33)**	**1 (1.67)**	**1.04 -**
Chuba Phong GPU	5.6	1 (3.33)	7 (23.33)	13 (43.33)	6 (20.00)	3 (10.00)	- -	1.09 -
Tangzi Bikmat GPU	5.1	- -	17 (56.67)	8 (26.67)	2 (6.67)	2 (6.67)	1 (3.33)	1.00 -
SOUTH SIKKIM DT	**5.6**	**2 (1.67)**	**40 (33.33)**	**44 (36.67)**	**22 (18.33)**	**9 (7.50)**	**3 (2.50)**	**1.04 -**

Source: Field Survey 2019-2020
Note: Figure in Parenthesis is Percentage
AFS-Average Family Size, M-Members, DR-Dependency Ratio

The family size was seen ranging from 1-2 members' i.e., nuclear family to more than 10 members i.e., joint/extended family. In Ravangla Block average of 5.8 members was found in the dairy farming HHs wherein 5.7 members were seen in Ralong Namlung GPU and 5.9 members in Kewzing Bakhim GPU. Similarly, in Namchi Block an average of 5.4 members were found, 5.6 members and 5.1 members respectively in Chuba Phong GPU and Tangzi Bikmat GPU. This makes the average family size as 5.6 members with a dependency ratio of 1.04 in South Sikkim. 36.67% dairy farming HHs were having a maximum family size of 5-6 members followed by 33.33% HHs having 3-4 members and remaining 18.33%, 7.5%, 2.5% and 1.67% having 7-8 members, 9-10 members, more than 10 members and 1-2 members respectively. A very scanty i.e., about 2% HHs was found to be living in 1-2 member families. The details have been exhibited clearly in the column charts below where vertical axis represents percentage and horizontal axis represents family members, family size and dependency ratio:

Figure 6.6: Distribution of Family Size and Dependency in Dairy Farming Families

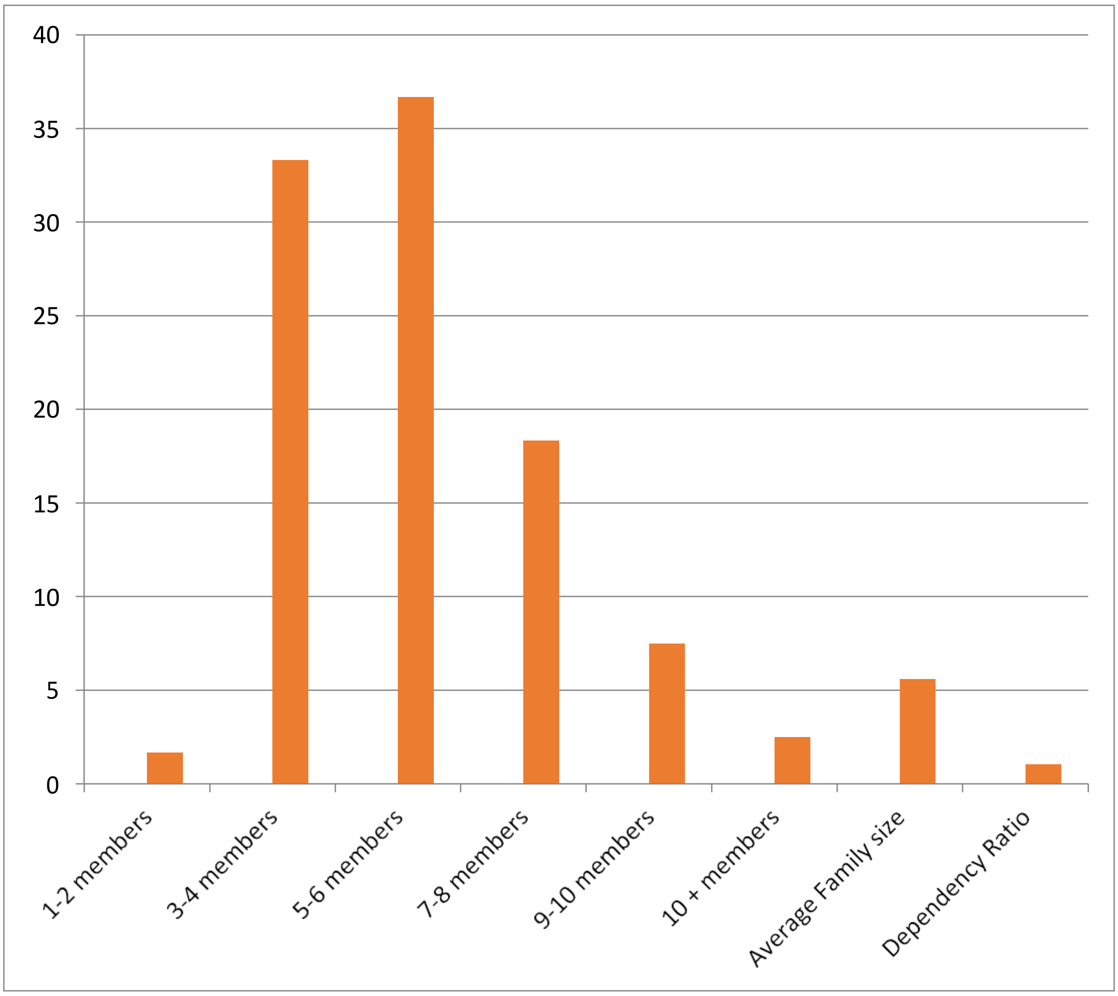


Table 6.7a: Inter-Generational Educational Achievements in Dairy Farming Families

Sl. No	Area Unit	Total Children	No. of HHs	HIGHEST EDUCATION LEVEL ATTAINED BY FAMILY **CHILDREN**					
				Nil	Upto Cl 5	Upto Cl 8	Upto Cl 10	Upto Cl 12	Cl 12+
1	**RB**	**92**	**60**	**3**	**15**	**6**	**9**	**9**	**18**
	RN GPU	36	30	1	10	3	4	3	9
	KB GPU	56	30	2	5	3	5	6	9
	NB	**111**	**60**	**3**	**20**	**16**	**9**	**4**	**8**
	CP GPU	52	30	2	9	9	4	2	4
	TB GPU	59	30	1	11	7	5	2	4
	SS DT	**203**	**120**	**6**	**35**	**22**	**18**	**13**	**26**
	SS DT (%)	**100**		**5.00**	**29.17**	**18.33**	**15.00**	**10.83**	**21.67**
2	Area Unit	Total Adults	No. of HHs	HIGHEST EDUCATION LEVEL ATTAINED BY FAMILY **ADULTS**					
				Nil	Upto Cl 5	Upto Cl 8	Upto Cl 10	Upto Cl 12	Cl 12+
	RB	**171**	**60**	**28**	**14**	**2**	**5**	**1**	**10**
	RN GPU	87	30	14	8	-	1	-	7
	KB GPU	84	30	14	6	2	4	1	3
	NB	**157**	**60**	**1**	**10**	**8**	**12**	**16**	**13**
	CP GPU	81	30	1	1	6	4	11	7
	TB GPU	76	30	-	9	2	8	5	6
	SS DT	**328**	**120**	**29**	**24**	**10**	**17**	**17**	**23**
	SS DT (%)	**100**		**24.16**	**20.00**	**8.33**	**14.17**	**14.17**	**19.17**
3	Area Unit	Total Elderly	No. of HHs	HIGHEST EDUCATION LEVEL ATTAINED BY **ELDERLY** FAMILY MEMBERS					
				Nil	Upto Cl 5	Upto Cl 8	Upto Cl 10	Upto Cl 12	Cl 12+
	RB	**84**	**60**	**28**	**14**	**2**	**5**	**1**	**10**
	RN GPU	48	30	14	8	-	1	-	7
	KB GPU	36	30	14	6	2	4	1	3
	NB	**53**	**60**	**14**	**11**	**5**	**1**	**-**	**29**
	CP GPU	36	30	10	7	3	-	-	10
	TB GPU	17	30	4	4	2	1	-	19
	SS DT	**137**	**120**	**42**	**25**	**7**	**6**	**1**	**39**
	SS DT (%)	**100**		**35.00**	**20.83**	**5.83**	**5.00**	**0.84**	**32.50**

Source: Field Survey 2019-2020

Note: HHs-Households, Cl-Class, RB-Ravangla Block, NB-Namchi Block, SS DT- South Sikkim District Total, RN-Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat

The study was conducted in South district from 120 sampled households to unveil the Inter-generational educational achievements in dairy farming families.

Education qualification data was collected separately for all three categories of family members, i.e., Children, Adults and Elderly. The data were collected each for all three categories having no qualification, primary level qualification, JHS qualification, Secondary level qualification, Higher Secondary qualification, and Graduation level qualification. The table 6.7a at sl. no. 1 depicts that a total of 203 children existed in the 120 HHs surveyed in all the four GPUs. 92 children in Ravangla Block consisting of 36 from Ralong Namlung GPU and 56 from Kewzing Bakhim GPU. The total of 111 children in Namchi Block consisting of 52 from Chuba Phong GPU and 59 from Tangzi Bikmat GPU, 55% children were seen in Namchi Block whereas only 45% children were there in Ravangla Block.

The highest education level attained by children in South Sikkim is as under:

Table 6.7b: Level of Education (Children)

Education Level	Percentage
Nil	5.00
Primary	29.17
JHS	18.33
Secondary	15.00
Senior Secondary	10.83
Above Senior Secondary	21.67

Source: Field Survey, 2019-2020

According to the table 6.7b, 5% had nil education; these may be the children below schooling age i.e., less than 3 years old children. 29.17% were qualified upto Primary level, i.e., 5th standard. This is the maximum qualification that most of the children have acquired in South Sikkim. 18.33% were qualified upto JHS level. 15% were Secondary level qualified. 10.83% were Senior Secondary level qualified. 21.67% were qualified beyond Sr. Sec. Level.

Sl. no. 2 of the table 6.7a throws light on the number of adult dairy farming family members and their highest educational qualification achieved.

A total of 328 adult members were found in 120 households surveyed in South Sikkim comprising of 171 members from Ravangla Block and 157 members from Namchi Block. The highest education level attained by family Adult in South Sikkim is as under:

Table 6.7c: Level of Education (Adult)

Education Level	Percentage
Nil/illiterate	24.16
Primary	20.00
JHS	8.00
HS and Sr. Secondary	14.17
Beyond Senior Secondary	19.17

Source: Field Survey, 2019-2020

From the table 6.7c, maximum adult population practising dairy farming was found illiterate, they constitute 24.16%. 20% had primary level qualification. Only 8% were JHS qualified. 14.17% each were qualified upto HS level and Sr. Sec. Level. 19.17% were qualified beyond Sr. Sec. Level.

Sl. no 3 of the table 6.7a unveils the total member of elderly population in dairy farming families and their education qualification of South Sikkim. This can be depicted below:

Table 6.7d: Level of Education (Elderly)

Education Level	Percentage
Nil/illiterate	35.00
Primary	20.83
JHS	5.83
Secondary	5.00
Senior Secondary	0.84
Above Senior Secondary	32.5

Source: Field Survey, 2019-2020

Like the adult members, the elder members were majority illiterate, they constituted 35%. 20.83% had primary level qualification. 5.83% had JHS level qualification. 5% had Sec. Level qualification. Almost negligible, i.e., 0.84% had Sr. Sec. Level qualification. 32.5% were highly qualified i.e., beyond 12th standard.

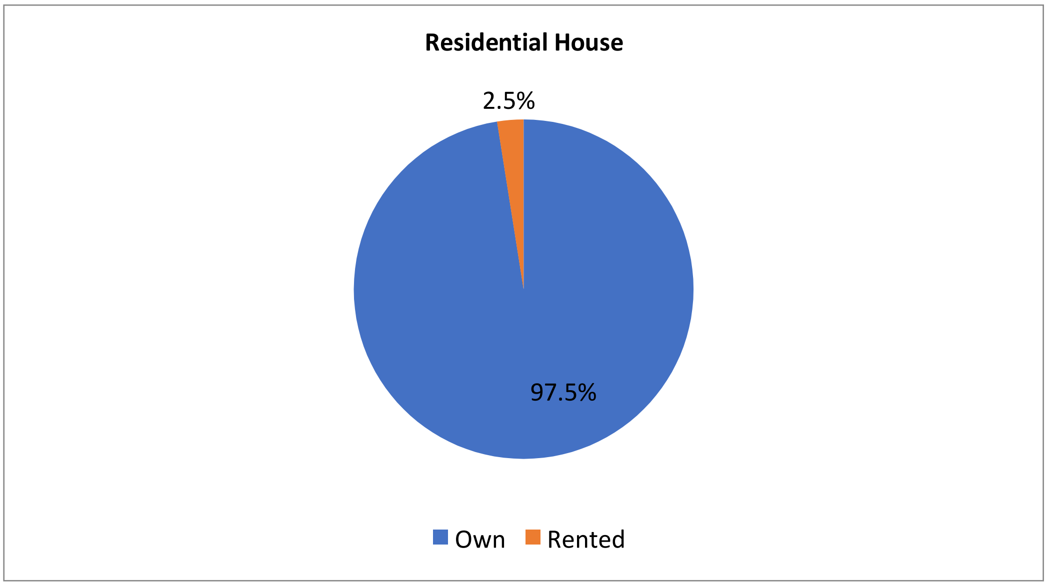
The fact that the older generation practising dairy farming were more conscious regarding education has been unveiled by the data which shows 32.5% of dairy farming elders having qualification beyond 12th standard as against only 21.67% in younger generation and 19.17% in adults.

Table 6.8: Residential House in Dairy Farming Families

Residential House	Frequency (HHs)	Percentage
Own	117	97.5
Rented	3	2.5
Total	**120**	**100**

Source: Field Survey 2019-2020

Figure 6.7: Residential House in Dairy Farming Families



Except for three (2.5%) dairy farming households in Ralong Namlung GPU in Ravangla Block who live in rented accommodation, all 117 (97.5%) other dairy farmers surveyed in South Sikkim reside in their own houses be it Kuccha, Pucca, Semi-Pucca or Ikra house. The percentage of residential house type (own/rented) found in the different survey sites is indicated in table 6.8 and Figure 6.7.

Settlement and House Pattern: A linear settlement pattern is evident in the areaunder study because most houses are situated along the roadside or right next to it. It isnot uncommon for farmers to build their own homes on the land they cultivate. Homesin the region are often classified as either pucca, semi-pucca, ikra and kuchha or thatchin one of these four ways. Houses with thatch roofs are constructed solely of bamboos, straw, reeds, or palm-leaf fronds, whereas those with kuchha roofs are constructed of a variety of materials. Cements, bricks, and other comparable building materials are used to make pucca dwellings. New concrete construction is widely used in the neighbourhood. Most houses feature a ground-floor room available for rent, which is also commonly used for grain storage. In most cases, the shelter for the animals in the research area is constructed some distance away from the dwellings and is typically composed of wood, stone, tin, and bamboo. The size and design of the animal barns as well as the houses themselves can be used to deduce the general degree of income of the house owner.

Table 6.9: Typical House type and Number of Rooms among Dairy Farming Households

Sl. no.	Area-Unit	No. of HHs	Ik	%	K	%	SP	%	P	%
1	**RB**	**60**	**17**	**28.33**	**5**	**8.33**	**16**	**26.67**	**22**	**36.67**
	RN GPU	30	13	43.33	5	16.67	8	26.67	4	13.33
	KB GPU	30	4	13.33	-	-	8	26.67	18	60.00
	NB	**60**	**5**	**8.33**	**5**	**8.33**	**20**	**33.33**	**30**	**50.00**
	CP GPU	30	5	16.67	3	10.00	11	36.67	11	36.67
	TB GPU	30	-	-	2	6.67	9	30.00	19	63.33
	SS DT	**120**	**22**	**18.33**	**10**	**8.33**	**36**	**30.00**	**52**	**43.33**

Sl. no.	Area-Unit	No. of HHs	1-2 R	%	3-4 R	%	5-6 R	%	7-8 R	%	9-10 R	%
2	**RB**	**60**	**-**	**-**	**33**	**55.00**	**20**	**33.33**	**5**	**8.33**	**2**	**3.33**
	RN GPU	30	-	-	17	56.67	12	40.00	1	3.33	-	-
	KB GPU	30	-	-	16	53.33	8	26.67	4	13.33	2	6.67
	NB	**60**	**-**	**-**	**21**	**35.00**	**32**	**53.33**	**5**	**8.33**	**2**	**3.33**
	CP GPU	30	-	-	10	33.33	16	53.33	3	10.0	1	3.33
	TB GPU	30	-	-	11	36.67	16	53.33	2	6.67	1	3.33
	SS DT	**120**	**-**	**-**	**54**	**45.00**	**52**	**43.33**	**10**	**8.33**	**4**	**3.34**

Source: Field Survey 2019-2020.
Note: HHs-Households, RB-Ravangla Block, NB-Namchi Block, SS DT- South Sikkim District Total, RN-Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat, R-Rooms, Ik-Ikra, K-Kuccha, SP-Semi-Pucca, P-Pucca.

The living condition of dairy farming households have been ascertained by identifying the type of houses they live in and the number of rooms it has. The detailed data has been listed in the table 6.9.

It can be learnt from the table 6.9 at sl. no 1 that a maximum 63.33% dairy farming households have Pucca houses in Tangzi Bikmat GPU followed by 60% in Kewzing Bakhim GPU. The good number of Pucca houses is mainly the result of Government schemes like Chief Ministers Rural Housing Mission (CMRHM), Reconstruction of Earthquake Damaged Rural Houses (REDRH) etc. the availability of road connectivity has also led to an increased number of Pucca houses in these areas. People have constructed houses through loans and a few from their savings too. Remote GPUs like Chuba Phong and Ralong Namlung have lesser Pucca houses only 36.67% and 13.33% respectively. South district has maximum of 43.33% dairy farming residing in Pucca houses. Less than 10% were found living still in Kuccha houses. The average figure of South district is only 8.33%. It unveils that the remote and far-flung areas are still deprived of Government aids and basic infrastructure like road connectivity thus lagging in the economic condition.

Another 18.33% of dairy farmers in South Sikkim were found residing in Ikra houses. The houses are built using bamboo sticks, sand and cement or mud. Areas where bamboos are readily, and abundantly available farmers prefer building such type of houses. Ralong Namlung GPU was found to have 43.33% households residing in Ikra houses, whereas no family in Tangzi Bikmat GPU lived in Ikra house. Similarly in total of South district 30% of the dairy farmers had Semi-Pucca houses.

Sl. no 2 of the said table reflects the number of rooms that are constructed in the houses where dairy farming families live irrespective of the type of house whether Pucca, Semi-Pucca, Kuccha or Ikra house. No households were found to be living in a single or two roomed houses in the entire study area. Majority of the households were having 3-4 roomed houses. In Ravangla Block more than half i.e., 55% of the dairy farmers had 3-4 rooms in their houses but, only 35% in Namchi Block was seen.

The figures were vice-versa for 5-6 roomed houses where more than half of the farmers i.e., 53.33% had 5-6 rooms in Namchi Block but, only 33.33% had 5-6 roomed houses in Ravangla Block. The percentages were seen decreasing as the number of rooms increased. Only 10% households had 7-8 roomed houses in South district and a meagre 4% had houses with more than 9-10 rooms. The typical house type found in the different survey sites are indicated above in table 6.9.

The details have been depicted clearly in the Pie chart below:

Figure 6.8: Typical House type and Rooms among Dairy Farming Households

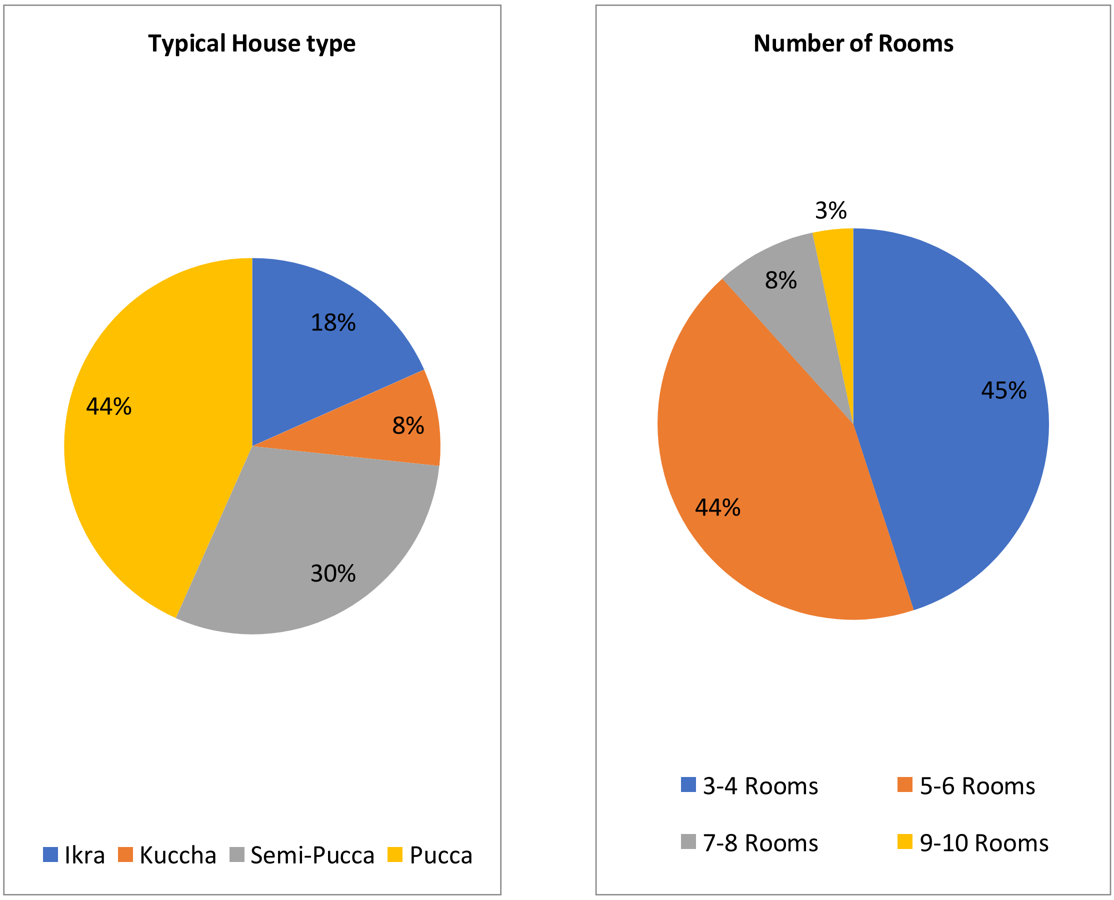


Table 6.10: Amenities among Dairy Farming Households

Drinking Water	**Frequency (HHs)**	**Percentage**
No	4	3.3
Yes	116	96.7
Total	120	100
Toilet	**Frequency (HHs)**	**Percentage**
No	-	-
Yes	120	100
Total	120	100
Electricity	**Frequency (HHs)**	**Percentage**
No	-	-
Yes	120	100
Total	120	100
Cell phone	**Frequency (HHs)**	**Percentage**
No	4	3.3
Yes	116	96.7
Total	120	100

Source: Field Survey 2019-2020

Except for two dairy farming households each in Chuba Phong GPU (Namchi Block) and in Ralong Namlung GPU (Ravangla Block), all other dairying families have access to drinking water amenities provided in most cases by regular Government schemes, or in the case of two households each in Ralong Namlung GPU and Tangzi Bikmat GPU, by provisioning of Northeast Rural Livelihood Project (NERLP) funds provided to Sikkim by the Northeast Council. All dairy farming households have their own toilet and domestic electricity amenities, and almost all of them have ready communication access with their own cell phones, surveyed in South Sikkim reside in their own houses. The dairy farmer has an average of 5 rooms in a house.

Table 6.11: Access to Energy, Personal Transport and Other Amenities among Dairy Farmers

Area-Unit	No. of HHs	Domestic LPG (SP)	%	Govt. LPG (S)	%	No LPG	%
RB	**60**	**43**	**71.67**	**7**	**11.67**	**10**	**16.66**
RN GPU	30	14	46.67	7	23.33	9	30.00
KB GPU	30	29	96.67	-	-	1	3.33
NB	**60**	**55**	**91.67**	**5**	**8.33**	**-**	**-**
CP GPU	30	25	83.33	5	16.67	-	-
TB GPU	30	30	100.00	-	-	-	-
SS DT	**120**	**98**	**81.67**	**12**	**10.00**	**10**	**8.33**

Area-Unit	No. of HHs	TV	%	No TV	%
RB	**60**	**42**	**70.00**	**18**	**30.00**
RN GPU	30	15	50.00	15	50.00
KB GPU	30	27	90.00	3	10.00
NB	**60**	**46**	**76.67**	**14**	**23.33**
CP GPU	30	25	83.33	5	16.67
TB GPU	30	21	70.00	9	30.00
SS DT	**120**	**88**	**73.33**	**32**	**26.67**

Area-Unit	No. of HHs	Have 2 Wheelers	%	Don't have 2 Wheeler	%	Have 4 Wheelers	%	Don't have 4 Wheelers	%
RB	**60**	**4**	**6.67**	**56**	**93.33**	**6**	**10.00**	**54**	**90.00**
RN GPU	30	-	-	30	100.0	1	3.33	29	96.67
KB GPU	30	4	13.33	26	86.67	5	16.67	25	83.33
NB	**60**	**5**	**8.33**	**55**	**91.67**	**3**	**5.00**	**57**	**95.00**
CP GPU	30	2	6.67	28	93.33	-	-	30	100.00
TB GPU	30	3	10.00	27	90.00	3	10.00	27	90.00
SS DT	**120**	**9**	**7.50**	**111**	**92.50**	**9**	**7.50**	**111**	**92.50**

Area-Unit	No. of HHs	Other Amenities	%	No Other Amenities	%
RB	**60**	**37**	**61.67**	**23**	**38.33**
RN GPU	30	15	50.00	15	50.00
KB GPU	30	22	73.33	8	26.67
NB	**60**	**29**	**48.33**	**31**	**51.67**
CP GPU	30	15	50.00	15	50.00
TB GPU	30	14	46.67	16	53.33
SS DT	**120**	**66**	**55.00**	**54**	**45.00**

Source: Field Survey 2019-2020

Note: HHs-Households, RB-Ravangla Block, NB-Namchi Block, SS DT- South Sikkim District Total, RN-Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat, SP- Self-Purchased, S- Subsidise,

The table 6.11 gives the basic information related to the household amenities among dairy farmers of South Sikkim. It has been learnt that 100% households under Namchi

Block have LPG connection. The LPG connection are of two different kinds, one which are self-purchased for domestic use and other provided by Government through various schemes. When we look into Ravangla Block it is seen that 17% of the households are still not having any LPG connection and solely depend on the traditional method of burning wood for cooking purpose.

The LPG connection through Government scheme has not covered the entire area viz. not a single household in Kewzing Bakhim GPU and Tangzi Bikmat GPU had LPG connection provided through Government schemes whereas 23% of Ralong Namlung GPU and 17% of Chuba Phong GPU had it. The percentage of self-purchased domestic LPG connection in South district is about 82% as recorded from the sampled households. In Kewzing Bakhim GPU of Ravangla Block it is about 97% and Tangzi Bikmat GPU of Namchi Block it is 100%. Contrary to the above Ralong Namlung GPU in Ravangla Block had it only 47% but, Chuba Phong GPU under Namchi Block had it 83%. It is pertinent to mention here that, whatever be the type of LPC connections they are not being used for preparing/cooking feed for the cattle. It is solely used by dairy farming families for domestic use. Fire woods are gathered for preparing/cooking feed for cattle.

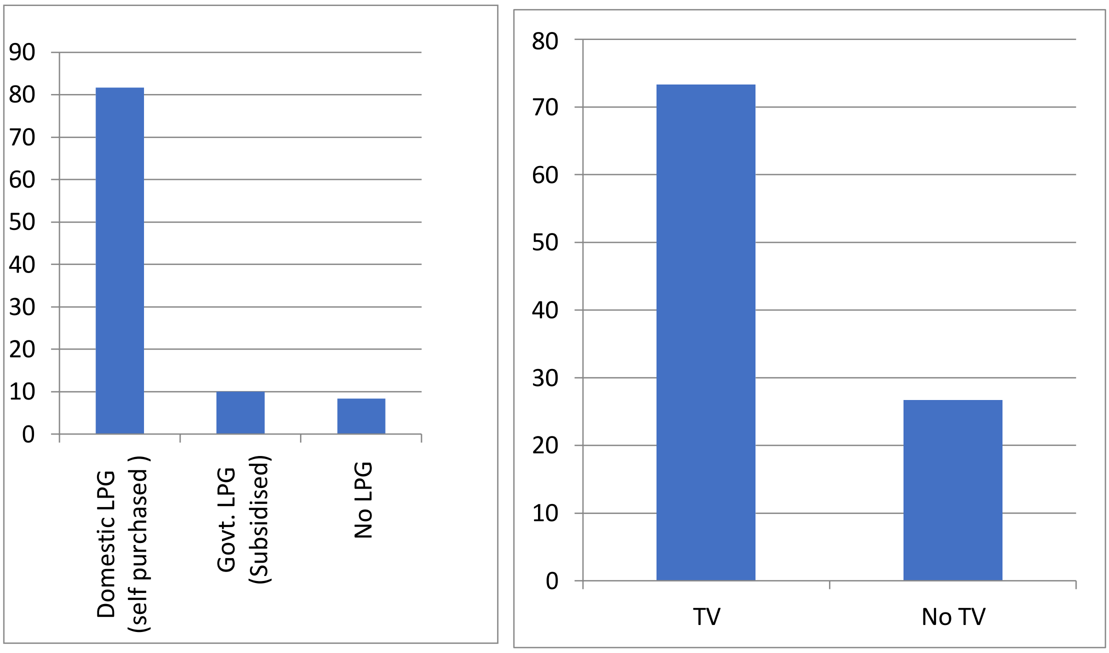
In today’s time, the living standard of dairy farmers has risen quite a bit. Majority of them, about 73%, own a TV set and have it in their house. 27% those who still do not own it visit neighbours house for watching their favourite programmes in television.

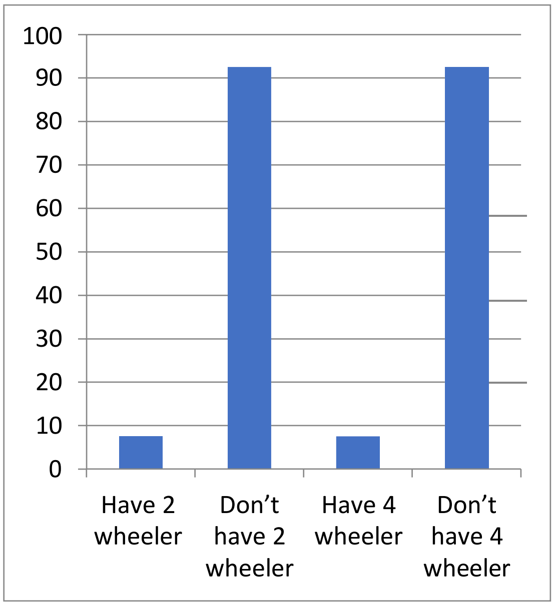
Few of the dairy farmers about 7.5% each also own 2-wheeled vehicles and 4-wheeled vehicles. But majority of about 92.5% still hire vehicle or travel on foot wherever needed. There are GPUs like Ralong Namlung, where not a single dairy farmer owns a 2-wheeler vehicle and Chuba Phong GPU where none of the dairy farmers owns a 4-wheeler.

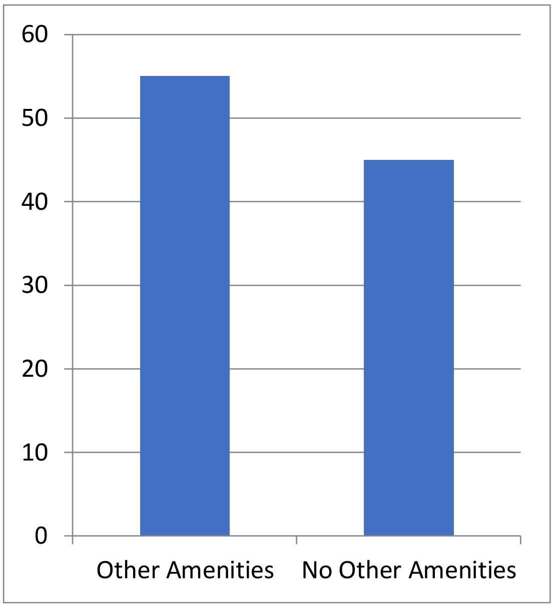
Other amenities like Refrigerators, washing machines, Oven, Radio, Video Player, Geyser, Flask, Electric Cattle, Iron, Room Heater, Fan, Laptop computer, Desktop computer, etc. were also being owned by dairy farmers of South Sikkim, the percentage being 55%. The balance 45% who do not own the above luxurious items fall in very poor category of dairy farmers.

It can be thus concluded that access to energy, personal transport and other amenities have added more desire in rural population to practice dairy farming and uplift their social status and add more feathers to the dairy industry of the state. South District total figure can be represented in column chart as below where vertical axis represents percentage and horizontal axis represents description of amenities:

Figure 6.9: Access to Energy, Personal Transport and Other Amenities among Dairy Farmers







The descriptive statistics of the Respondent and the family profile is presented in table 6.12

Table 6.12: Descriptive Statistics of Respondent and Family Profile

Variables	Mean	Standard Deviation
Age	50.78	13.162
Family Size	5.57	2.180
Children	1.69	1.098
Adults	2.73	1.430
Elderly	1.14	0.901

Source: Authors calculation based on survey data

The table 6.12 gives the information regarding the descriptive statistics of the respondents and their family profile. The data has been obtained from sampled households and analysed using SPSS software. The mean age of the family respondent both male and female is about 51 years with its Standard Deviation 13.162 which indicates that the numbers (age) are more spread out; the average family size is about 5 members in the dairy farming households and its Standard Deviation is 2.180 meaning that most of the numbers (family size) is close to the average. Average number of children is approximately 2, adults are 3 and elderly is about 1 with Standard Deviation

1.098, 1.430 and 0.901 respectively indicating that the numbers of children, adult and elderly are close to the average.

Layout of Various Landholdings and assets holding profile: There is a considerable imbalance in the allocation of landholdings in Sikkim that are utilised for agricultural purposes. Those landholdings are used for agricultural purposes. Most of these landholdings can be found in the eastern region of the state. The imbalance that arises as a direct consequence of the fact that there are more people living in Sikkim than there are farmers is brought about by the presence of a greater population overall. During the years 1990-1991, almost half of the population was comprised of marginal landholders, who possessed 10.30 percent of the total operational land area. This percentage represented 10.30 percent of the total operational land area. The percentage of the population who owned less than five acres of land was comparable to this figure. In addition to this, these landholders only had access to a very small portion of the entire property that was up for grabs at the time. These landowners were a part of the category of landowners that had the worst financial situations overall. The percentage of landholdings in the east district that were held by marginal farmers was the greatest of any other district, and this was true both in terms of the total number of landholdings (56 percent) and the total land area. It was found that this was the case for both measurements. Regarding both measurements, the situation looked like this (12.80 percent). On the other hand, farmers who owned large holdings accounted for only 2.3% of the total landholdings but held 20.2% of the operational area. This discrepancy is since large farmers tend to own more land. This discrepancy was caused by the fact that huge holdings took up more space than smaller ones did. This disparity arose because large estates held a wider area of land than smaller estates did. The north district not only had the highest overall proportion of large farmers, but it also had the highest percentage of large farmers who possessed more than thirty percent of the cultivable land in the area. This was the district with the highest overall percentage of large farmers. As a result of this, the north district was able to claim the title of having the largest overall percentage of major farmers. Large farms, which were classified as those that possessed more than thirty percent of the total cultivable land in the region, were most prevalent in the region's northern district. This district also had the highest number of large farms. On the other hand, landholdings and operable area are rather evenly distributed, at least among the small and semi-medium farmers, apart from the eastern district. However, the distribution of landholdings and operable area is more uneven in the eastern district. This is the situation because the eastern district is the only district in which there is no presence of a forest. Every district, apart from the one in the east, exhibits this behaviour, apart from the eastern district. The number of different kinds of land that is available on a per-person basis has significantly decreased throughout the course of recent history as a direct result of rising levels of population pressure. This change occurred during recent history. This decline can be directly attributable to the expanding human population all over the world (Pradhan, *et al.*, 2004).

According to the Land Holding and Asset Holding Profile, farmers in the study area of South Sikkim have an estimated land holding and asset profile. Here, the researcher had covered everything from horticulture crops to agricultural and horticultural jobs. There may be some rounding mistakes when comparing these data to the state's land revenue estimates because survey takers in the research area gave approximate answers. As a result of this oversight, they were unable to provide accurate answers to the questions they were asked during the polling process. Here's a look at how dairy farmers in South Sikkim's landholdings and operational landholdings stack up against one another.

Table 6.13: Land-use within Ownership and Operational Landholdings of Dairy-Farmers *(Figures in acres)*

OWNED LAND								
Sl. no	Area-Unit	FL	HS	PK	SK	TCL	OF	SOH
1	**RB**	**1.20**	**0.48**	**0.51**	**0.81**	**0.26**	**0.31**	**3.57**
	RN GPU	1.28	0.47	0.83	0.85	0.20	0.30	3.93
	KB GPU	1.12	0.50	0.18	0.77	0.32	0.31	3.20
	NB	**1.62**	**0.50**	**0.14**	**0.58**	**0.96**	**0.57**	**4.37**
	CP GPU	1.60	0.50	0.08	0.95	1.63	0.85	5.61
	TB GPU	1.63	0.50	0.20	0.20	0.28	0.28	3.09
	SS DT	**1.41**	**0.49**	**0.33**	**0.69**	**0.61**	**0.44**	**3.97**
	SS DT (%)	**35.52**	**12.34**	**8.31**	**17.38**	**15.36**	**11.09**	**100.00**

OPERATED LAND										
	Area-Unit	FL	HS	PK	SK	TCL	OF	OH	IH	UIH
2	**RB**	**3.57**	**0.50**	**0.21**	**0.02**	**0.27**	**0.00**	**3.07**	**1.57**	**1.50**
	RN GPU	3.93	0.50	0.25	0.00	0.47	0.00	3.21	1.62	1.59
	KB GPU	3.20	0.50	0.17	0.03	0.07	0.00	2.93	1.51	1.42
	NB	**4.37**	**0.50**	**0.08**	**0.00**	**0.67**	**0.00**	**3.62**	**1.86**	**1.74**
	CP GPU	5.61	0.50	0.10	0.00	1.33	0.00	4.18	1.77	2.41
	TB GPU	3.09	0.50	0.07	0.00	0.00	0.00	3.02	1.95	1.07
	SS DT	**3.97**	**0.50**	**0.15**	**0.01**	**0.47**	**0.00**	**3.34**	**1.72**	**1.62**
	SS DT (%)	**-**	**-**	**45.45**	**1.45**	**77.05**	**-**	**-**	**51.50**	**48.50**

LAND LEASE-IN (+), LAND LEASE-OUT (-)								
	Area-Unit	FL	HS	PK	SK	TCL	OF	SOH
3	**RB**	**2.36**	**0.02**	**-0.30**	**-0.79**	**0.01**	**-0.31**	**-0.55**
	RN GPU	2.65	0.03	-0.58	-0.85	0.27	-0.30	-0.72
	KB GPU	2.07	0.00	-0.02	-0.73	-0.25	-0.31	-0.37
	NB	**2.75**	**0.00**	**-0.06**	**-0.58**	**-0.29**	**-0.57**	**-1.08**
	CP GPU	4.02	0.00	0.02	-0.95	-0.30	-0.85	-1.73
	TB GPU	1.47	0.00	-0.13	-0.20	-0.28	-0.28	-0.43
	SS DT	**2.56**	**0.01**	**-0.18**	**-0.69**	**-0.14**	**-0.44**	**-0.82**

Source: Field Survey 2019-2020

Note: FL- Farm Land, HS- Homestead, PK- Pani Khet, SK- Sukha Khet, TCL- Tree-Cropped Land, OF- Other Fallow, SOH- Self-Owned Holding, OH- Operated Holding, IH- Irrigated Holding, UIH- Un-Irrigated Holding

Sl. no 1 of the table 6.13 indicates the details of land owned by the dairy farmers, according to the use for which it has been designated and utilized. The study area includes two GPUs, each from the two blocks in South Sikkim. The GPUs are Ralong Namlung and Kewzing Bakhim from Ravangla Block and Chuba Phong GPU and Tangzi Bikmat GPU from Namchi block. The land owned from all the sampled households in the GPU have been segregated into farmland, the part of the land which has been used for growing various crops; homestead, the portion of land used in housing, cow shed etc; panikhet, the land used for growing cereals like paddy, etc, sukhakhet, land used for farming crop requiring no water; tree cropped land, land where tree plantation has been done; and other fallow land, the land left fallow i.e., no farming has been done in it. The table shows that the self-owned land holding in Ralong Namlung GPU is 3.93 acres followed by 3.20 acres in Kewzing Bakhim GPU making the average in the Ravangla Block as 3.57 acres. The average self-owned holding in Namchi Block is 4.37 acres with 5.61 acres in Chuba Phong GPU and 3.09 acres in Tangzi Bikmat GPU. It is thus clearly seen that the highest percentage of self-owned land holding was in Chuba Phong GPU and the lowest in Tangzi Bikmat GPU. This however does not mean that in Chuba Phong GPU economically strong farmers reside and in Tangzi Bikmat GPU comparatively economically weaker section resides. From the self-owned land holding maximum percentage land was seen in the farmland category. It comprised 35.52% in the study area. The figures were almost similar in all the four GPUs.

In the homestead category all the farmers were found to own approx. 0.50 acres land in South Sikkim thus makes the percentage land coverage for homestead as 12.34%. The percentage of land owned for panikhet in South Sikkim was the lowest with only 8.31%. Similarly, the percentage of land for sukhakhet was recorded as 17.38%. The percentage of the tree cropped land in the study area is 15.36%, the highest figure was found in Chuba Phong GPU. The other fallow land in the study area was seen to cover 11.09% of the total owned land. Thus, maximum land in the owned land category was farmland and the minimum was panikhet.

Sl. no 2 of the table indicates the operated land from the self-owned landholding. From the total 8.31% of owned land allotted as panikhet only 45.45% is used/operated in the South Sikkim. Similarly, from the total 17.38% of owned land allotted as sukhakhet in table 6.13, only 1.45% are operational. Further, the tree cropped land which covered 15.36% of the owned land 77.05% is used. Other fallow land that covered 11.09% of the owned land is not in use. The maximum area of panikhet is in Ralong Namlung GPU and the same is in maximum use/operation as compared to other GPUs. Also, the operated land holding has been segregated into two types, one as irrigated holding and the other as un-irrigated holding. Both the types were seen to have similar coverage with 51.50% as irrigated holding and 48.50% as un-irrigated holding. Chuba Phong GPU under Namchi Block has the maximum un-irrigated holding of land. The figures represent that the farmers own and operate both irrigated as well as un-irrigated lands. The un-irrigated land holdings are due to the shortage of work force, low numbers of family members etc.

Sl. no. 3 of the said table shows details about land leased in and land leased out. The plus (+) sign indicates that the farmers has taken or leased in someone else land for use. Similarly, the minus (-) sign indicates that the farmer has given or leased out part of his land to someone else. From the table it is clear that except for farmland and homestead land all other lands viz. panikhet, sukhakhet, some tree cropped land and other fallow land has been leased out. The data’s clearly show that now-a-days landowners prefer leasing out land rather than leasing in. The reasons being shortage of workforce in farming due to.

Table 6.14: Reason being Shortage of workforce in farming

Reason	Average Percentage
OFOJ	76
MGNREGA	69
Population Migration	81
Decline in labour force	87
Subsidies ration system	56
Water crises	83
Poor road connectivity	71
Ban on Grazing	79
Other	66

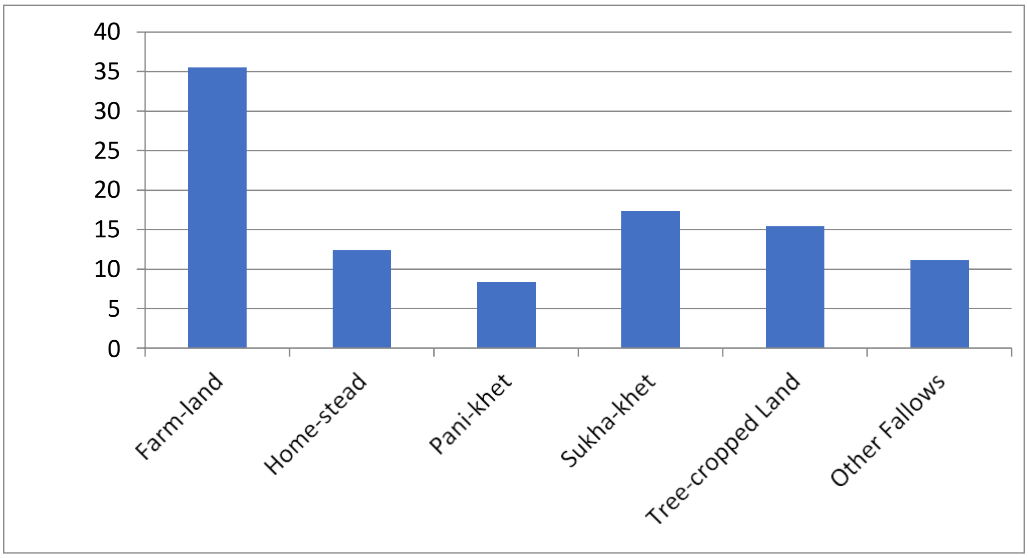
Source: Field Survey, 2019-2020

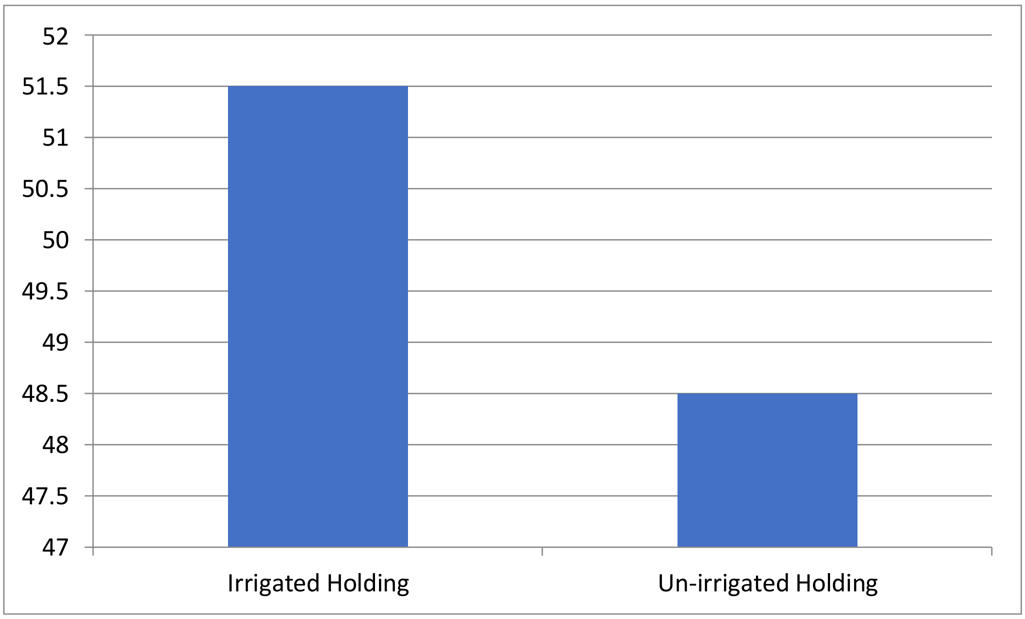
From the table 6.14, there are many reasons like, new job opportunities like One Family One Job (OFOJ) scheme in Sikkim, Schemes like MGNREGA, Migration of rural populations to urban areas, Decline in labour force, Free and subsidise ration system, Water crises, Non accessible area, poor road connectivity, Ban on grazing in forest areas, Villagers keen to give good quality education to their children do not like to burden then with household chores are the major reason being shortage of workforce in dairy/agricultural farming in Sikkim.

In addition to the above, it is also seen that due to rise in population (in the State as well as in a family), the available land when divided among the siblings becomes too less for farming. They are forced to construct homes to accommodate their families in agricultural land thus leading to decrease in farmland. It is also observed that now-a-days instead of purchasing land the present tendency of farmers is to sell off their agricultural land for meet their housing, health, and child education needs.

Below figures of bar graph represents owned land and irrigated as well as un-irrigated holding of land. The vertical axis represents the percentage, and the horizontal axis represents different types of land in the study area.

Figure 6.10: Owned land





The table 6.15 depicts the participations of dairy farmers in growing principal agricultural/horticultural crops in South Sikkim.

Table 6.15: Principal Agricultural/Horticultural Crops Sown by South Sikkim Dairy-farmers *(Farmers participating)*

Area-Unit	Ma	Mi	Pa	OP	Gr	Veg	Po	Gi	Ca	Or	T
RAVANGLA BLOCK	**56**	**8**	**25**	**17**	**1**	**16**	**0**	**25**	**20**	**9**	**177**
Ralong Namlung GPU	29	8	18	12	1	0	0	14	8	9	99
Kewzing Bakhim GPU	27	0	7	5	0	16	0	11	12	0	78
NAMCHI BLOCK	**48**	**13**	**5**	**29**	**0**	**8**	**8**	**44**	**5**	**5**	**165**
Chuba Phong GPU	18	0	1	7	0	8	8	22	5	5	74
Tangzi Bikmat GPU	30	13	4	22	0	0	0	22	0	0	91
SOUTH SIKKIM DT	**104**	**21**	**30**	**46**	**1**	**24**	**8**	**69**	**25**	**14**	**342**
SOUTH SIKKIM DT (%)	**30.4**	**6.1**	**8.77**	**13.4**	**0.29**	**7.02**	**2.34**	**20.2**	**7.31**	**4.10**	**100**

Source: Field Survey 2019-2020

Note: Ma- Maize, Mi- Millet, Pa- Paddy, OP- Other Pulses, Gr- Grains, Veg- Vegetables, Po- Potatoes, Gi- Ginger, Ca- Cardamom, Or- Orange, T- Total

In the field survey, it has been found that the major crops sown in the study area are maize, millet, paddy, other pulses, grains, vegetables, potatoes, ginger, cardamom, oranges etc. The above crops are the major crops grown by the dairy farmers through allied farming. Their major occupation to support their family, is however dairy farming.

It is seen in the table 6.15 that the total farmer's participation in principle agricultural/horticultural crop sown by the dairy farmers in the sampled household exceeds the number of sampled households since one particular farmer is cultivating more than one variety of crop as depicted in the said table.

The participation of farmers in grain cultivation is meagre about 0.29% followed by potato 2.34%, oranges 4.10%, millet 6.14%, vegetables 7.02%, cardamom 7.31%, paddy 8.77%, other pulses 13.45%, ginger 20.17% and maize 30.41% respectively.

Maize, ginger, and other pulses are seen to lead the crops sown in the study area with 30.41% maize and 20.17% ginger and 13.45% other pulses.

The survey of the study area showed that in Namchi Block no dairy farmer participation was seen in grains, other than maize, millet, and paddy cultivation. Also, in Ravangla Block none of the dairy farmers were involved in potatoes cultivation. Surprisingly, among all the four GPUs in the study area only Ralong Namlung GPU dairy farmers were seen participating in grain cultivation and only Chuba Phong GPU dairy farmers were seen growing potatoes.

In the table ‘zero’ represents that the dairy farmers are not producing output sufficient for sale but only enough for household consumption. Overall, it may be said that all the dairy farmers are cultivating maize thus making it the principal agricultural crop in the study area. This crop can be used in many forms to feed cattle and thus obtain good returns in dairy farming enabling quick and stable economic growth.

Below figure of bar graph represents principal crops sown of South Sikkim. The vertical axis represents the percentage, and the horizontal axis represents different types of crops cultivating in the study area.

Figure 6.11: Principal Agricultural/Horticultural Crops Sown by South Sikkim Dairy-farmers

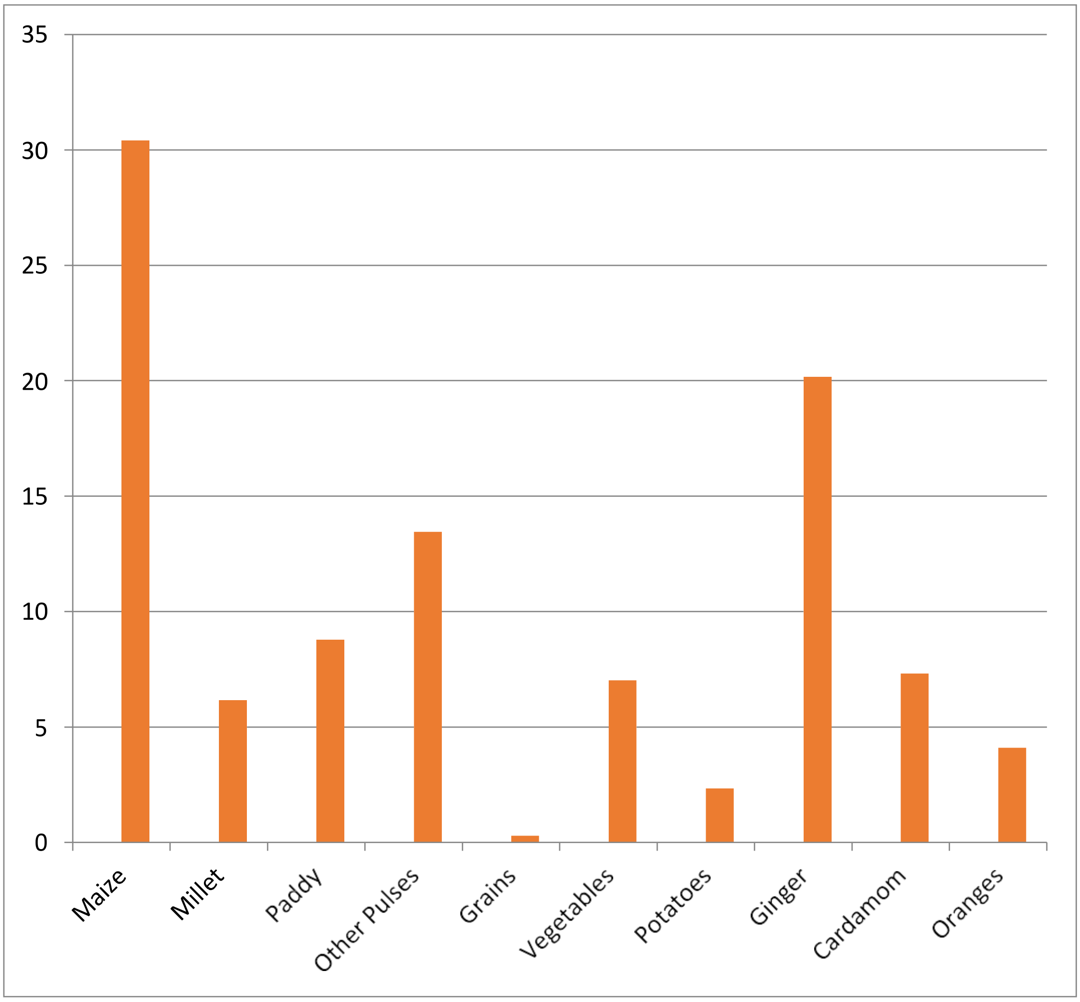


Table 6.16: Occupational Distribution among South Sikkim Dairy-Farmers

DISTRIBUTION OF DAIRY FARMERS BY PRIMARY OCCUPATIONS									
Sl. no	Area-Unit	Agri-culture	Pvt. Service	Govt. Service	Petty Business	Tra-de	Wage Labo-ur	Oth-ers	Total
1	**RAVANGLA BLOCK**	**33**	**7**	**18**	**2**	**1**	**2**	**2**	**65**
	Ralong Namlung GPU	22	4	5	0	0	1	1	33
	Kewzing Bakhim GPU	11	3	13	2	1	1	1	32
	NAMCHI BLOCK	**30**	**5**	**17**	**8**	**8**	**3**	**4**	**75**
	Chuba Phong GPU	12	2	10	4	4	1	1	34
	Tangzi Bikmat GPU	18	3	7	4	4	2	3	41
	SOUTH SIKKIM DT	**63**	**12**	**35**	**10**	**9**	**5**	**6**	**140**
	SOUTH SIKKIM DT (%)	**45.00**	**8.57**	**25.00**	**7.14**	**6.43**	**3.57**	**4.29**	**100.0**
DISTRIBUTION OF DAIRY FARMERS BY SECONDARY OCCUPATIONS									
2	Area-Unit	Agri-culture	Pvt. Service	Govt. Service	Petty Business	Tra de	Wage Labo-ur	Oth-ers	Total
	RAVANGLA BLOCK	**26**	**4**	**1**	**3**	**4**	**23**	**5**	**66**
	Ralong Namlung GPU	8	2	0	1	4	16	2	33
	Kewzing Bakhim GPU	18	2	1	2	0	7	3	33
	NAMCHI BLOCK	**26**	**4**	**4**	**6**	**4**	**12**	**6**	**62**
	Chuba Phong GPU	16	0	0	4	3	7	0	30
	Tangzi Bikmat GPU	10	4	4	2	1	5	6	32
	SOUTH SIKKIM DT	**52**	**8**	**5**	**9**	**8**	**35**	**11**	**128**
	SOUTH SIKKIM DT (%)	**40.63**	**6.25**	**3.91**	**7.03**	**6.25**	**27.34**	**8.59**	**100.0**

Source: Field Survey 2019-2020

The table 6.16 throws light on the occupational distribution of dairy farmers in South Sikkim. Sl. no 1 of the said table shows the distribution of dairy farmers according to their primary occupation.

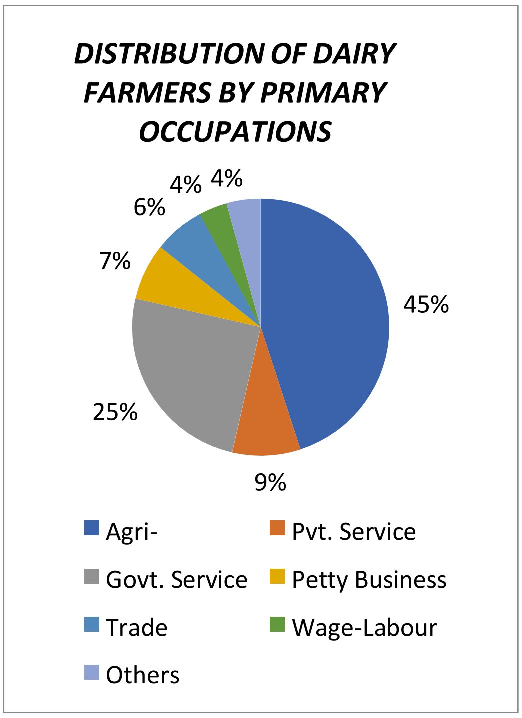
Agriculture is seen to be the primary occupation of dairy farmers in all the four GPUs, the percentage being 45%. Maximum numbers of farmers were seen in Ralong Namlung GPU followed by those in Tangzi Bikmat GPU. Government service comprises 25% of the primary occupation of dairy farmers. It indicates that though being a government servant, yet they are into dairy farming as well to earn some extra money to support their families in studies and other allied activities. Similarly, other primary occupations like private service, petty business, trade, wage labour and other occupation comprises 8.57%, 7.14%, 6.43%, 3.57% and 4.29% respectively. Apart from the above primary occupations, the dairy farmers of the study area also engaged in secondary occupations which can be perused at sl. no. 2 of the table 6.16.

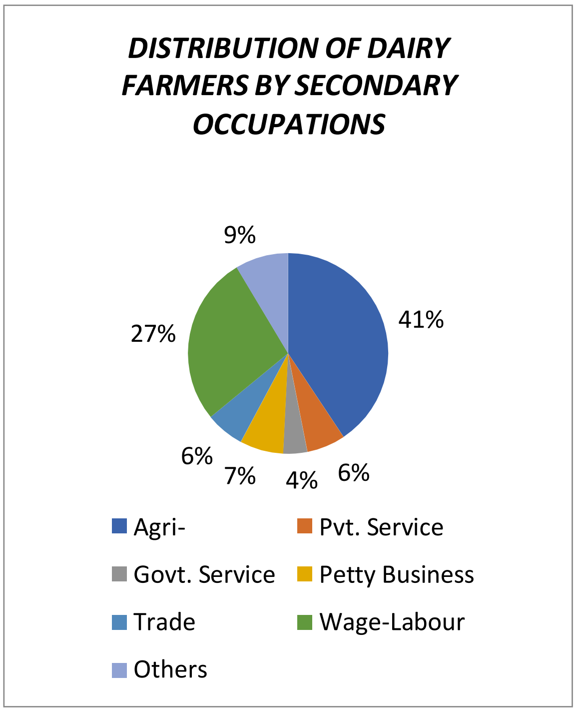
It is observed that those farmers whose primary occupation is private service his/her secondary occupation will be as agriculture, petty business, or trade. Similarly, if the primary occupation of the dairy farmer is Government employee his/her secondary occupation will be agriculture or petty business etc. it means that if one occupation is primary the other occupations which he follows will be other than his/her primary occupation.

The highest percentage of secondary occupation among dairy farmers of the study area was found to be agriculture having 41% followed by wage labour as 27.34%, others 8.59%, petty business as 7.03%. Private Service and trade were seen to have equal percentage i.e., 6.25% each. 4% of the dairy farmers have their secondary occupation as Government service meaning that for them dairy farming is providing then the major source of income.

The below pie charts depict the distribution of dairy farmers occupations both primary and secondary. The percentage has been rounded off.

Figure 6.12: Primary and Secondary Occupation Distribution





The descriptive statistics of the Land holding and asset holding profile is presented in table 6.17

Table 6.17: Descriptive Statistics of Land holding and asset holding profile including income and expenditure

Sl. no.	Variables	Maximum	Mean	Standard Deviation
1	Total Land Holdings	70.0	3.958	6.2804
2	Irrigated Farmland	5.5	1.658	1.0452
3	Un-irrigated Farmland	24.0	1.567	2.2990

Source: Authors calculations

The table 6.17 gives the information regarding the descriptive statistics of the landholding and asset holding profile including income and expenditure. The data has been obtained from sampled households and analysed using SPSS software. The maximum land holding of the respondent in the study area is recorded as 70 acres of land. Maximum 5.5 acres of irrigated farmland and 24 acres of un-irrigated farmland were found. The average total land holding in the study area is 3.958 acres. The average irrigated farmland is 1.658 acres, and the average un-irrigated farmland is 1.567 acres. The standard deviation of total land holding is 6.2804 it indicates that the total land holdings are more spread out. The standard deviation of the irrigated farmland is 1.0452 which means that most of the area of dairy farmers irrigated farmland is close to the average. Similarly, the standard deviation of the un-irrigated farmland is 2.2990 which means that most of the area of dairy farmers un-irrigated farmlands are also close to the average.

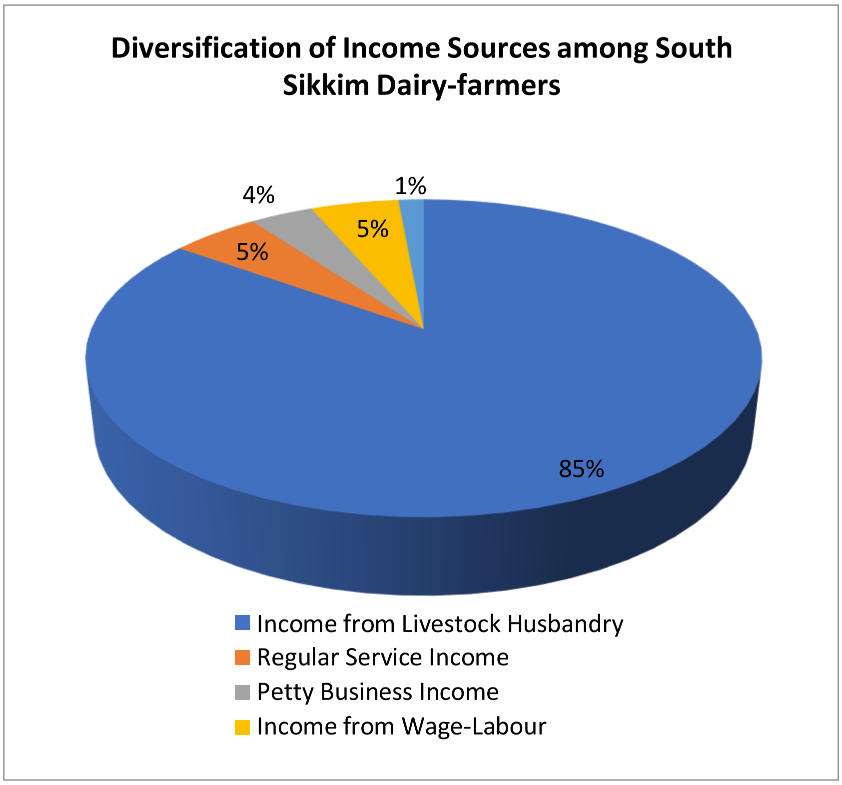
Table 6.18: Diversification of Income Sources among South Sikkim Dairy-Farmers *(Number of farmers)*

Area-Unit	Income from Livestock Husbandry	Regular Service Income	Petty Business Income	Income from Wage-Labour	Income from Other Sources	Total
RAVANGLA BLOCK	**60 (43.16)**	**5 (3.60)**	**3 (2.16)**	**6 (4.34)**	**2** (1.44)	**76 (54.67)**
Ralong Namlung GPU	30 (21.58)	2 (1.44)	1 (0.72)	5 (3.60)	1 (0.72)	39 (28.06)
Kewzing Bakhim GPU	30 (21.58)	3 (2.16)	2 (1.44)	1 (0.72)	1 (0.72)	37 (26.62)
NAMCHI BLOCK	**58 (41.73)**	**2** (1.44)	**2** (1.44)	**1** (0.72)	**0**	**63 (45.32)**
Chuba Phong GPU	28 (20.14)	2 (1.44)	2 (1.44)	0	0	32 (23.02)
Tangzi Bikmat GPU	30 (21.58)	0	0	1 (0.72)	0	31 (22.30)
SOUTH SIKKIM DT	**118 (84.90)**	**7 (5.03)**	**5 (3.60)**	**7 (5.03)**	**2 (1.44)**	**139 (100)**

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

Figure 6.13: Income Diversification



The table 6.18 and figure 6.13 provide a detailed description of the income sources among South Sikkim dairy farmers and the percentage has been rounded off in the pie-chart. The data indicates the number of farmers. The income sources are from livestock husbandry, regular service, petty business, wage labour and other sources. 85% of the dairy farmers in the study area have livestock husbandry as their source of income. Only 5.03% of the dairy farmers have regular service as their source of income.

However, there are no dairy farmers having regular service as their source of income in Tangzi Bikmat GPU. 3.60% of the dairy farmers of the study area have petty business as their source of income. Tangzi Bikmat GPU has no farmers whose occupation is petty business therefore none of the farmers have any income from it. 5.03% of dairy farmers of the study area earn income from wage labour but Chuba Phong GPU has no farmer earning any income from wage labour. A meagre 1.44% of dairy farmers in the study area have income from other sources. On the whole, it was observed that the dairy farmers of Namchi Block earned income only from occupations like livestock husbandry, regular service, petty business and wage labour. The information gathered is however from sampled household of South Sikkim dairy farmers only. Livestock husbandry was seen as the occupation contributing highest income to the dairy farmers.

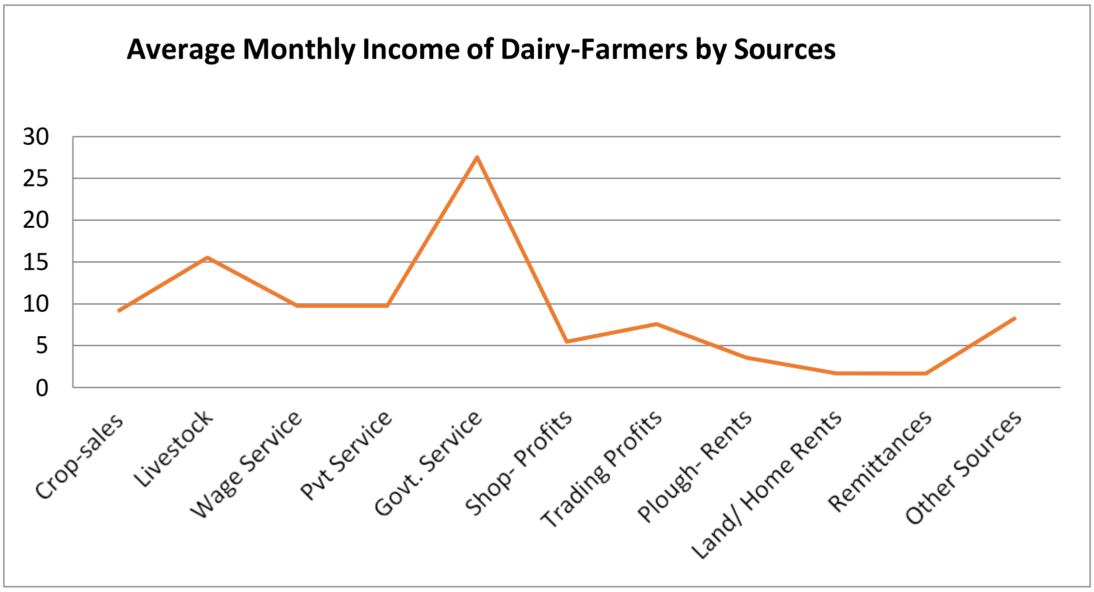
Table 6.19: Average Monthly Income of South Sikkim Dairy-Farmers by Sources *(Figures in Rs.)*

Area-Unit	Crop Sales	Live-stock	Wage Service	Pvt Service	Govt. Service	Shop-Profits	Trade Profits	Ploug Rents	Land/ Home Rents	Re.	OS	TI Rs/p.m.
RB	**1995**	**3,998**	**2,542**	**2,467**	**6,050**	**858**	**1,375**	**683**	**380**	**258**	**1,408**	**22,015**
RN GPU	2317	5,200	3,267	2,900	1,600	0	1,267	683	243	100	233	17,810
KB GPU	1673	2,797	1,817	2,033	10,500	1,717	1,483	683	517	417	2,583	26,220
NB	**2208**	**3,180**	**1,975**	**2,050**	**6,683**	**1,683**	**2,133**	**957**	**408**	**510**	**2,450**	**24,238**
CP GPU	2737	4,917	1,583	1,500	7,567	2,567	2,633	1,013	667	233	0	25,417
TB GPU	1680	1,443	2,367	2,600	5,800	800	1,633	900	150	787	4,900	23,060
SS DT	**2102**	**3,589**	**2,258**	**2,258**	**6,367**	**1,271**	**1,754**	**820**	**394**	**384**	**1,929**	**23,126**
SS DT (%)	**9.09**	**15.52**	**9.76**	**9.76**	**27.53**	**5.49**	**7.58**	**3.55**	**1.70**	**1.67**	**8.35**	**100.00**

Source: Field Survey 2019-2020

Note: RN- Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat, SS DT- South Sikkim District Total, RB- Ravangla Block, NB- Namchi Block, OS- Other Sources, Re- Remittances, TI- Total Income

Figure 6.14: Average Monthly Income



The table 6.19 and figure 6.14 show the monthly income distribution of the dairy farmers in South Sikkim. There are from different sources contributing to the income of dairy farmers' viz. crop sale, livestock, wage service, private service, Government service, shop profits, trading profits, plough rents, land/house rents, remittances, and other sources. Apart from these some of the dairy farmers also engage themselves in street vending activities for income. The said table shows that the highest contribution for monthly income is made from Government service. It accounts to 27.53% followed by livestock which contributes 15.52%.

Similarly, from crop sales 9.09%, wage service and private service 9.76% each, trade profits 7.58%, shop profits 5.49%, plough rents 3.55%, remittances from within state and outside the state 2% and through land/home rents 1.70%, other sources contribution for monthly income is 8.35%. A few family members of the dairy farmers have also left their village and have ventured out to urban areas within and outside state to work and earn more to support their families.

In the rural areas or village, livestock alone is seen to be the reliable source of income, though the farmers opt for other sources of income like private service, wage service, shop profits, trading profits and others but in time of need and emergency only livestock saves them the most. The same has been seen to be further reinforced during the crisis of the COVID-19 PANDEMIC. No other source provides them the security of income as livestock does.

From the said table it is seen that the Chuba Phong GPU dairy farmers sell crops in larger quantities as compared to other three GPUs of the study area. It helps them to raise their monthly family income well. Ralong Namlung GPU on the other hand relies more on livestock, wage service and private service for income than in other GPUs of South Sikkim. Kewzing Bakhim GPU is seen to rely more on Government service for income as it stands on the top positions in this GPU. It may hint that the salaried people in the said GPU are actively engaged in dairy farming activities also. Income from shop profits is nil in Ralong Namlung GPU. In totality, it can be summed up that despite the dairy farmers have varied sources of income yet a good 15.52% of regular monthly income is received through the livestock sector.

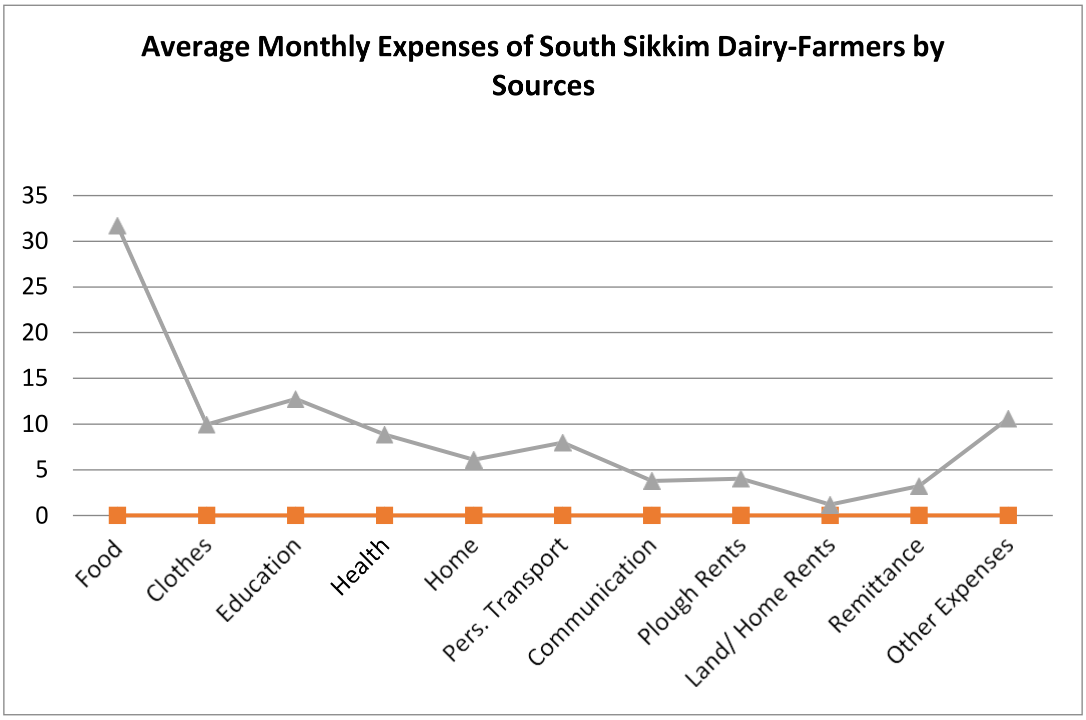
Based on the monthly income of dairy farmers in terms of Rupees in the study area maximum is earned by farmers of Kewzing Bakhim GPU amounting Rs. 26,220/- per month followed by Rs. 25,417/- by farmers of Chuba Phong GPU, Rs. 23,060/- per month by farmers of Tangzi Bikmat GPU and the lowest by dairy farmers of Ralong Namlung GPU amounting to Rs. 17,810/- per month. Farmers also have income sources through plough rents as most of the farmers do not own oxes of their own but hire them on rent as and when required for ploughing their fields. It is also seen that nearly 2% of dairy farmers do not own any land nor have their own houses, they live in some landlord’s land and pay rent either in cash or kind. Thus, it can be concluded that income source of dairy farmer is from many sources not only from dairy farming, but their primary source of income is from dairy only.

Table 6.20: Average Monthly Expenses of South Sikkim Dairy-Farmers by Sources *(Figures in Rs.)*

Area-Unit	Food	Clothes	Education	Health	Home	Pers. Transport	Commu-nication	Plough Rents	Land/ Home Rents	Re	OE	Total Expenses p.m.
RB	**5,797**	**1,437**	**1,860**	**1,243**	**778**	**1,260**	**692**	**648**	**200**	**475**	**1,512**	**15,902**
RN GPU	5,877	1,167	1,003	1,117	767	1,063	633	663	183	377	1,077	13,927
KB GPU	5,717	1,707	2,717	1,370	790	1,457	750	633	217	573	1,947	17,877
NB	**4,600**	**1,820**	**2,317**	**1,658**	**1,208**	**1,352**	**542**	**667**	**185**	**577**	**1,958**	**16,883**
CP GPU	4,967	1,523	3,150	1,800	1,117	1,090	750	480	100	417	1,717	17,110
TB GPU	4,233	2,117	1,483	1,517	1,300	1,613	333	853	270	737	2,200	16,657
SS DT	**5,198**	**1,628**	**2,088**	**1,451**	**993**	**1,306**	**617**	**658**	**193**	**526**	**1,735**	**16,393**
SS DT %	**31.71**	**9.93**	**12.74**	**8.85**	**6.06**	**7.97**	**3.76**	**4.01**	**1.18**	**3.21**	**10.58**	**100.00**

Source: Field Survey 2019-2020.
Note: RN- Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat, SS DT- South Sikkim District Total, RB- Ravangla Block, NB- Namchi Block, OE- Other Expenses, Re- Remittances.

Figure 6.15: Average Monthly Expenses



The table 6.20 and the figure (line diagram) 6.15 give the description of the monthly expenses of the South Sikkim dairy farmers' family for standard categories of expenditure commonly associated with the households. The vertical axis of the line diagram represents the percentage, and the horizontal axis represents the various expenditure sources. The expenditure levels of the dairy farming families depend on the households' size and the income level of the family. Whatever be the level of income of the dairy farming families' expenditure is done primarily on the following viz. food, clothes, education, health, house maintenance, personal transport, communication, plough rent, land/home rent, remittances, and other expenses.

In totality, the highest burden on the earnings of a household is normally put by the food expenses. Each household must incur about 32% of the income on food items. It is observed from the said table that the expenses on food in Ravangla Block exceed a bit than that of Namchi Block. The variations in the expenditure pattern of the household occur according to age, generation as well as cultural effects. The second highest expense of dairy farmers in the study area is in education, it is about 13%. The investment on education represents a family's willingness to invest for its own socio-economic future.

The expenditure in cloths comprises about 10% followed by health about 9%, home maintenance 6%, personal transport 8%, communication 4%, plough rent 4%, land/home rents 1%, remittance 3% and other expenditure about 11%. The above pattern/percentage of expenditure incurred by dairy farmer remains similar in families belonging to the same economic class. From the table 6.19 and 6.20 it is observed that from the total average monthly income of Rs. 23126/- the dairy farmer usually invests average amount of Rs. 16393/-. The balance amount is either deposited in bank or invested in physical assets. Ultimately, whatever be the level of income among the farmers the expenditure pattern for basic items like food, clothes, education, health etc. was seen to be almost the same.

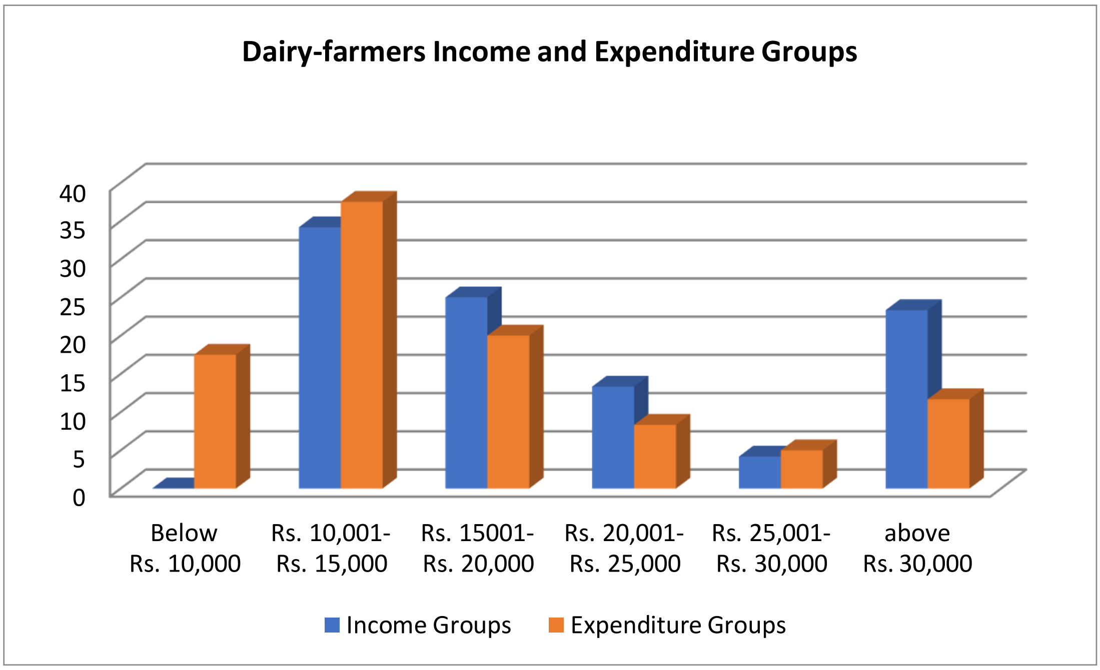
Table 6.21: Classification of Dairy-farmers by Income and Expenditure Groups

(Number of farmers)

Sl. no	Area-Unit	Below Rs. 10,000	Rs. 10,001- Rs. 15,000	Rs. 15001- Rs. 20,000	Rs. 20,001- Rs. 25,000	Rs. 25,001- Rs. 30,000	above Rs. 30,000	Total HHs.
	Income Groups							
1	**RAVANGLA BLOCK**	**-**	**23**	**14**	**8**	**2**	**13**	**60**
	Ralong Namlung GPU	-	13	10	4	1	2	30
	Kewzing Bakhim GPU	-	10	4	4	1	11	30
	NAMCHI BLOCK	**-**	**18**	**16**	**8**	**3**	**15**	**60**
	Chuba Phong GPU	-	7	10	3	1	9	30
	Tangzi Bikmat GPU	-	11	6	5	2	6	30
	SOUTH SIKKIM DT	**-**	**41**	**30**	**16**	**5**	**28**	**120**
	SOUTH SIKKIM DT (%)	**-**	**34.17**	**25.00**	**13.33**	**4.17**	**23.33**	**100.00**
	Expenditure Groups							
2	Area-Unit	Below Rs. 10,000	Rs. 10,001- Rs. 15,000	Rs. 15001- Rs. 20,000	Rs. 20,001- Rs. 25,000	Rs. 25,001- Rs. 30,000	above Rs. 30,000	Total HHs.
	RAVANGLA BLOCK	**12**	**22**	**8**	**7**	**3**	**8**	**60**
	Ralong Namlung GPU	4	13	6	2	1	4	30
	Kewzing Bakhim GPU	8	9	2	5	2	4	30
	NAMCHI BLOCK	**9**	**23**	**16**	**3**	**3**	**6**	**60**
	Chuba Phong GPU	5	9	11	0	2	3	30
	Tangzi Bikmat GPU	4	14	5	3	1	3	30
	SOUTH SIKKIM DT	**21**	**45**	**24**	**10**	**6**	**14**	**120**
	SOUTH SIKKIM DT (%)	**17.50**	**37.50**	**20.00**	**8.33**	**5.00**	**11.67**	**100.00**

Source: Field Survey 2019-2020

Figure 6.16: Income and Expenditure Groups



The table 6.21 and the figure 6.16 above give the information on the clustering of South Sikkim dairy farming through income and expenditure groups based on the data's collected from all the four GPUs of the South Sikkim i.e., Ralong Namlung GPU and Kewzing Bakhim GPU under Ravangla Block and Chuba Phong GPU and Tangzi Bikmat GPU under Namchi Block.

It is based on the number of farmers; the income groups of the farmers have been categorised into six clusters viz. below Rs. 10,000/- per month, Rs. 10,001/- to Rs. 15,000/-, Rs. 15,001/-to Rs. 20,000/-, Rs. 20,001/-to Rs. 25,000/-, Rs. 25,001/-to Rs. 30,000/- and above Rs. 30,000/-. It was found that whatever be the living standard or lifestyle of the dairy farmers none of them have income below Rs. 10,000/- per month.

A maximum of 34% dairy farmers in the study area have income between Rs. 10,001/- to Rs. 15,000/-per month followed by 25% dairy farmers with income between Rs. 15,001/- to Rs. 20,000/-, 23% of them have income above Rs. 30,000/- per month, 13.33% have income between Rs. 20,001/- to Rs. 25,000/- and only 4% have income between Rs. 25,001/- to Rs. 30,000/- per month. In the said table it can be seen that the dairy farmers of Kewzing Bakhim GPU have the highest average monthly income through different sources and thus they have maximum dairy farmers having income above Rs. 30,000/-. Chuba Phong GPU has dairy farmers having the second highest average monthly income through different sources thus the farmers here too have income above Rs. 30,000/- per month.

Now, again when we investigate the expenditure groups detailed at sl. no. 2 in the said table, the highest expenditure per month incurred by the dairy farmers of the study area is in between Rs. 10,001/- to Rs. 15000/- which accounts for 37.50%. This is followed by expenditure between Rs. 15,001/- to Rs. 20,000/- per month which is 20% and these with expenditure below 10,000/- per month were 17.50%. it is interesting to note that 23% of dairy farmers have income more than Rs. 30,000/- per month but only 12% of dairy farmers have expenditure above Rs. 30,000/-, this reflects the fact that the dairy farmers have savings. The details on the descriptive statistics of income and expenditure profile of the dairy farmers have been presented in table 6.22 and analysed it.

Table 6.22: Classification of income and expenditure profile

Sl. no.	Variables	Maximum	Mean	Standard Deviation
1	Average Monthly Income	66,000	23126.67	13063.45
2	Average Monthly Expenditure	44,000	16392.50	8475.731

Source: Authors calculations based on survey data

The table 6.22 gives the information regarding the descriptive statistics on the income and expenditure profile of the dairy farmers of the study area. The data has been obtained from sampled households and analysed with the help of SPSS software. When we talk about the descriptive statistics of the dairy farmers' maximum monthly income and expenditure, it was seen that income is Rs. 66,000/- and expenditure is Rs. 44,000/- . The dairy farmers' average monthly income is Rs. 23,126/- and the average monthly expenditure is Rs. 16,392/-. It means that most of the farmers have savings habits either they save in a bank or invest in physical assets. The standard deviation of the average monthly income **(13063.45)** and expenditure **(8475.731)** are more spread out and are not close to the average.

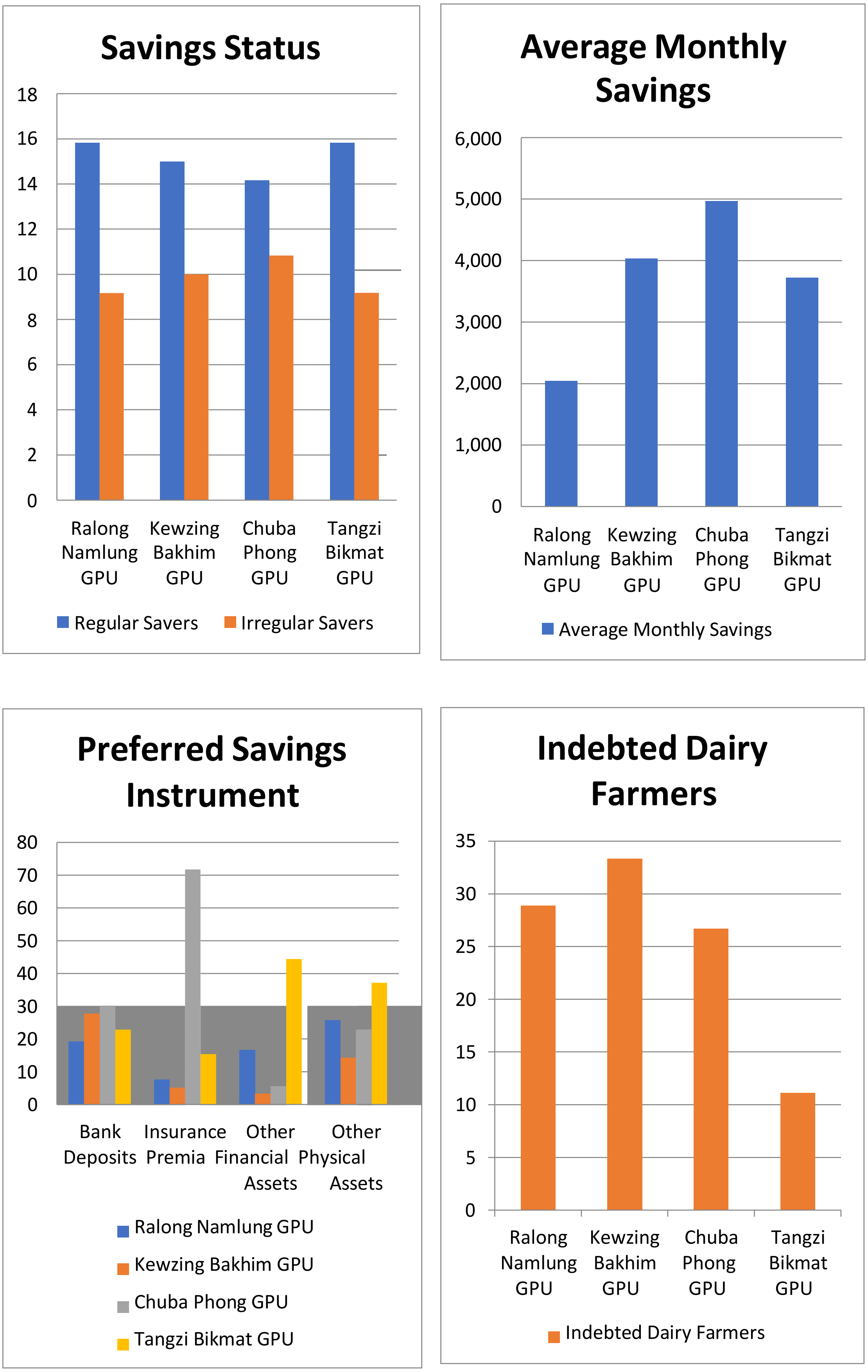
Table 6.23: Savings, Preferred Investments, and Indebtedness among Dairy farmers

Sl. no.	Area-Unit	Regular Savers	%	Irregular Savers	%	Average Monthly Savings (Rs.)
1	**RAVANGLA BLOCK**	**37**	**30.83**	**23**	**19.17**	**3,040**
	Ralong Namlung GPU	19	15.83	11	9.17	2,047
	Kewzing Bakhim GPU	18	15.00	12	10.00	4,033
	NAMCHI BLOCK	**36**	**30.00**	**24**	**20.00**	**4,346**
	Chuba Phong GPU	17	14.17	13	10.83	4,971
	Tangzi Bikmat GPU	19	15.83	11	9.17	3,720
	SOUTH SIKKIM DT	**73**	**60.83**	**47**	**39.17**	**3,693**

Sl. no.	PREFERRED SAVINGS INSTRUMENT						
2	Area-Unit	Bank Deposits	**%**	Insurance Premium	%	Other Financial Assets	%
	RAVANGLA BLOCK	**39**	**46.99**	**5**	**12.82**	**9**	**50.00**
	Ralong Namlung GPU	16	19.28	3	7.69	3	16.67
	Kewzing Bakhim GPU	23	27.71	2	5.13	6	3.33
	NAMCHI BLOCK	**44**	**53.01**	**34**	**87.18**	**9**	**50.00**
	Chuba Phong GPU	25	30.12	28	71.79	1	5.56
	Tangzi Bikmat GPU	19	22.89	6	15.39	8	44.44
	SOUTH SIKKIM DT	**83**	**100.00**	**39**	**100.00**	**18**	**100.00**
	Area-Unit	Other Physical Assets		%	Indebted Dairy Farmers		%
	RAVANGLA BLOCK	**14**		**40.00**	**28**		**62.22**
	Ralong Namlung GPU	9		25.71	13		28.89
	Kewzing Bakhim GPU	5		14.29	15		33.33
	NAMCHI BLOCK	**21**		**60.00**	**17**		**37.78**
	Chuba Phong GPU	8		22.86	12		26.67
	Tangzi Bikmat GPU	13		37.14	5		11.11
	SOUTH SIKKIM DT	**35**		**100.00**	**45**		**100.00**

Source: Field Survey 2019-2020

Figure 6.17: Status of Savings and Indebted



This section focuses on the Savings, Investments, and Indebtedness among South Sikkim Dairy Farmers. It presents an account of savings behaviour along with the investment pattern and indebtedness of the dairy farmer’s family. The table 6.23 and figure 6.17 give the description of the savings, preferred investment, and the indebtedness of the dairy farmers of the study area. Almost equal percentage of dairy farmers have the habit of regular savings, in all the GPUs i.e., about 60 percent of South District. On the other hand, irregular savers are also found in the study area, almost 40 percent of the dairy farmers have the habit of irregular savings. These farmers save the money but on irregular basis.

Further, from the said table in the Sl. No. 1 the average monthly savings habit of the dairy farmers is about Rs. 3000/- in Ravangla Block and about Rs. 4300/- in Namchi Block. This indicates that the dairy farmers of Namchi Block save a little more than that of Ravangla Block farmers.

Sl. No. 2 of the table above indicates the preferred form of savings investment on various categories are in the form of Bank Deposits, Insurance Premium, Other Financial Assets and Other Physical Assets. Ralong Namlung GPU dairy farmers save about 19 percent, Kewzing Bakhim GPU dairy farmers save about 28 percent under Ravangla Block. Similarly, 30 percent from Chuba Phong GPU, and about 23 percent of the dairy farmers of Tangzi Bikmat GPU saves in the form of Bank deposits under Namchi Block. When we talk about insurance premium section as the preferred savings investment, about 8 percent and 5 percent of dairy farmers in Ralong Namlung GPU and Kewzing Bakhim GPU respectively under Ravangla Block prefer to save through insurance mode.

On the other hand, about 15 percent and 72 percent of the dairy farmers of Tangzi Bikmat and Chuba Phong GPU invest in insurance premium. It has been observed that the dairy farmers of Chuba Phong GPU invest more on insurance than the dairy farmers of other GPUs in the study area. Similarly, in the investment on the other financial assets category, the dairy farmers of Tangzi Bikmat GPU are seen to invest maximum i.e.,44 percent followed by 17 percent in Ralong Namlung GPU,6 percent in Chuba Phong GPU and a meagre 3 percent only by dairy farmers of Kewzing Bakhim GPU.

Likewise, in the investment in the other physical assets category, the highest percentage is of Tangzi Bikmat GPU dairy farmers which is about 37 percent, followed by Ralong Namlung GPU of about 26 percent, Chuba Phong GPU is about 23 percent and Kewzing Bakhim GPU is about 14 percent.

Lastly, when we talk about indebted dairy farmers, about 33 percent of Kewzing Bakhim GPU, about 29 percent of Ralong Namlung GPU, about 27 percent of Chuba Phong GPU, and about 11 percent of Tangzi Bikmat GPU dairy farmers were found in indebt. These saving, investment and indebtedness are also presented in the bar diagram above.

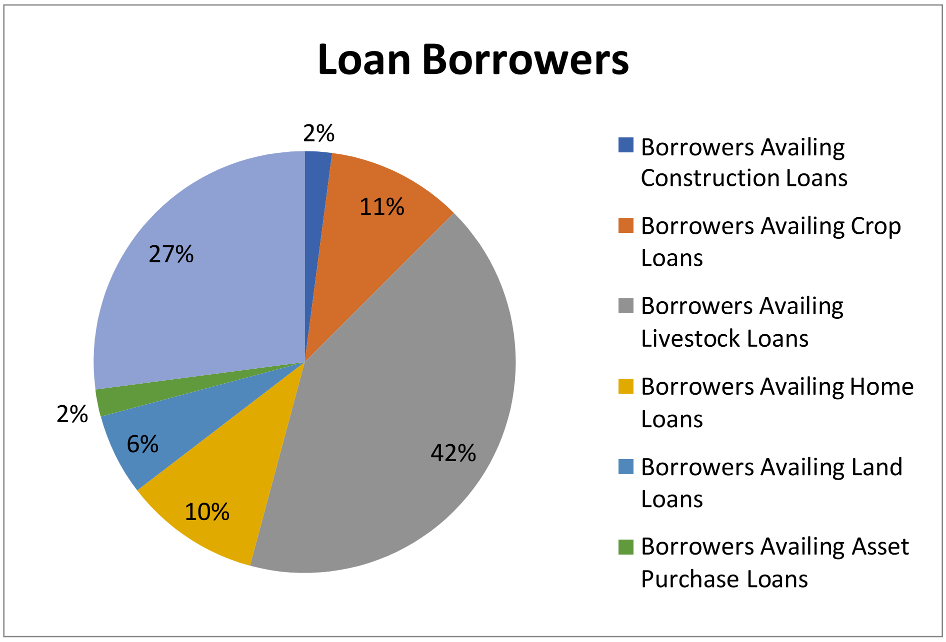
Table 6.24: Loan Borrowing among South Sikkim Dairy Farmers Classified by Loan Category

Area-Unit	Borrowers Availing						
	Construction Loans	Crop Loans	Livestock Loans	Home Loans	Land Loans	Asset Purchase Loans	Other Loans
RAVANGLA BLOCK	**-**	**5 (10.42)**	**15 (31.25)**	**2 (4.16)**	**1 (2.08)**	**-**	**6 (12.50)**
Ralong Namlung GPU	-	-	11 (22.92)	-	1 (2.08)	-	2 (4.16)
Kewzing Bakhim GPU	-	5 (10.42)	4 (8.33)	2 (4.16)	-	-	4 (8.33)
NAMCHI BLOCK	**1 (2.08)**	**-**	**5 (10.42)**	**3 (6.25)**	**2 (4.16)**	**1 (2.08)**	**7 (14.58)**
Chuba Phong GPU	1 (2.08)	-	4 (8.33)	2 (4.16)	2 (4.16)	1 (2.08)	4 (8.33)
Tangzi Bikmat GPU	-	-	1 (2.08)	1 (2.08)	-	-	3 (6.25)
SOUTH SIKKIM DT	**1 (2.08)**	**5 (10.42)**	**20 (41.67)**	**5 (10.42)**	**3 (6.25)**	**1 (2.08)**	**13 (27.08)**

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

Figure 6.18: Loan Borrowers



The table 6.24 provides information on the loan borrowing category in today's South Sikkim Dairy Farmers. These loans are classified into different categories like, construction loan, crop loan, livestock loan, home loan, land loan, asset purchase loan and other loans. When we talk about the figure of the study area, only 2 percent each of the dairy farmers have availed construction and asset purchase loan from the Namchi Block. None have availed these loans from Ravangla Block. In total, nearly 6 percent of the dairy farmers of the study area have been found availing land loans whereas none of the farmers from Kewzing Bakhim and Tangzi Bikmat GPUs have availed such loans.

Around 10 percent of the dairy farmers in the study area have been found availing crop loan and home loans whereas none of the dairy farmers have availed these loans from Ralong Namlung GPU. From all the GPUs in the study area, the highest percent of loan i.e., about 42 percent is seen to be availed in livestock purchase by the dairy farmers. Besides all these categories of loan, there are other types of loan being availed by the dairy farmers in the study area, its contribution is around 27 percent. The whole scenario of these loan borrowings is also presented in the pie diagram above.

Table 6.25: Average Total Debt, Paid and Unpaid Debt and Effective Interest Dues of South Sikkim Dairy farmers

Area-Unit	Average Total Debt (Rs.)	Average Loan Unpaid (Rs.)	Average Principal Repaid (Rs.)	Effective Interest Rate (% pa)
RAVANGLA BLOCK	**6,78,333**	**97,310**	**44,414**	**11.6**
Ralong Namlung GPU	1,51,818	67,429	19,714	12.2
Kewzing Bakhim GPU	7,68,500	1,25,200	67,467	13.0
NAMCHI BLOCK	**12,06,500**	**2,12,765**	**1,30,773**	**12.8**
Chuba Phong GPU	16,45,000	2,53,083	1,39,364	13.0
Tangzi Bikmat GPU	7,00,000	1,16,000	84,000	12.4
SOUTH SIKKIM DT	**10,60,667**	**1,39,978**	**78,025**	**12.0**

Source: Field Survey 2019-2020

A description about the average total debt, paid and unpaid debt and effective interest dues of South Sikkim dairy farmers is reflected in the table 6.25. The total average debt of the dairy farmers of the study area of all the four GPUs is Rs. 10,60,667/- out of which the average unpaid loans of all the four GPUs are Rs. 1,39,978/- and the average principal repaid amount is Rs. 78,025. The dairy farmers effective repayment interest rates range from 11-13 percent with average as 12 percent. These repayment interest rates are varied due to the different mode of loan availed by the dairy farmers in the study area.

Table 6.26: Usual Sources of Borrowing among South Sikkim Dairy-farmers

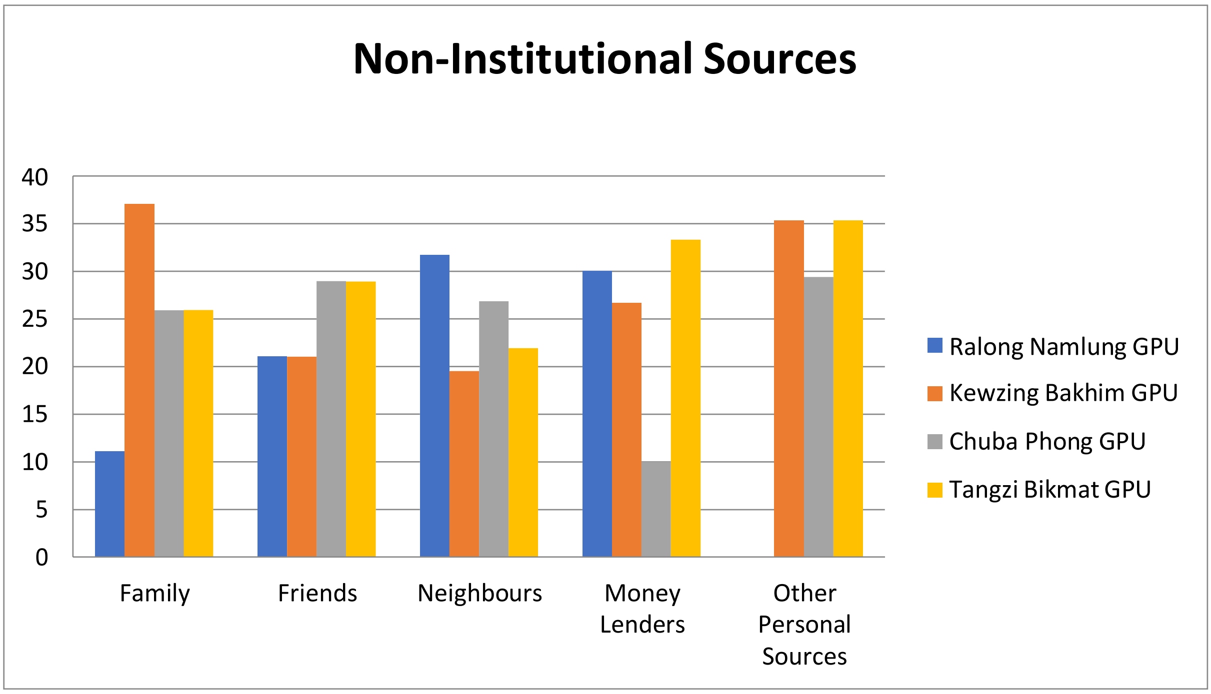
Non-Institutional Sources											
Sl. no.	Area-Unit	Fa	%	Fr	%	Ne	%	ML	%	OPS	%
1	**RAVANGLA BLOCK**	**13**	**48.2**	**16**	**42.1**	**21**	**51.2**	**17**	**56.7**	**6**	**35.29**
	Ralong Namlung GPU	3	11.1	8	21.0	13	31.7	9	30.0	-	-
	Kewzing Bakhim GPU	10	37.1	8	21.1	8	19.5	8	26.7	6	35.29
	NAMCHI BLOCK	**14**	**51.8**	**22**	**57.9**	**20**	**48.8**	**13**	**43.3**	**11**	**64.70**
	Chuba Phong GPU	7	25.9	11	28.9	11	26.8	3	10.0	5	29.41
	Tangzi Bikmat GPU	7	25.9	11	28.9	9	21.9	10	33.3	6	35.29
	SOUTH SIKKIM DT	**27**	**100**	**38**	**100**	**41**	**100**	**30**	**100**	**17**	**100**
Institutional Sources											
2	Area-Unit	BL	%	LCC	%	LGS	%	OIS	%		
	RAVANGLA BLOCK	**42**	**50.0**	**14**	**51.85**	**9**	**40.9**	**14**	**43.75**		
	Ralong Namlung GPU	21	25.0	10	37.04	7	31.8	2	6.25		
	Kewzing Bakhim GPU	21	25.0	4	14.81	2	9.09	12	35.50		
	NAMCHI BLOCK	**42**	**50.0**	**13**	**48.15**	**13**	**59.1**	**18**	**56.25**		
	Chuba Phong GPU	21	25.0	6	22.22	4	18.2	6	18.75		
	Tangzi Bikmat GPU	21	25.0	7	25.93	9	40.9	12	37.50		
	SOUTH SIKKIM DT	**84**	**100**	**27**	**100**	**22**	**100**	**32**	**100**		

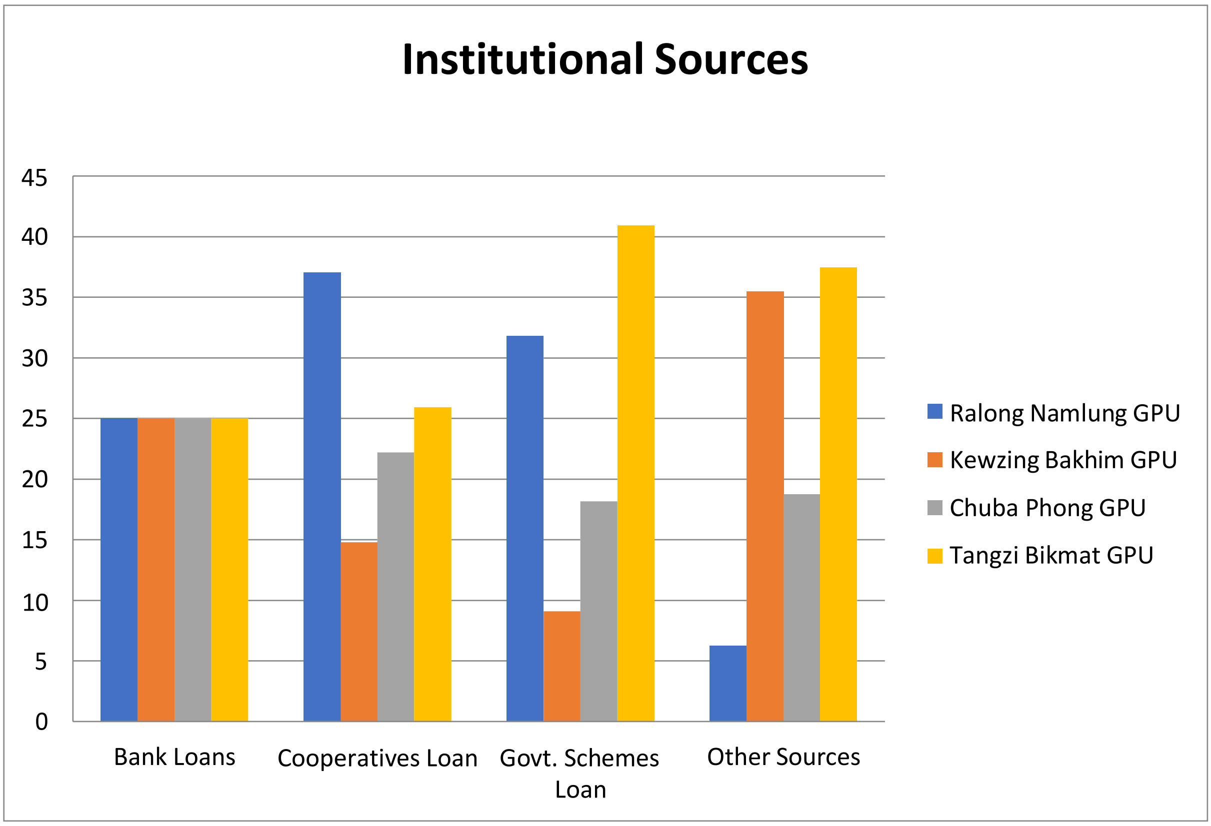
Source: Field Survey 2019-2020
Note: Fa- Family, Fr- Friends, Ne- Neighbour, ML- Money Lender, OPS- Other Personal Sources, BL- Bank Loan, LCC- Loan from Credit Cooperatives, LGS- Loan against Government Scheme, OIS- Other Institutional Sources.

The table 6.26 gives the description of the most common sources of borrowing among South Sikkim Dairy Farmers. These sources of borrowing are classified into non-institutional sources and institutional sources. The non-institutional sources of borrowing are from family, friends, neighbours, money lenders, and other personal sources. Sl. No 1 of the said table indicates the non-institutional sources of borrowing. From the total dairy farming households surveyed in the study area, 27 percent of the households fulfil their immediate need from the family. 38 percent of the dairy farming households used friends circle to fulfil their immediate needs. In the study area, 41 percent of the dairy farmers usually borrow from the neighbours to fulfil their immediate needs. In today's era also, there are money lenders found in the study area, 30 percent of the dairy farmers use this mode to fulfil both there short-term and long-term needs. Besides these, there are other personal sources too. In this category 17 percent of the dairy farmers in the study area i.e., South Sikkim use other personal sources to fulfil their immediate needs. At sl. no. 1 and 2 of the said table, percentage figure is different since the respondents of the study area respond with more than one answer that means their mode of borrowing under both the non-institutional as well as in institutional sources are more than one. Therefore, the surveyed households figure comes up more than that of surveyed households. Hence, the percentage is calculated in all the different sources.

Sl. no 2 above reflects the institutional sources of borrowing these are classified into Bank loans, Loans from Credit Cooperatives, Loan against Government Schemes, and other institutional sources. Maximum number of dairy farmers of the study area use bank loan, it contributes 84 percent in South District. 27 percent of the dairy farmers of the study area uses loan from credit cooperatives and 32 percent of the dairy farmers use other institutional sources. From the table above it has been observed that almost all the dairy farmers have the habit to borrow loans by using both institutional as well as non-institutional sources. The bar diagram below has been created for more clarity on the data.

Figure 6.19: Sources of Borrowing





: Dairy Farming Operations and Management

Table 6.27: Dairying Enterprise Status and Investment Sources among South Sikkim Dairy-farmers *(Number of respondents)*

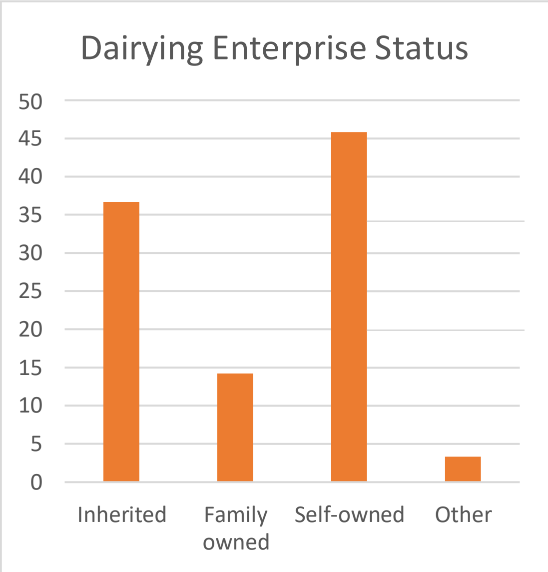
Area-Unit	TDE (yrs.)	*DAIRYING ENTERPRISE STATUS*							
		IH	%	FO	%	SO	%	O	%
RAVANGLA BLOCK	**25.8**	**24**	**20.00**	**9**	**7.50**	**26**	**21.67**	**1**	**0.83**
Ralong Namlung GPU	26.8	20	16.67	4	3.33	6	5.00	-	-
Kewzing Bakhim GPU	24.9	4	3.33	5	4.17	20	16.67	1	0.83
NAMCHI BLOCK	**25.7**	**20**	**16.67**	**8**	**6.67**	**29**	**24.17**	**3**	**2.50**
Chuba Phong GPU	23.5	10	8.33	2	1.67	16	13.33	2	1.67
Tangzi Bikmat GPU	28.0	10	8.34	6	5.00	13	10.84	1	0.83
SOUTH SIKKIM DT	**25.8**	**44**	**36.67**	**17**	**14.17**	**55**	**45.83**	**4**	**3.33**

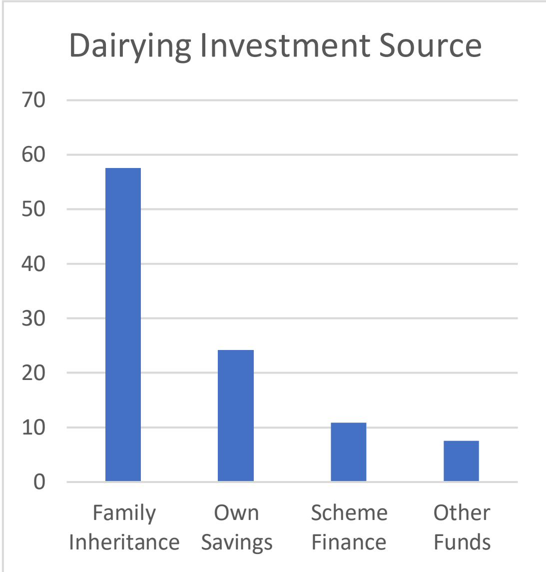
Area-Unit	*DAIRYING INVESTMENT SOURCES*							
	FI	%	OS	%	SF	%	OF	%
RAVANGLA BLOCK	**38**	**31.67**	**11**	**9.17**	**9**	**7.50**	**2**	**1.67**
Ralong Namlung GPU	18	15.00	5	4.17	6	5.00	1	0.83
Kewzing Bakhim GPU	20	16.67	6	5.00	3	2.50	1	0.83
NAMCHI BLOCK	**31**	**25.83**	**18**	**15.00**	**4**	**3.33**	**7**	**5.83**
Chuba Phong GPU	13	10.84	12	10.00	3	2.50	2	1.67
Tangzi Bikmat GPU	18	15.00	6	5.00	1	0.83	5	4.17
SOUTH SIKKIM DT	**69**	**57.50**	**29**	**24.17**	**13**	**10.84**	**9**	**7.50**

Source: Field Survey 2019-2020

Note- TDE- Total Dairy Farming Experience, IH- Inherited, FO- Family Owned, SO- Self Owned, O- Other, FI- Family Inheritance, OS- Own Savings, SF- Scheme Finance, OF- Other Finance.

Figure 6.20: Dairying Enterprise and Investment Source





The table 6.27 and figure 6.20 reveals the dairying enterprise status and investment sources among South Sikkim dairy farmers. The total dairying experience of the dairy farmers was also surveyed.

In the average the dairy farmers of the study area were found to have an experience of approximately 26 years in dairy farming. A majority of approx. 46 percent had self owned it, followed by 37 percent who had inherited it from their parents and grandparents. Nearly 14 percent respondent had their family owned dairy farming and a meagre 3 percent were found having experience through other means apart from those listed above.

The sources of investment for establishing/practising dairy farming by the farmers of the study area were through own savings, scheme finance, family inheritance and through other funds as well. Majority of dairy farmer approx. 58 percent inherited dairying, it was passed onto them free of cost. Nearly 24 percent made investment through their own savings. Almost 11 percent of the respondent invested in dairying through scheme finance and approx. 8 percent got it sourced through other funds.

Table 6.28: Livestock Holdings among South Sikkim Dairy-farmers

(Number of animals)

Sl. no.	Area-Unit	Average Bovine Livestock	Average Ovine Livestock	Average Porcine Livestock
1	**RAVANGLA BLOCK**	**5.6**	**2.0**	**0.8**
	Ralong Namlung GPU	6.5	1.1	0.9
	Kewzing Bakhim GPU	4.6	2.9	0.6
	NAMCHI BLOCK	**5.5**	**2.9**	**0.4**
	Chuba Phong GPU	6.3	2.9	0.3
	Tangzi Bikmat GPU	4.7	2.9	0.4
	SOUTH SIKKIM DT	**5.6**	**2.5**	**0.6**
2	Area-Unit	Mature Cows	Cows in Milk	Cattle Yearlings
	RAVANGLA BLOCK	**2.4**	**1.5**	**1.4**
	Ralong Namlung GPU	2.9	1.6	1.6
	Kewzing Bakhim GPU	1.9	1.3	1.2
	NAMCHI BLOCK	**2.0**	**1.6**	**1.5**
	Chuba Phong GPU	2.1	1.8	1.7
	Tangzi Bikmat GPU	1.9	1.3	1.3
	SOUTH SIKKIM DT	**2.2**	**1.5**	**1.5**
3	Area-Unit	Indigenous Cattle Breeds	Exotic Cattle Breeds	Cross Breed Cattle
	RAVANGLA BLOCK	**1.7**	**0.2**	**1.8**
	Ralong Namlung GPU	2.0	0.2	2.0
	Kewzing Bakhim GPU	1.3	0.1	1.6
	NAMCHI BLOCK	**1.5**	**0.2**	**2.0**
	Chuba Phong GPU	1.6	0.1	2.3
	Tangzi Bikmat GPU	1.3	0.2	1.7
	SOUTH SIKKIM DT	**1.6**	**0.2**	**1.9**
4	Area-Unit	Breeding Bulls	Bullocks	
	RAVANGLA BLOCK	**0.1**	**0.2**	
	Ralong Namlung GPU	0.2	0.3	
	Kewzing Bakhim GPU	0.1	0.1	
	NAMCHI BLOCK	**0.1**	**0.4**	
	Chuba Phong GPU	0.1	0.7	
	Tangzi Bikmat GPU	0.1	0.1	
	SOUTH SIKKIM DT	**0.1**	**0.3**	

Source: Field Survey 2019-2020

The table 6.28 throws light on the Livestock Holding among South Sikkim Dairy farmers. Out of the six most common livestock types, details of the three i.e., cattle, sheep and pigs have been collected as these were predominant in the study area. Rest of three chickens, ducks and goats have not been touched upon. Cattles or bovine livestock make up the largest group of livestock worldwide. In the study area too, it is the largest with 5 to 6 animals in every household. Sheep or the ovine livestock are among the first few animals which were domesticated. They are raised primarily for wool and meat. In the study area the average ovine livestock was recorded as 2.5. Ralong Namlung GPU in Ravangla Block however had a smaller number of ovine. Pigs forming the porcine livestock are raised for meat since ancient times. They are fed with leftover food by households. The average porcine livestock in the study area was 0.6. A study was also done on the number of mature cows, cows in milk and cattle yearlings that a household reared in the study area. On an average it was seen that a household had 2 to 3 mature cows, 1 to 2 cows in milk and cattle yearlings also 1 to 2.

Study on the breed of cattles/bovine livestock was done. It revealed that on an average a household had 1 to 2 indigenous cattle breeds. A very less number only 0.2 exotic cattle breed was reported. However, the average of cross breed cattle was 2 numbers. A huge scarcity of breeding bulls was seen in the study area. The indigenous cattle, SIRI breeding bull was especially reared in a farm in Ralong Namlung GPU so that the indigenous cattle of SIRI breed are kept alive and intact. Bullocks was used both for drought power and as a breeding bull in the study area. However, its number was also found quite less in all the four GPUs.

Table 6.29: Cattle-shed Infrastructure for Dairying by South Sikkim Dairy-farmers

Sl. no.	Area-Unit	Straw Cattle-shed	GCI-Sheet Cattle-shed	RCC Shed Cattle-shed	Other Cattle-shed
1	**RAVANGLA BLOCK**	**21 (16.53)**	**35 (27.55)**	**4 (3.15)**	**2 (1.57)**
	Ralong Namlung GPU	16 (12.59)	14 (11.02)	1 (0.78)	-
	Kewzing Bakhim GPU	5 (3.93)	21 (16.53)	3 (2.36)	2 (1.57)
	NAMCHI BLOCK	**8 (6.29)**	**50 (39.37)**	**5 (3.93)**	**2 (1.57)**
	Chuba Phong GPU	7 (5.51)	21 (16.53)	4 (4.15)	1 (0.78)
	Tangzi Bikmat GPU	1 (0.78)	29 (22.83)	1 (0.78)	1 (0.78)
	SOUTH SIKKIM DT	**29 (22.83)**	**85 (66.93)**	**9 (7.08)**	**4 (3.15)**

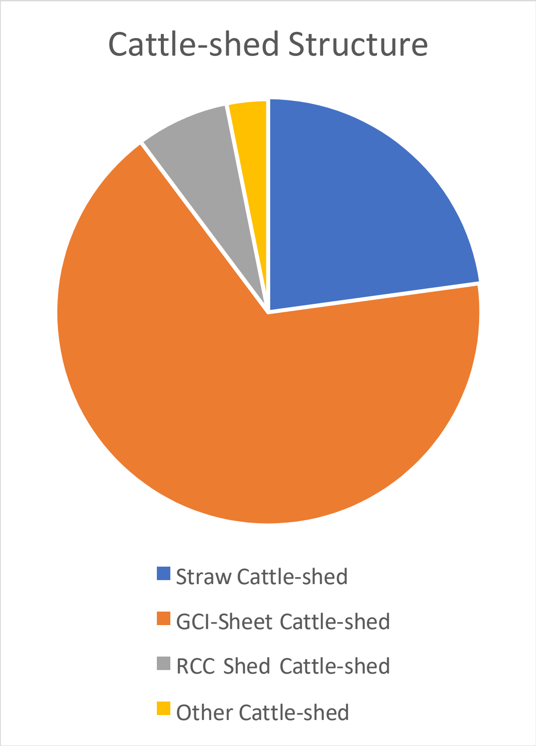
Sl. no.	Area-Unit	Cattle-shed Size (sq.m)	Cattle-shed Age in years
2	**RAVANGLA BLOCK**	**28.9**	**7.2**
	Ralong Namlung GPU	28.9	6.8
	Kewzing Bakhim GPU	28.9	7.7
	NAMCHI BLOCK	**37.8**	**9.1**
	Chuba Phong GPU	48.5	8.3
	Tangzi Bikmat GPU	27.2	9.9
	SOUTH SIKKIM DT	**33.4**	**8.2**

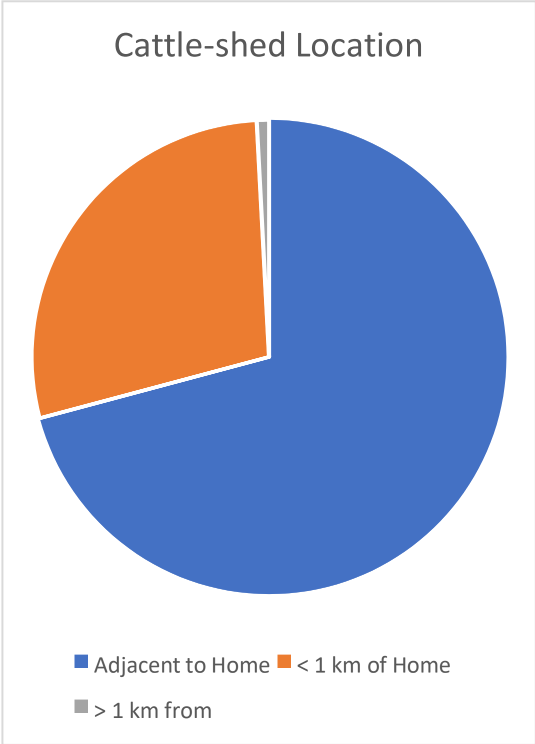
Sl. no.	Area-Unit	*CATTLE-SHED LOCATION*		
		Adjacent to Home	< 1 km of Home	> 1 km from Home
3	**RAVANGLA BLOCK**	**33 (27.50)**	**27 (22.50)**	**-**
	Ralong Namlung GPU	7 (5.83)	23 (19.17)	-
	Kewzing Bakhim GPU	26 (21.67)	4 (3.33)	-
	NAMCHI BLOCK	**52 (43.33)**	**7 (5.83)**	**1 (0.83)**
	Chuba Phong GPU	25 (20.83)	4 (3.33)	1 (0.83)
	Tangzi Bikmat GPU	27 (22.50)	3 (2.50)	-
	SOUTH SIKKIM DT	**85 (70.83)**	**34 (28.33)**	**1 (0.83)**

Source: Field Survey 2019-2020,

Note: Figure in Parenthesis are Percentage.

Figure 6.21: Structure and Location of Cattle-shed





The table 6.29 and figure 6.21 throw light on the cattle shed infrastructure for dairying by South Sikkim dairy farmers. on the average, approx. 67 percent dairy farmers were found to have cattle shed with GCI sheet roofing, approx. 23 percent had straw cattle shed, 7 percent had a pucca RCC cattle shed and a few nearly 3 percent had other types of cattle shed. The average size of the cattle shed was 33.4 sq. m. and its life was a little more than 8 years. Approx. 71 percent dairy farmers had it located adjacent to their homes. Approx. 28 percent had it within a kilometre away from their home and barely 1 percent had in more than 1 kilometre away from their home. It has been observed that in Ravangla Block and in Tangzi Bikmat GPU under Namchi Block no dairy farmer has built his cattle shed more than one kilometre from his home.

Table 6.30: Labour Engagement for Dairying and Farming Operations among South Sikkim Dairy-farmers

(Persons engaged)

Sl. no.	Area-Unit	Total Dairy Labour	Male Family Dairy-labour	Female Family Dairy-labour	Male Hired Dairy-labour	Female Hired Dairy-labour
1	**RAVANGLA BLOCK**	**136 (55.51)**	**62 (25.31)**	**34 (13.88)**	**28 (11.43)**	**12 (4.90)**
	Ralong Namlung GPU	79 (32.24)	32 (13.06)	22 (8.98)	17 (6.94)	8 (3.26)
	Kewzing Bakhim GPU	57 (23.27)	30 (12.15)	12 (4.90)	11 (4.49)	4 (1.63)
	NAMCHI BLOCK	**109 (44.49)**	**60 (24.49)**	**31 (12.65)**	**14 (5.71)**	**4 (1.63)**
	Chuba Phong GPU	67 (27.35)	32 (13.06)	25 (10.20)	8 (3.26)	2 (0.82)
	Tangzi Bikmat GPU	42 (17.14)	28 (11.43)	6 (2.45)	6 (2.45)	2 (0.82)
	SOUTH SIKKIM DT	**245 (100.00)**	**122(49.79)**	**65 (26.53)**	**42 (17.14)**	**16 (6.53)**
2	Area-Unit	Total Farm Labour	Male Farm-labour	Female Farm-labour	Male Hired Farm-labour	Female Hired Farm-labour
	RAVANGLA BLOCK	**183 (51.40)**	**67 (18.82)**	**50 (14.04)**	**39 (10.95)**	**27 (7.58)**
	Ralong Namlung GPU	109 (30.62)	35 (9.83)	30 (8.42)	29 (8.15)	15 (4.21)
	Kewzing Bakhim GPU	74 (20.78)	32 (8.99)	20 (5.62)	10 (2.80)	12 (3.37)
	NAMCHI BLOCK	**173 (48.59)**	**70 (19.66)**	**35 (9.83)**	**50 (14.04)**	**18 (5.05)**
	Chuba Phong GPU	100 (28.09)	35(9.83)	26 (7.30)	25 (7.02)	14 (3.93)
	Tangzi Bikmat GPU	73 (20.50)	35 (9.83)	9 (2.53)	25 (7.02)	4 (1.12)
	SOUTH SIKKIM DT	**356 (100.00)**	**137(38.48)**	**85 (23.88)**	**89 (25.00)**	**45(12.64)**
3	Area-Unit		Full-time Dairy Farmers		Part-time Dairy Farmers	
	RAVANGLA BLOCK		**38 (31.67)**		**22 (18.33)**	
	Ralong Namlung GPU		22 (18.33)		8 (6.67)	
	Kewzing Bakhim GPU		16 (13.33)		14 (11.67)	
	NAMCHI BLOCK		**51 (42.50)**		**9 (7.50)**	
	Chuba Phong GPU		26 (21.67)		4 (3.33)	
	Tangzi Bikmat GPU		25 (20.83)		5 (4.17)	
	SOUTH SIKKIM DT		**89 (74.17)**		**31 (25.83)**	

Source: Field Survey 2019-2020,
Note: Figure in Parenthesis are Percentage.

The table 6.30 provides details on the labour engagement for dairying and farming operations among South Sikkim dairy farmers. They reported that in an average the dairy farmers of the study area engaged 245 labours annually out of which approx. 76 percent comprised of their family members and 24 percent comprised hired labours. In total approx. 50 percent were male family dairy labour, approx. 27 percent were female family dairy labour, approx. 17 percent were male hired dairy labour and approx. 7 percent were female hired dairy labour. The participation of females in dairy was seen to be quite less compared to male population.

Similarly, study on the farm labour was also done. It revealed that the dairy farmers engaged 356 labours annually out of which approx. 62 percent comprised family members and approx. 38 percent comprised hire labours. In total approx. 38 percent were male family farm labour, approx. 24 percent were female family farm labour, 25 percent were male hired farm labour and approx. 13 percent female hired farm labour.

The participation of females in farm labour was also quite less as compared to that of males. Approximately 74 percent were fulltime dairy farmers and approx. 26 percent were part time dairy farmers. Full time dairy farmers comprised of those whose 100 percent livelihood depended on dairy farming and allied farming including production and marketing of dairy products. Parttime dairy farmers were those whose main occupation was either Government service or those working in private firms. They practised dairy side by side to fulfil their religious needs and to respect the sentiments of senior citizens in the family who had inherited it from their forefathers.

Table 6.31a: Labour Engagement by South Sikkim Dairy-farmers for Cattle-washing

(Persons engaged)

Sl. no.		Cattle Washing-frequency				
1	Area-Unit	Once Weekly	Once Monthly	Occasionally		
	RAVANGLA BLOCK	**13 (10.83)**	**2 (1.66)**	**45 (37.50)**		
	Ralong Namlung GPU	-	1 (0.83)	29 (24.17)		
	Kewzing Bakhim GPU	13 (10.83)	1 (0.83)	16 (13.33)		
	NAMCHI BLOCK	**6 (5.00)**	**1 (0.83)**	**53 (44.17)**		
	Chuba Phong GPU	6 (5.00)	1 (0.83)	23 (19.16)		
	Tangzi Bikmat GPU	-	-	30 (25.00)		
	SOUTH SIKKIM DT	**19 (15.83)**	**3 (2.50)**	**98 (81.67)**		
2		**Worker used for Washing of Cattles**				
	Area-Unit	Total Workers	Family Males	Family Females	Hired Males	Hired Females
	RAVANGLA BLOCK	**104 (55.61)**	**56 (29.94)**	**28 (14.97)**	**13 (6.95)**	**7 (3.74)**
	Ralong Namlung GPU	56 (29.94)	29 (15.51)	13 (6.95)	8 (4.27)	6 (3.20)
	Kewzing Bakhim GPU	48 (25.67)	27 (14.44)	15 (8.02)	5 (2.67)	1 (0.53)
	NAMCHI BLOCK	**83 (44.38)**	**57 (30.48)**	**13 (6.95)**	**12 (6.41)**	**1 (0.53)**
	Chuba Phong GPU	46 (24.59)	29 (15.51)	11 (5.88)	6 (3.20)	-
	Tangzi Bikmat GPU	37 (19.78)	28 (14.97)	2 (1.06)	6 (3.20)	1 (0.53)
	SOUTH SIKKIM DT	**187 (100.00)**	**113 (60.43)**	**41 (21.93)**	**25 (13.37)**	**8 (4.27)**

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

The table 6.31a shows details on the labour engagement for cattle washing by South Sikkim dairy farmers. The survey revealed that approx. 16 percent of dairy farmers washed their cattle once a week. Approx. 2 percent washed them only once a month. A huge approx. 82 percent washed their cattle's occasionally on the actual need basis.

For farmers who practise dairy farming in a larger scale, they need to even hire workers for washing the cattle. In the survey of the study area, it was found that in a year 187 workers were used in washing of cattle's, out of which approx. 82 percent were family members and 18 percent had to be hired. In total approx. 61 percent of the workers were male members in the family, approx. 22 percent were female members, approx. 13 percent were hired males and approx. 4 percent were hired females. The male's participation is seen to exceed the female participation greatly.

Table 6.31b: Labour Engagement by South Sikkim Dairy-farmers for Cattle-shed cleaning

(Persons engaged)

Sl. no.		Cattle-shed cleaning frequency			
1	Area-Unit	Once Weekly	Once Monthly	Occasio-nally	Total
	RAVANGLA BLOCK	**54 (45.00)**	**5 (4.16)**	**1 (0.83)**	**60 (50.00)**
	Ralong Namlung GPU	28 (23.33)	2 (1.66)	-	30 (25.00)
	Kewzing Bakhim GPU	26 (21.66)	3 (2.50)	1 (0.83)	30 (25.00)
	NAMCHI BLOCK	**50 (41.66)**	**8 (6.66)**	**2 (1.66)**	**60 (50.00)**
	Chuba Phong GPU	22 (18.33)	6 (5.00)	2 (1.66)	30 (25.00)
	Tangzi Bikmat GPU	28 (23.33)	2 (1.66)	-	30 (25.00)
	SOUTH SIKKIM DT	**104 (86.67)**	**13 (10.83)**	**3 (2.50)**	**120 (100.00)**

		Worker used for Cattle-shed cleaning				
2	Area-Unit	Total Workers	Family Males	Family Females	Hired Males	Hired Females
	RAVANGLA BLOCK	**107 (55.44)**	**58 (30.05)**	**30 (15.54)**	**14 (7.25)**	**5 (2.59)**
	Ralong Namlung GPU	59 (30.56)	31 (16.06)	15 (7.77)	9 (4.66)	4 (2.07)
	Kewzing Bakhim GPU	48 (24.87)	27 (13.99)	15 (7.77)	5 (2.59)	1 (0.52)
	NAMCHI BLOCK	**86 (44.56)**	**54 (27.98)**	**21 (10.88)**	**9 (4.66)**	**2 (1.04)**
	Chuba Phong GPU	50 (25.91)	27 (13.99)	18 (9.33)	4 (2.07)	1 (0.52)
	Tangzi Bikmat GPU	36 (18.65)	27 (13.99)	3 (1.55)	5 (2.59)	1 (0.52)
	SOUTH SIKKIM DT	**193 (100.00)**	**112 (58.03)**	**51 (26.42)**	**23 (11.92)**	**7 (3.63)**

Source: Field Survey 2019-2020
Note: Figure in Parenthesis are Percentage

The table 6.31b shows details on the labour engagement for cattle shed cleaning by South Sikkim dairy farmers. The data collected from study area revealed that approx. 87 percent dairy farmers cleaned the cattle shed once in a week. Approx. 11 percent cleaning it once a month and approx. 2 percent cleaned the cattle shed occasionally as and when required.

A study on workers engaged for cattle shed cleaning in the study area revealed that out of 193 workers engaged for it in a year, approx. 84 percent were family members and 16 percent were hired by those who practised dairy farming in a larger scale. In total it was seen that approx. 58 percent were male members of the family. Approx. 26 percent were female members of the family, approx. 12 percent were hired male members and approx. 4 percent were hired female members. The involvement of male population is high in cattle shed cleaning too.

Table 6.31c: Dairying Practices Chart: Common Grasses/Trees used as Fodder in Sikkim

Locally Available Common Grasses/Trees with Scientific/ Botanical name:
Amlisho – Thysanolaena maxima
Baar – Terminalia bellerica
Badar – Artocarpus lakoocha
Khanew – Ficus semicordata
Khari – Celtis australis
Kutmero – Litsea monopetala
Nebharo – Ficus hookeriana
Napier- Pennisetum purpureum
Bamboo- Bambusoideae
Banana plant- Musa sp
Maize plant- Zea mays subsp. mays
Hay- Alfalfa (Medicago sativa L.)
Common grasses/trees in local name:
Trees-Parari, Seeduray, Salfosro, Kabro, Takhi, Churi, Harra, Falath, Ningalo, Parang, Gayo, Kaulo, Tuni, etc.
Grass- Salimboo, Dudayjhar, Kurojhar, Ilamay, Kharukhi, Dubo, Banso, etc.

Source: Field Survey 2019-2020

Table 6.31d: Fodder Saplings and cuttings distributed to the Dairy Farmers, SHGs, NGOs from fodder seed farm

Sl.No	Type of Fodder Saplings/Slips distributed	No. of Saplings/Slip distributed (Study area)	Total No. of beneficiaries availed benefits (Study area)
1	Hybrid Napier	125962	500
2	Guinea grass	112750	50
3	Amliso	-	-
4	Signal grass	27125	-
5	Hamel grass	23730	15
6	Desmodium	250	5

Source: Field Survey, 2019-2020, Department of Animal Husbandry, 2016, GOS.

In the study area, the department of animal husbandry distributed 10 metric tonnes (MT) of oat seed and 2 metric tonnes (MT) of maize seed as part of a fodder seed distribution programme to help make up for a shortage of green fodder during the area's long, dry winter. In part because the feed is so nutritious, this approach is gaining traction among farmers. Farmers were urged to save the third cuttings from their oat crops to use as seed, so that they could meet their own seed needs. Winter feed, such as oat seeds and maize, was in high demand, therefore this prompted them to increase the land dedicated to its growth.

Table 6.32: Fodder Materials and Grazing Hours used by the South Sikkim Dairy-farmers for Feeding Livestock

Area-Unit	Average Grazing Hours		Fodder Materials (Purchased)			
	Summer	Winter	Oilcake	Maize Husks	Straw and Hay	Other
RAVANGLA BLOCK	**6.5**	**5.9**	**50**	**40**	**21**	**14**
Ralong Namlung GPU	6.8	5.8	23	26	14	6
Kewzing Bakhim GPU	6.1	6.0	27	14	7	8
NAMCHI BLOCK	**6.3**	**5.9**	**60**	**16**	**8**	**16**
Chuba Phong GPU	6.6	5.9	30	5	5	7
Tangzi Bikmat GPU	6.0	6.0	30	11	3	9
SOUTH SIKKIM DT	**6.4**	**5.9**	**110**	**56**	**29**	**30**
South Sikkim (%)	**-**	**-**	**91.67**	**46.67**	**24.17**	**25.00**
Area-Unit	Fodder Materials (Locally available-non purchased)					
	Amliso Broom Grass	Napier Grass	Plantain Leaves	Nebharo Leaves	Khari Trees	Other Local Trees
RAVANGLA BLOCK	**45**	**43**	**31**	**26**	**7**	**8**
Ralong Namlung GPU	30	29	17	21	2	4
Kewzing Bakhim GPU	15	14	14	5	5	4
NAMCHI BLOCK	**16**	**16**	**5**	**5**	**4**	**11**
Chuba Phong GPU	5	5	3	2	2	4
Tangzi Bikmat GPU	11	11	2	3	2	7
SOUTH SIKKIM DT	**61**	**59**	**36**	**31**	**11**	**19**
South Sikkim (%)	**50.83**	**49.17**	**30.00**	**25.83**	**9.17**	**15.83**

Source: Field Survey 2019-2020

The table 6.32 throws light on the fodder materials and grazing hours used by the South Sikkim Dairy farmers for feeding livestock. Oilcake is found to be the most common fodder material purchased by the dairy farmers in the study area. Almost 92 percent of the dairy farmers were found to purchase it. Maize husk is another type of fodder material, almost half approximately 47 percent of dairy farmers purchase it for fodder. Straw and hay and fodder material other than these are used by approximately 25 percent of dairy farmers in the study area. It was found that dairy farmers rely on all the different types of fodder materials. They are used simultaneously. Farmers in the study area were found not only feeding the cattle in the shed, but also allowing them to graze in the nearby private land for a few hours a day. Grazing hours for the cattle is almost same in all the GPUs in both the blocks. It being 6.4 hours in a day in summer season and 5.9 hours in a day in winter season.

There are many other fodder materials in the study area which are locally available and need not be purchased by the dairy farmers. Amliso Broom Grass scientific name Thysanolaena maxima is the most popular one. It is almost 51 percent of the dairy farmers use it as fodder, closely followed by Napier Grass which is used by approximately 50 percent dairy farmers. Plantain leaves (Banana leaves) are used by 30 percent followed by Nebharo leaves approximately 26 percent. Nearly 16 percent dairy farmers in the study area use fodder available from other local trees and ground grasses in the study area. Only 10 percent dairy farmers are found to obtain fodder from Khari tree as well. Here also, different types of these locally available fodder are used simultaneously or in rotation by the dairy farmers.

Table 6.33: Typical Feeding Material Quantities and Costs for South Sikkim Dairy-farmers

Area-Unit	AMC	Green Fodder	Fodder -grass	Straw/ Hay	Cho-ker	Other Feed	Water	Avg. Feed Value
		kg/week					Litres/ day	(Rs.)
RB	**2.5**	**532.0**	**177.3**	**133.0**	**44.3**	**44.3**	**532.0**	**1,108.33**
RN GPU	3.0	630.0	210.0	157.5	52.5	52.5	630.0	1,312.50
KB GPU	2.1	434.0	144.7	108.5	36.2	36.2	434.0	904.17
NB	**2.5**	**521.5**	**173.8**	**130.4**	**43.5**	**43.5**	**521.5**	**1,086.46**
CP GPU	2.8	581.0	193.7	145.3	48.4	48.4	581.0	1,210.42
TB GPU	2.2	462.0	154.0	115.5	38.5	38.5	462.0	962.50
SS DT	**2.5**	**526.8**	**175.6**	**131.7**	**43.9**	**43.9**	**526.8**	**1,097.40**
Area-Unit	AY	Green Fodder	Fodder -grass	Straw/ Hay	Cho-ker	Other Feed	Water	Avg. Feed Value
		kg/week					Litres/ day	(Rs.)
RB	**1.4**	**14.9**	**5.0**	**5.0**	**1.3**	**1.3**	**14.9**	**32.23**
RN GPU	1.6	16.8	5.6	5.6	1.5	1.5	16.8	36.40
KB GPU	1.2	13.0	4.3	4.3	1.1	1.1	13.0	28.06
NB	**1.5**	**15.9**	**5.3**	**5.3**	**1.4**	**1.4**	**15.9**	**34.50**
CP GPU	1.7	17.9	6.0	6.0	1.5	1.5	17.9	38.68
TB GPU	1.3	14.0	4.7	4.7	1.2	1.2	14.0	30.33
SS DT	**1.5**	**15.4**	**5.1**	**5.1**	**1.3**	**1.3**	**15.4**	**33.37**

Source: Field Survey 2019-2020

Note: RB-Ravangla Block, NB-Namchi Block, SS DT- South Sikkim District Total, RN-Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat, AMC- Avg. No. of Mature Cattle, AY- Avg. No. of Yearlings

The table 6.33 elaborates on the typical feeding material, its quantity and cost for the South Sikkim Dairy farmers. Study has been done for both Mature Cattle and Yearlings separately. Almost similar type of data is found in the entire study area, on the average a dairy farmer is found to own 2-3 Mature Cattles. It consumed approximate 526.8 kg of green fodder per week, 175.6 kg of fodder grass per week, 131.7 kg of straw and hay per week, 43.9 kg of choker per week and 432.9 kg of other feed per week. Average water consumption was found to be approximate of 526.8 litres per day (for the preparation of feed, bathing, washing and cleaning cattle shed, etc.) and the average value of feed amounted to Rs. 1,097/- per week.

Similarly, a dairy farmer was found to own 1-2 numbers of Yearlings in the entire study area. It consumed 15.4 kg of green fodder per week, 5.1 kg of fodder grass per week, 5.1 kg of straw/hay per week, 1.3 kg of choker per week and 1.3 kg of other feed per week. Water consumed by the Yearling was recorded as 15.4 litres per day. The average value of feed was Rs. 33.37 per week.

Patterns of milk production, technical efficiency, consumption, collection, and marketing system in Sikkim

Table 6.34: Average Dairy Production, Consumption and Sales by Dairy-Farmers

Area-Unit	Prime Dairy-months	Slack Dairy-months	In-season Yield Lt/day	Off-season Yield Lt/day	Household Consumption Lt/day	
RAVANGLA BLOCK	**7.5**	**4.5**	**9.2**	**6.0**	**2.8**	
Ralong Namlung GPU	7.7	4.3	10.4	7.0	3.0	
Kewzing Bakhim GPU	7.2	4.7	8.1	5.0	2.7	
NAMCHI BLOCK	**6.9**	**5.1**	**9.6**	**5.1**	**2.3**	
Chuba Phong GPU	7.3	4.7	10.8	5.8	2.0	
Tangzi Bikmat GPU	6.5	5.5	8.4	4.4	2.5	
SOUTH SIKKIM DT	**7.2**	**4.8**	**9.4**	**5.6**	**2.6**	
Area-Unit	In-season Sale Lt/day	Off-season Sale Lt/day	In-season Sale (Rs)	Off-season Sale (Rs)	Annual Sale (Rs)	Other Dairy Sale (Rs)
RAVANGLA BLOCK	**7.1**	**3.9**	**324**	**184**	**63,912**	**11,362**
Ralong Namlung GPU	8.2	4.9	354	227	77,967	14,367
Kewzing Bakhim GPU	6.0	2.9	294	142	49,857	8,357
NAMCHI BLOCK	**7.4**	**2.7**	**373**	**134**	**68,383**	**5,483**
Chuba Phong GPU	8.5	3.4	425	172	87,267	8,600
Tangzi Bikmat GPU	6.4	2.0	322	97	49,500	2,367
SOUTH SIKKIM DT	**7.3**	**3.3**	**348**	**159**	**66,148**	**8,423**

Source: Field Survey 2019-2020

The table 6.34 throws light on the current dairy production and sales by South Sikkim Dairy-farmers. The data collected from the study area revealed that in a year, 7 months are the prime dairy months and almost 4-5 months are slack dairy months thereby meaning that they get good milk yield from the cattle for 7 months in a year thereafter for the rest of the 5 months the yield decreases. Average milk yield in the In-season was approximately 9 litres per day and it decreased to nearly 6 litres per day in the off-season. However, the household consumption of Ralong Namlung GPU is recorded as 3.0 litres per day in the average.

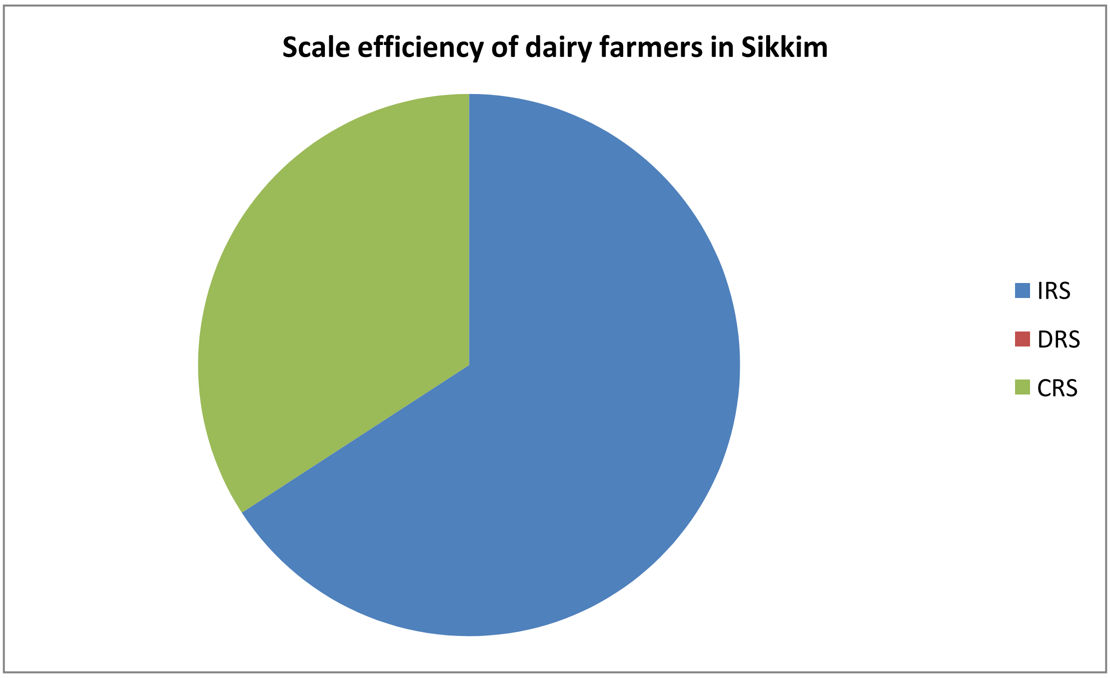
Likewise, Kewzing Bakhim GPU is 2.7 litres per day, Chuba Phong GPU 2.0 litres per day and Tangzi Bikmat GPU is 2.5 litres per day. The consumption pattern is different in all the GPUs and according to the respondents of the study area this consumption pattern remained almost the same throughout the year, with the average of 2.6 litre per day. Survey also revealed the data on sale of milk, it was found that in the In-season a dairy-farmer can sell approx. 7 litre of milk per day, the same reduced to approx. 3 litre per day in Off-season. A dairy farmer sold milk worth Rs. 348/- in In-season and only worth Rs. 159/- in Off-season. The average money earned annually through the sale of milk in both In and Off season amounted to approx. Rs. 66,000/-. The annual sale of other dairy items fetched him/her approx. Rs. 8,000/-.

Table 6.35: Frequency distribution of technical and scale efficiency coefficients of dairy farmers

Efficiency level	Technical Efficiency (at CRS)	Technical Efficiency (at VRS)	Scale
less than 0.1	3	3	0
0.11-0.2	16	15	0
0.21-0.3	24	20	1
0.31-0.4	22	24	1
0.41-0.5	24	22	0
0.51-0.6	19	10	4
0.61-0.7	4	5	6
0.71-0.8	5	5	9
0.81-0.9	1	4	9
0.91-0.99	1	3	49
1	1	9	41
mean	0.39	0.449	0.917

Source: Field Survey, 2019-2020, Authors Calculations

Figure 6.22: Scale efficiency of dairy farmers in Sikkim



Source: Field Survey, 2019-2020, Authors Calculations

To evaluate the efficiency of dairy production using village/farm level survey data from 120 dairy farmer households in South Sikkim in 2019-2020. Data Envelopment Analysis (DEA) results reveal Constant Return to Scale (CRS) and Variable Return to Scale (VRS) technical efficiency in South Sikkim dairy production. Feed, labour, vaccines, medicines, transportation, equipment, and cow shed are major variable expenditures in South Sikkim dairy farms. Human labour and its salary rate, dairy feed value in kg, and the price of manufactured or premade dairy feed in kg were utilised to determine technical efficiency. These were chosen as the primary variable costs.

Other variable costs, including medicine, transportation, and depreciation, were presented aggregately but not by volume or quantity. The table 6.35 shows the frequency distribution and summary statistics of DEA frontier efficiency estimates. Given the computed efficiency's unpredictability (lowest efficiency score of less than 0.1 and highest score of 1.00). The efficiency ratings were classified into eleven groups: less than 0.1, 0.11-0.2, 0.21-0.3, 0.31-0.4, 0.41-0.5, 0.51-0.6, 0.61-0.7, 0.71-0.8, 0.81-0.9, 0.91-0.99 and 1.00. About 1% of the dairy farms/farmers under the CRS and about 8% of the dairy farms/farmers under VRS had fully technical efficiency level. The number of fully efficiency farmers/farms are less which means that other farmers/farms have higher potential to increase the levels of dairy products.

According to the model, maximum number of farms have a good prospect for increasing the dairy productivity thus increasing the return to scale (IRS) however the rest are able to maintain a constant productivity rate (CRS). The Mean CRS and VRS's technical efficiency were 39% and about 45% respectively of the DEA border. When CRS and VRS assumptions are utilised, the DEA reveals enormous efficiencies in Sikkim's commercial dairy industry. Sikkim's dairy industry has improved by cutting costs while maintaining output. This finding may assist policymakers to encourage more farmers into dairy farming.

Table 6.36: Receipts and Utilization of Dairy Income by Dairy farmers

Area-Unit	Avg. Annual Dairy Income (Rs)	Dairy Income used for Livestock Purchase (Rs)	Dairy Income used for Household Expenses (Rs)	Dairy Income used for Occasional Expenses (Rs)
RAVANGLA BLOCK	76,744	16,899 **(23.19)**	49,732 **(68.25)**	10,113 **(13.88)**
Ralong Namlung GPU	93,666	23,333 **(32.02)**	62,500 **(85.77)**	7,833 **(10.75)**
Kewzing Bakhim GPU	59,821	10,464 **(14.36)**	36,964 **(50.72)**	12,393 **(17.00)**
NAMCHI BLOCK	68,996	24,000 **(32.93)**	29,367 **(40.30)**	15,629 **(21.45)**
Chuba Phong GPU	86,790	31,500 **(43.23)**	49,433 **(67.84)**	5,857 **(8.04)**
Tangzi Bikmat GPU	51,200	16,500 **(22.64)**	9,300 **(12.76)**	25,400 **(34.86)**
SOUTH SIKKIM DT	72,870	20,449 **(28.06)**	39,549 **(54.27)**	12,871 **(17.67)**

Source: Field Survey 2019-2020,
Note: Figure in Parenthesis are Percentage

The table 6.36 provides details on the receipts and utilization of dairy income by South Sikkim Dairy farmers. The survey revealed that the average annual income of dairy farmers in the study area was approx. Rs. 73,000/-, the dairy farmers of Ravangla Block were seen to earn more than those of Namchi Block. Their income was used for various purposes such as for livestock purchase, household expenses and for other occasional expenses.

Approximately 54 percent of dairy farmers in the study area used their income from dairy for meeting their household expenses. Nearly 28 percent used it for purchasing livestock. The remaining approx. 18 percent dairy farmers were found using their income for meeting other occasional expenses like fulfilling social obligations, etc. The same has been depicted through a clustered column chart below. It has been used to compare valued across a few categories like income used for livestock purchase, household expenses and occasional expenses.

Figure 6.23: Utilization of Dairy Income

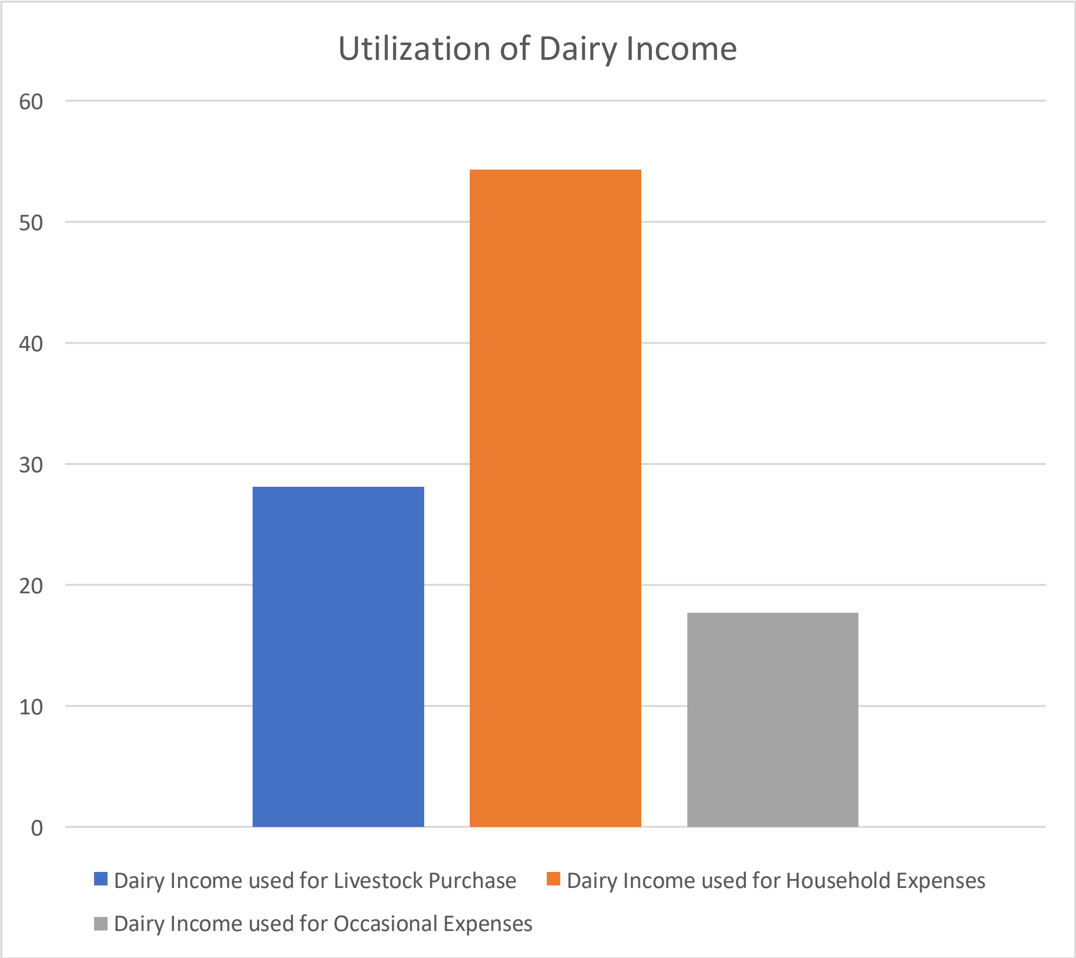


Table 6.37: Cattle Purchases by South Sikkim Dairy-farmers

Area-Unit	Cattle Purchased	Young Animals	Prime Animals	Other Animals	Average Age (yrs.)
RAVANGLA BLOCK	**21 (43.75)**	**12 (25.00)**	**7 (14.58)**	**2 (4.16)**	**3.8**
Ralong Namlung GPU	13 (27.08)	8 (16.66)	4 (8.33)	1 (2.08)	4.3
Kewzing Bakhim GPU	8 (16.66)	4 (8.33)	3 (6.25)	1 (2.08)	3.4
NAMCHI BLOCK	**27 (56.25)**	**18 (37.5)**	**4 (8.33)**	**5 (10.42)**	**3.7**
Chuba Phong GPU	19 (39.58)	13 (27.08)	3 (6.25)	3 (6.25)	4.1
Tangzi Bikmat GPU	8 (16.66)	5 (10.42)	1 (2.08)	2 (4.16)	3.3
SOUTH SIKKIM DT	**48 (100.00)**	**30 (62.50)**	**11 (22.92)**	**7 (14.58)**	**3.8**

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

The table 6.37 throws light on the cattle purchases by South Sikkim Dairy-farmers. It was found that approximately 63 percent dairy farmers purchased young animals, 23 percent purchased prime animals and the remaining 14 percent purchased other animals which are neither prime nor young. The Dairy farmers preferred purchasing cattle between the age of 3-4 years old. The young ones of best breed cattle were seen to be preferred by the experienced dairy farmers. They shared that took good care of them, which yield them good returns. The cattle were like a member of their family, which they cared for even after it turned dry. Even the cremation of the cattle was done with the ritual in a respectable manner.

A clustered bar chart has been used to depict the comparative values of the few categories of animals like young animals, prime animals, and animals neither young nor prime.

Figure 6.24: Cattle Purchase by Dairy farmers

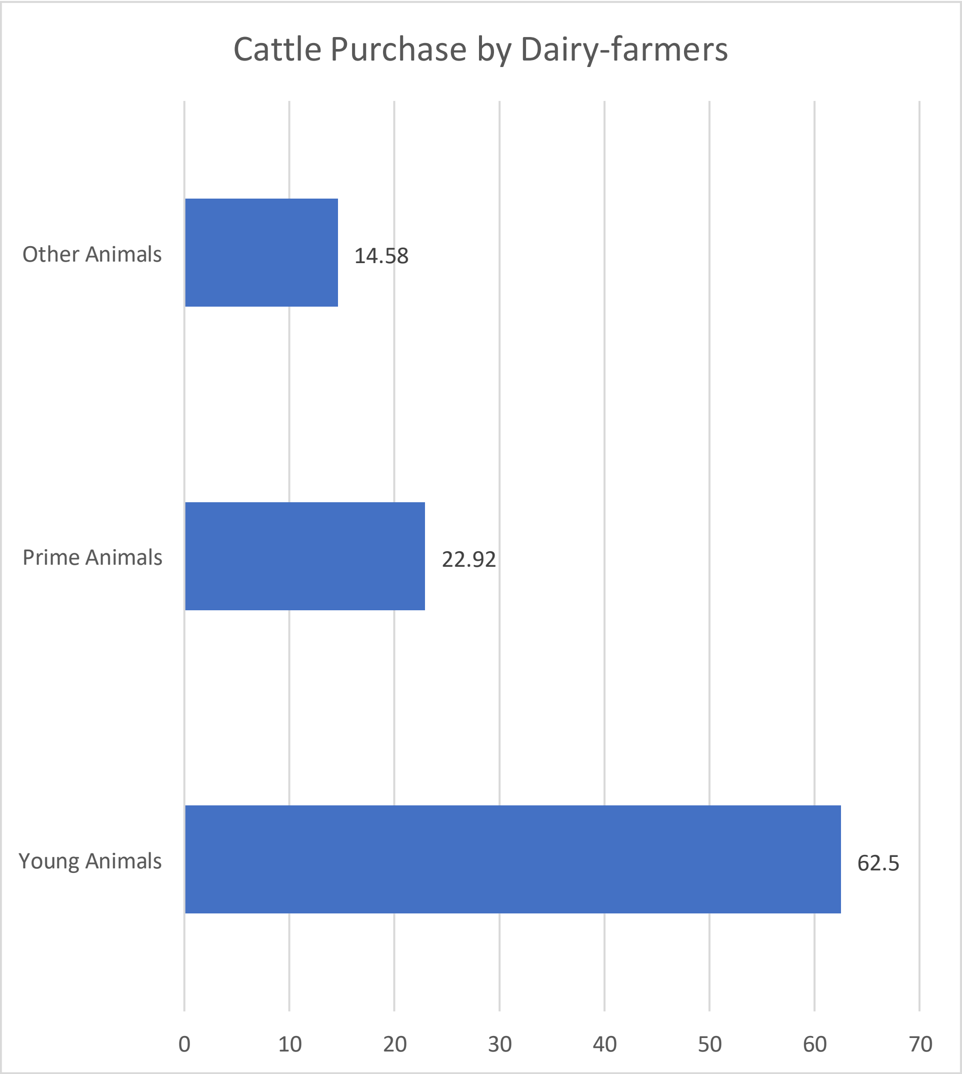


Table 6.38a: Cattle Sales by Dairy-farmers (Cattle-units)

Area-Unit	AS	AA	PB	LY	DA	WA	DiA	OA
RAVANGLA BLOCK	**21**	**5.7**	**5**	**10**	**9**	**10**	**4**	**21**
Ralong Namlung GPU	10	6.9	2	4	9	8	3	3
Kewzing Bakhim GPU	11	4.6	3	6	-	2	1	18
NAMCHI BLOCK	**35**	**6.7**	**1**	**14**	**11**	**19**	**3**	**12**
Chuba Phong GPU	30	7.6	-	10	5	2	2	11
Tangzi Bikmat GPU	5	5.8	1	4	6	17	1	1
SOUTH SIKKIM DT	**56 -**	**6.2 -**	**6 (5.04)**	**24 (20.17)**	**20 (16.81)**	**29 (24.37)**	**7 (5.88)**	**33 (27.73)**

Source: Field Survey 2019-2020,
Note: Figure in Parenthesis are Percentage.
AS- Animal Sold, AA- Avg. Age (yrs.), PB- Poor Breeds, LY- Low Yielding,
DA- Dry Animals, WA- Weak Animals, DiA- Diseased Animals,
OA- Other Animals

The table 6.38a throws light on the cattle sale (types) by South Sikkim Dairy farmers. From the field survey in the study area, it has been learned that in the year 2019 the dairy farmers sold 56 animals. They cited many reasons for doing so. Approximately 24 percent dairy farmers reported that when the animals become weak, they sell it, 20 percent said they sell low yielding cattle's, approx. 17 percent preferred selling dry animals, approx. 6 percent they sell diseased animal, 5 percent shared they sell poor breed cattle. Majority of dairy farmers nearly 28 percent sold the animals for other reasons as well. The respondents had more than one reason for cattle sales hence it is seen that the total figure does not tally with the animal sold figure in the said table.

Similarly, table 6.38b shows the cattle sales (to whom) by South Sikkim dairy farmers. It highlights the places where the dairy farmers prefer selling their cattle. The data from the field survey revealed that 119 cattle were sold in the study area during 2019-2020. Majority approx. 97 percent of dairy farmers sold within the village. Approx. 6 percent sold to their relatives, almost 9 percent sold to cattle traders, 21 percent sold to market agents, approx. 25 percent sold to neighbours and major 40 percent sold to other purchasers apart from those mentioned above.

From the tables 6.37, 6.38a and 6.38b it can be inferred that all level of dairy farmers is involved in cattle purchase and sell as a regular dairy farming routine.

Table 6.38b: Cattle Sales by Dairy-farmers (Cattle-units)

Area-Unit	Total Cattle Sold	Sold to Relative	Sold to Neigh-bours	Sold to Market Agents	Sold to Cattle Traders	Sold to Others
RAVANGLA BLOCK	**60**	**3**	**19**	**14**	**1**	**23**
Ralong Namlung GPU	30	2	14	10	1	3
Kewzing Bakhim GPU	30	1	5	4	-	20
NAMCHI BLOCK	**59**	**4**	**11**	**11**	**9**	**24**
Chuba Phong GPU	29	1	7	7	6	8
Tangzi Bikmat GPU	30	3	4	4	3	16
SOUTH SIKKIM DT	**119**	**7**	**30**	**25**	**10**	**47**
SOUTH SIKKIM DT (%)	**100.00**	**5.88**	**25.21**	**21.01**	**8.40**	**39.49**

Area-Unit	Total Cattle Sold (%)	Sold within Village	Sold outside Village
RAVANGLA BLOCK	**50.42**	**59**	**1**
Ralong Namlung GPU	25.21	30	-
Kewzing Bakhim GPU	25.21	29	1
NAMCHI BLOCK	**49.58**	**57**	**2**
Chuba Phong GPU	24.37	27	2
Tangzi Bikmat GPU	25.21	30	-
SOUTH SIKKIM DT	**-**	**116**	**3**
SOUTH SIKKIM DT (%)	**100.00**	**97.48**	**2.52**

Source: Field Survey 2019-2020

Table 6.39: Manure Production and Self-use by Dairy-farmers

(Manure-users)

Area-Unit	Avg. Dung-pit Size (sq.m)	Manure for Own Cultiva-tion	Manure for Own Cultivation and Market	Manure for Market only	Manure for Crop Farming
RAVANGLA BLOCK	**16.9**	**49**	**11**	**1**	**56**
Ralong Namlung GPU	18.2	27	3	1	29
Kewzing Bakhim GPU	15.6	22	8	1	27
NAMCHI BLOCK	**17.5**	**42**	**17**	**1**	**59**
Chuba Phong GPU	18.3	17	12	1	29
Tangzi Bikmat GPU	16.8	25	5	-	30
SOUTH SIKKIM DT	**17** **-**	**91** **(75.83)**	**28** **(23.33)**	**2** **(1.67)**	**115** **(95.83)**
Area-Unit	Manure for Horti-culture	Manure for Flori-culture	Manure for Vegetable crops	Manure for Cash crops	
RAVANGLA BLOCK	**58**	**17**	**18**	**10**	
Ralong Namlung GPU	30	5	6	10	
Kewzing Bakhim GPU	28	12	12	-	
NAMCHI BLOCK	**54**	**6**	**22**	**1**	
Chuba Phong GPU	24	-	16	1	
Tangzi Bikmat GPU	30	6	6	-	
SOUTH SIKKIM DT	**112** **(93.33)**	**23** **(19.17)**	**40** **(33.33)**	**11** **(9.17)**	

Source: Field Survey 2019-2020
Note: Figure in Parenthesis are Percentage obtained from the Surveyed Households in Total.

The table 6.39 throws light on the manure production and self-use by South Sikkim dairy farmers. During the survey in the study area, it was found that the average size of the Dung pit was $17m^2$. They collected the cow dung and used it for various purposes. As the respondents came up with more than one answer therefore the percentage is calculated on the individual usage as discussed below.

Majority of the dairy farmers approx. 96 percent used it as a manure for crop farming. Approx. 76 percent used the manure for own cultivation, meaning for growing vegetables and crops for just their personal use and fulfilling their daily nutrition needs. Approximately 23 percent was found to use the manure for both own cultivation as well as for marketing it. A few i.e., approx. 2 percent dairy farmers used it completely for marketing it. The study also revealed the areas in which the dairy farmers used the manure obtained from the cattle. They used it simultaneously for various purposes. Approx. 94 percent revealed that they used for Horticulture development, approx. 33 percent used for growing vegetable crop, approx. 19 percent used it for floriculture and approx. 9 percent used it for growing cash crop.

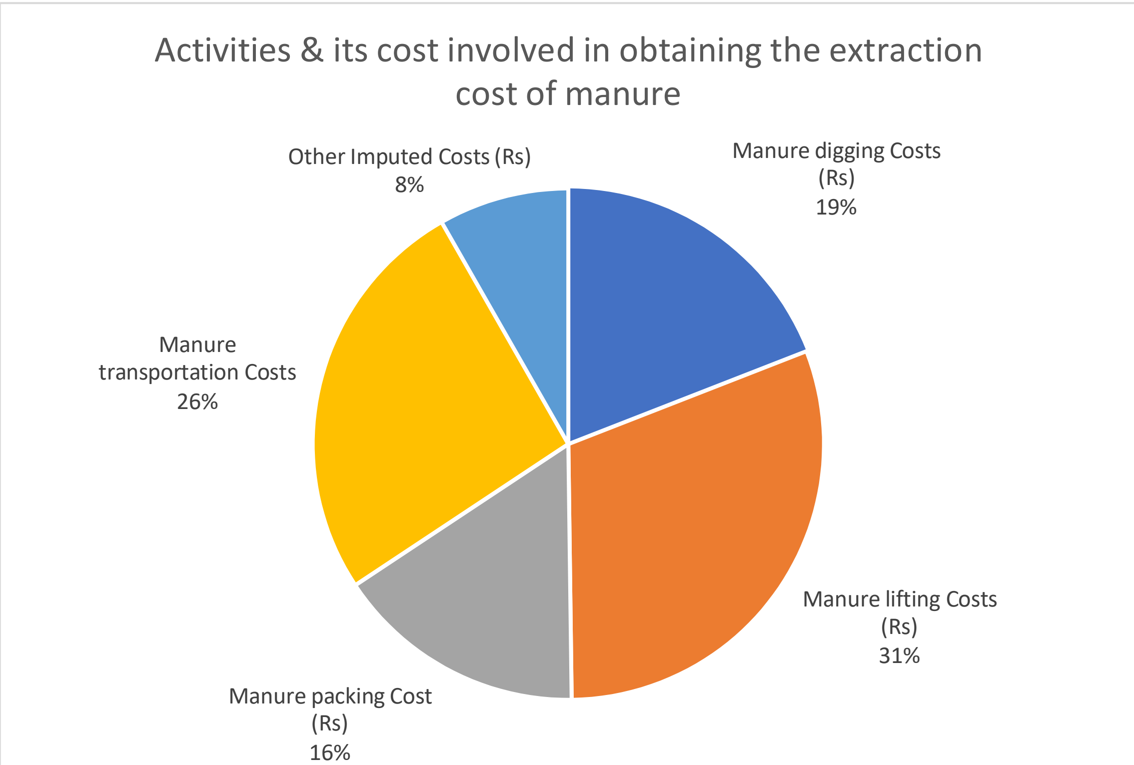
Now a days the growing demand of manure to produce organic fruits and vegetables is seen to rise in every part of the state hence, the dairy farmers tend to produce maximum manure to raise their level of income thereby helping them improve their living standard.

Table 6.40: Manure Production and Extraction Costs of Dairy-farmers

Area-Unit	Dry Manure Sales (Doko)	Manure digging Costs (Rs)	Manure lifting Costs (Rs)	Manure packing Cost (Rs)	Manure transport -tation Costs (Rs)	Other Imputed Costs (Rs)	Total Manure Costs (Rs)
RAVANGLA BLOCK	**160**	**960**	**1,438**	**800**	**1,525**	**400**	**5,123**
Ralong Namlung GPU	65	780	975	650	1,625	325	4,355
Kewzing Bakhim GPU	95	1,140	1,900	950	1,425	475	5,890
NAMCHI BLOCK	**310**	**1,860**	**3,100**	**1,550**	**2,325**	**820**	**9,655**
Chuba Phong GPU	150	1,800	3,000	1,500	2,250	839	9,389
Tangzi Bikmat GPU	160	1,920	3,200	1,600	2,400	800	9,920
SOUTH SIKKIM DT	**235**	**1,410**	**2,269**	**1,175**	**1,925**	**610**	**7,389**

Source: Field Survey 2019-2020

Figure 6.25: Activities and its cost of obtaining the extraction cost of manure



The table 6.40 throws light on the manure production and extraction costs for South Sikkim Dairy-farmers. It was found that every household that practices dairy farming collect the cow dung for manure and put it in various beneficial use like for allied agriculture, but a few do it purely for marketing the manure. This table in particular shares data of these category of dairy farmers only.

It is seen that on the average they sale 235 Doko annually. The dairy farmers of Ravangla Block were found to sale half the quantity of manure as that of Namchi Block dairy farmers. This is since Namchi Block has better road connectivity as compared to Ravangla Block and for a normal purchaser it is easier for them to purchase manure from Namchi Block as no head load carriage is involved.

Manpower is involved in digging the manure from the cow dung pit, it has to be lifted thereafter it has to be packed and transported to a place where it is stacked for selling. As such, cost is involved in all the above procedures before it is ready for sale. The manure cost is arrived at after adding cost involved in all such activities. Other imputed cost is also added though it does not have to be paid by the dairy farmer as no extra manpower is hired for a few activities as it is done by him or his family members themselves.

The manure digging cost in the average was found to be Rs. 1,410/- per annum, the lifting cost was Rs. 2,269/- per annum, manure packing cost was Rs. 1,175/- per annum, the transportation cost was Rs. 1,925/- per annum. Other imputed cost was Rs. 610/- per annum. Thus, the total manure cost amounting to Rs. 7,389/- per annum for obtaining 235 doko dry manure on an average. The same has been depicted in the pie chart above.

Cost of Milk Production:

As per the survey data, it has been found that a dairy farmer invests ₹438.96 on a mature cattle per week and ₹22.25 of its yearling for the production of milk. The investment as above totalling to ₹461.21 per cattle per week, i.e., ₹65.88 per cattle per day, is on green fodder, fodder grass, dry straw, choker, water and others. However, this amount does not include the implicit cost involved like household labour, firewood, cattle shed construction and maintenance etc. in the milk production process.

Also, the survey findings reveal that a cow on an average produces 9.4 litre of milk per day in season and 5.6 litre of milk per day in the off season. The average milk production per day is thus 7.5 litre per day. Now, from the above data it can be inferred that for production of 1litre of milk the dairy farmer has to spend ₹9.0 without including the implicit cost involved.

Marketing cost of Milk:

A dairy farmer, who is a member of dairy cooperative, on supplying/marketing milk to the SMU Ltd. gets ₹39.0 per litre. The Milk Cooperative Society gets ₹1.0 per litre from SMU. Thus, the SMU purchases milk from rural dairy farmers at ₹40.0/litre, but only on a condition that the milk contains minimum 3.5% FAT and 7.5% SNF. Further, SMU pays higher rates for milk having 7.0% FAT and 9.8% SNF which goes to ₹67.63/litre. In addition to the above rates, the dairy farmers supplying milk to SMU are paid ₹8.0/litre as an incentive by the State Government on quarterly basis every year.

Transportation and Processing cost:

Both the transportation and processing cost of milk supplied to the SMU is borne by the SMU itself. Fixed rate vehicles are hired on a monthly basis for transportation of the milk to and fro from the SMU to the village milk collection centres. The quantity of milk supplied to the SMU is directly proportional to the profit it obtains. The processing of milk is solely done by the employees of SMU and let out in the open market for sale through agents at ₹60.0 per litre. Thus, the transportation, processing and profit of SMU is all encompassed within ₹20.0 per litre.

Revenue and its Determinants

In microeconomics, one of the most important ideas is revenue. Revenue is the money a business makes when it is running normally. It is calculated by multiplying the average sale price by the number of units sold. Gross income is the amount of money that comes in before any costs are taken out. On the income statement, income is also known as sales.

Most of a dairy farm or business's income comes from the price of the product and how much people are willing to pay for it. When demand is inelastic, a rise in the price of a product doesn't change how much people want it, so the total revenue goes up. On the other hand, when demand is elastic, a rise in the price of a product will cause less people to want it, so the total revenue goes down. Other things that can affect revenue are the quality of the product, the marketing strategy, the marketing staff, the development of technology, the availability of funds to increase production factors, etc. A lot of what determines and affects revenue comes from the outside, like the economy, government rules, the market position of competitors, etc.

Profit of Dairy Farmers

Table 6.41: Profit earned by dairy farmers

Amount in range	Frequency	Percentage
0.0000	2	1.67
1000-5000	19	15.83
5001-10000	32	26.67
10001-20000	37	30.83
20001-30000	21	17.50
30001-40000	4	3.33
40001-50000	2	1.67
50001-60000	0	0
60001-70000	0	0
70001-80000	1	0.83
80001-90000	1	0.83
90001-100000	1	0.83
N=120 Mean=14802.18867 Median=11562.50000 Mode=5562.5000[a] Minimum=0.0000 Maximum=93812.5000		

Source: Field Survey 2019-2020

Profitability is how much a dairy farmer makes compared to how much it costs to run. Farmers who are more efficient will make more money relative to what they spend than farmers who are less efficient, who must spend more to make the same amount of money. From the table 6.41, we can see that the majority of dairy farmers are making money. About 98% of dairy farmers make money by keeping cows on their farms. The remaining 2% might be keeping cows that don't produce milk or consume the entire milk at home.

According to the table, most dairy farmers who make money are those who earn between Rs. 10001 and Rs. 20000 per month, about 31% dairy farmers fall under this category. Then comes Rs. 5001 to Rs. 10,000, which is about 27% of people who regularly earn money in a month. In the study area, there was also a dairy farmer who made more than Rs. 70,000 per month, and 2 households that were losing money in the dairy industry. But both were found to be happy because one earned very well through dairy and the other though was on no profit but was very happy with the dairy products they ate at home. In the study area, the average profit is Rs. 14802.18867, the median is Rs. 11562.50000, and the mode is Rs. 5562.5000[a]. The profit ranges from Rs. 0 to Rs. 93812 per month. In the end, we can say that anyone who works in the dairy industry will make a profit, no matter how big or small. So, we can say for sure that dairy farming is a business that makes money as the demand for dairy is inelastic.

Animal Health Practices

Table 6.42: Attitudes to Adoption of Artificial Insemination Programme among South Sikkim Dairy-farmers *(Farmer's reporting)*

Area-Unit	***AI ADOPTION BENEFIT***			
	Improved Animal Health	Improved Animal Survival	Improved Milch Breeds	Improved Dairy Incomes
RAVANGLA BLOCK	**26**	**24**	**29**	**33**
Ralong Namlung GPU	9	9	13	16
Kewzing Bakhim GPU	17	15	16	17
NAMCHI BLOCK	**38**	**37**	**37**	**38**
Chuba Phong GPU	16	15	15	16
Tangzi Bikmat GPU	22	22	22	22
SOUTH SIKKIM DT	**64**	**61**	**66**	**71**
South Sikkim (%)	53.33	50.83	55.00	59.17
Area-Unit	***AI ADOPTION DISINCENTIVE***			
	AI not Needed	AI not Available	AI not Suitable	High AI Costs
RAVANGLA BLOCK	**6**	**33**	**14**	**3**
Ralong Namlung GPU	2	13	11	3
Kewzing Bakhim GPU	4	20	3	-
NAMCHI BLOCK	**3**	**43**	**14**	**-**
Chuba Phong GPU	3	15	12	-
Tangzi Bikmat GPU	-	28	2	-
SOUTH SIKKIM DT	**9**	**76**	**28**	**3**
South Sikkim (%)	7.50	63.33	23.33	2.50

Source: Field Survey 2019-2020

The table 6.42 shows the attitudes to adoption of Artificial Insemination among South Sikkim Dairy farmers. From the data collected from the sampled households it has been found that majority of dairy farmers in the study area accepted that adoption of AI provided benefits to both the animals as well as the dairy farmers. In total, almost 53 percent dairy farmers shared that an improvement in the Animal Health was evident. Almost 51 percent shared that the animal survival rate was improved. 55 percent shared that AI help improve milch breeds and major 59 percent dairy farmers found that adopting AI helped them improve dairy incomes.

However, a few dairy farmers disagreed to the above and said that they preferred not to adopt AI for the cattle as they feel that it might create birthing problem in the local breed. Approximately 8 percent said that they don’t need AI, almost 63 percent told that AI is not available freely in their area, 23 percent reported that AI did not suit their cattle and a few 3 percent said the cost for AI was quite high.

Table 6.43: Common Cattle Ailments and Adoption of Animal Vaccination Among South Sikkim Dairy-farmers *(Farmer's reporting)*

Area-Unit	Dysentery	Fevers	Foot and Mouth Diseases	Other Ailments	
RAVANGLA BLOCK	**10 (8.33)**	**39 (32.5)**	**5 (4.17)**	**8 (6.66)**	
Ralong Namlung GPU	6 (5.00)	17 (14.17)	4 (3.33)	3 (2.5)	
Kewzing Bakhim GPU	4 (3.33)	22 (18.33)	1 (0.83)	5 (4.17)	
NAMCHI BLOCK	**21 (17.5)**	**23 (19.17)**	**4 (3.33)**	**18 (15.00)**	
Chuba Phong GPU	6 (5.00)	8 (6.66)	4 (3.33)	18 (15.00)	
Tangzi Bikmat GPU	15 (12.5)	15 (12.5)	-	-	
SOUTH SIKKIM DT	**31 (25.83)**	**62 (51.67)**	**9 (7.5)**	**26 (21.67)**	
Area-Unit	Cattle Vaccinated	Age (yrs) on Vaccina-tion	Vaccina-tion for Fevers	Vaccination for Foot and Mouth Diseas -es	Vaccin-ation for Other Diseas-es
RAVANGLA BLOCK	**46 (38.33)**	**4.3**	**27 (22.5)**	**22 (18.33)**	**12 (10.0)**
Ralong Namlung GPU	28 (23.33)	5.3	15 (12.5)	15 (12.5)	3 (2.5)
Kewzing Bakhim GPU	18 (15.00)	3.3	12 (10.0)	7 (5.83)	9 (7.5)
NAMCHI BLOCK	**57 (47.5)**	**2.8**	**30 (25.0)**	**16 (13.33)**	**34 (28.33)**
Chuba Phong GPU	27 (22.5)	2.8	7 (5.83)	7 (5.83)	20 (16.66)
Tangzi Bikmat GPU	30 (25.00)	2.8	23 (19.16)	9 (7.5)	14 (11.66)
SOUTH SIKKIM DT	**103 (85.83)**	**3.6**	**57 (47.5)**	**38 (31.67)**	**46 (38.33)**

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

The table 6.43 provides details on the common cattle Ailments and Adoption of Animal Vaccination among South Sikkim Dairy farmers.

The major Ailments reported in the study area were Fevers in cattle, Dysentery, Foot and Mouth Diseases, and other Ailments. Maximum, about 52 percent dairy farmers stated that their cattle suffered from fevers, 25 percent reported that dysentery was common, a few dairy farmers approximately 8 percent shared that their cattle mostly suffered from foot and mouth diseases. Nearly 22 percent dairy farmers said that the cattle suffered from other ailments as well.

Animal Vaccination status was also surveyed in the study area. It was found that around 86 percent of dairy farmers had vaccinated their cattle. Nearly 48 percent had vaccinated their cattle for fevers, about 32 percent had vaccinated their cattle for foot and mouth diseases and almost 38 percent had them vaccinated for other diseases. However, it was reported that due to lack of awareness the dairy farmers did not vaccinate their cattle in the right age but only after they got infected by a particular disease when the veterinarian tells them that vaccination is available to prevent such diseases.

Table 6.44: Veterinary Service-seeking Behaviour of South Sikkim Dairy-farmers by Type of Ailment

(Farmer's reporting and number of farmers household)

Area-Unit	SPOT TREATMENT			
	Local	Govt. Vet.	Pvt. Vet.	Total
RAVANGLA BLOCK	**24 (20.00)**	**35 (29.16)**	**1 (0.83)**	**60 (50.00)**
Ralong Namlung GPU	1 (0.83)	28 (23.33)	1 (0.83)	30 (25.00)
Kewzing Bakhim GPU	23 (19.16)	7 (5.83)	-	30 (25.00)
NAMCHI BLOCK	**30 (25.00)**	**27 (22.50)**	**3 (2.50)**	**60 (50.00)**
Chuba Phong GPU	-	27 (22.50)	3 (2.50)	30 (25.00)
Tangzi Bikmat GPU	30 (25.00)	-	-	30 (25.00)
SOUTH SIKKIM DT	**54** (45.00)	**62** (51.67)	**4** (3.33)	**120** (100.00)
Area-Unit	TREATMENT AT BIRTHING			
	Local	Govt. Vet.	Pvt. Vet.	Total
RAVANGLA BLOCK	**21 (17.5)**	**38 (31.66)**	**1 (0.83)**	**60 (50.00)**
Ralong Namlung GPU	1 (0.83)	28 (23.33)	1 (0.83)	30 (25.00)
Kewzing Bakhim GPU	20 (16.66)	10 (8.33)	-	30 (25.00)
NAMCHI BLOCK	**34 (28.33)**	**26 (21.66)**	**-**	**60 (50.00)**
Chuba Phong GPU	4 (3.33)	26 (21.66)	-	30 (25.00)
Tangzi Bikmat GPU	30 (25.00)	-	-	30 (25.00)
SOUTH SIKKIM DT	**55** (45.83)	**64** (53.33)	**1** (0.83)	**120** (100.00)
Area-Unit	DISEASE TREATMENT			
	Local	Govt. Vet.	Pvt. Vet.	Total
RAVANGLA BLOCK	**16 (13.33)**	**43 (35.83)**	**1 (0.83)**	**60 (50.00)**
Ralong Namlung GPU	-	29 (24.16)	1 (0.83)	30 (25.00)
Kewzing Bakhim GPU	16 (13.33)	14 (11.66)	-	30 (25.00)
NAMCHI BLOCK	**-**	**49 (40.83)**	**11 (9.16)**	**60 (50.00)**
Chuba Phong GPU	-	28 (23.33)	2 (1.66)	30 (25.00)
Tangzi Bikmat GPU	-	21 (17.50)	9 (7.50)	30 (25.00)
SOUTH SIKKIM DT	**16** (13.33)	**92** (76.67)	**12** (10.00)	**120** (100.00)

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

The table 6.44 throws light on the veterinary service seeking behaviour of South Sikkim Dairy-farmers by type of ailments their cattle suffer from.

From the survey, it was evident that 45 percent of dairy farmers in the study area did the spot treatment of their cattle locally. 52 percent, however preferred going to Government Veterinary Centres and a few nearly 3 percent took their cattle to private veterinary centres for spot treatment. For treatment of cattle at birthing, majority of the dairy farmers i.e., 53 percent took service from Government Veterinary Centres, 46 percent treated their cattle locally during birthing and almost negligible of around 1 percent took service of private veterinary centres for treatment. For disease treatment also, majority, i.e., 77 percent of the dairy farmers availed the service of Government Vet. Centres, a few 13 percent treated them locally and the remaining 10 percent took the service of Pvt. Vet. Centres for various disease treatment. This can be seen in below diagram:

Figure 6.26: Animal Treatment

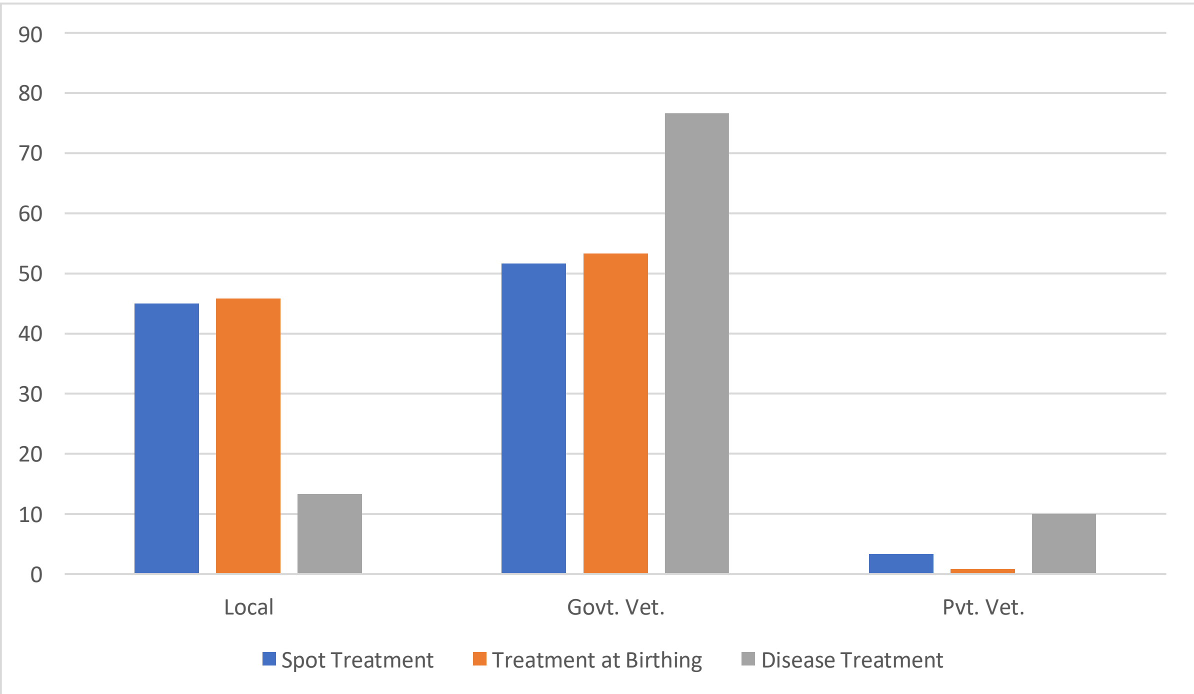


Table 6.45: Veterinary Services Availed and Veterinary Service-Ratings by South Sikkim Dairy-farmers

Area-Unit	Veterinary Services Availed			
	Local	Govt. Vet.	Pvt. Vet.	Other Services
RAVANGLA BLOCK	**-**	**16 (13.33)**	**31 (25.83)**	**13 (10.83)**
Ralong Namlung GPU	-	1 (0.83)	27 (22.50)	2 (1.66)
Kewzing Bakhim GPU	-	15 (12.50)	4 (3.33)	11 (9.16)
NAMCHI BLOCK	**-**	**36 (30.00)**	**22 (18.33)**	**2 (1.66)**
Chuba Phong GPU	-	15 (12.50)	13 (10.83)	2 (1.66)
Tangzi Bikmat GPU	-	21 (17.50)	9 (7.50)	-
SOUTH SIKKIM DT	**-**	**52** (43.33)	**53** (44.17)	**15** (12.50)
Area-Unit	Vaccination Status			
	Paid Service	Free Service	Vaccination Fees Rs./animal	Total
RAVANGLA BLOCK	**48 (40.00)**	**12 (10.00)**	**602**	**60 (50.00)**
Ralong Namlung GPU	29 (24.16)	1 (0.83)	630	30 (25.00)
Kewzing Bakhim GPU	19 (15.83)	11 (9.16)	574	30 (25.00)
NAMCHI BLOCK	**26 (21.66)**	**34 (28.33)**	**987**	**60 (50.00)**
Chuba Phong GPU	17 (14.16)	13 (10.83)	607	30 (25.00)
Tangzi Bikmat GPU	9 (7.50)	21 (17.50)	1367	30 (25.00)
SOUTH SIKKIM DT	**74** (61.67)	**46** (38.33)	**794**	**120** (100.00)
Area-Unit	Veterinary Service-Ratings			
	Excellent	Good	Fair	Poor
RAVANGLA BLOCK	**1 (0.83)**	**29 (24.16)**	**24 (20.00)**	**6 (5.00)**
Ralong Namlung GPU	-	14 (11.66)	16 (13.33)	-
Kewzing Bakhim GPU	1 (0.83)	15 (12.50)	8 (6.66)	6 (5.00)
NAMCHI BLOCK	**7 (5.83)**	**40 (33.33)**	**13 (10.83)**	**-**
Chuba Phong GPU	-	22 (18.33)	8 (6.66)	-
Tangzi Bikmat GPU	7 (5.83)	18 (15.00)	5 (4.16)	-
SOUTH SIKKIM DT	**8** (6.67)	**69** (57.50)	**37** (30.83)	**6** (5.00)

Source: Field Survey 2019-2020

Note: Figure in Parenthesis are Percentage

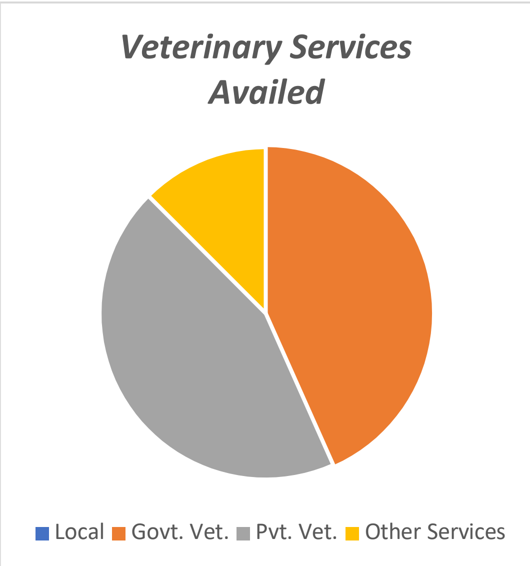
The table 6.45 highlights on the Veterinary Services availed and Veterinary Service Ratings by South Sikkim Dairy-farmers. The survey of the study area showed that equal percentage i.e., around 44 percent dairy farmers availed Government Veterinary

Services and Private Veterinary Services respectively. Rest 12 percent of the dairy farmers provided other type of care/service. No local service centre per se was reported in the study area.

Similarly, the survey on the Vaccination status in the study area depicted that approximately 62 percent of dairy availed paid services while the rest about 38 percent availed free services for their cattle. The annual vaccination fee was found to be around Rs. 800/-per animal.

Further, the study of the Veterinary Service Ratings showed that a majority of dairy farmers i.e., about 58 percent rated the veterinary service as Good, a few about 7 percent rated it as Excellent, almost 31 percent dairy farmers found the services as Fair, and 5 percent dairy farmers rated it as Poor. These veterinary services availed and ratings can be seen as below pie diagrams.

Figure 6.27: Veterinary Services Availed and Ratings



Factors Affecting Adoption of Artificial Insemination – Logit Analysis: When the dependent variable is discrete and binary, a binary logistic model is used(Gujarati and Porter, 2003). As a result, we have employed a logit model to clarify the connection between a binary variable representing whether or not dairy farmers have access to Artificial Insemination and a set of explanatory variables representing the socio-economic situations of dairy farmers.

Table 6.46: Sample overview and summary statistics

Sl. no.	Explanatory variables	Mean	Standard Deviation
1	Age	50.78	13.162
	Family Size	5.57	2.180
	Land	3.96	6.280
	Cattle	3.95	1.887
	Adult Education	9.12	3.679
2	**Structure of cattle shed**	**Frequency**	**Percentage**
	Near Home	85	70.83
	Other	35	29.17
3	**Full/Part timer dairy farmers**	**Frequency**	**Percentage**
	Full	89	74.17
	Part	31	25.83
4	**Establishment**	**Frequency**	**Percentage**
	Self	55	45.83
	Others	65	54.17
5	**Vaccinated**	**Frequency**	**Percentage**
	Yes (No Risk)	103	85.83
	No (High Risk)	17	14.17

Source: Field Survey, 2019-2020

The statistics and overview of the sampled dairy farmer households are shown in the table 6.46 above. Sl. no. 1 shows the explanatory variables, such as age. The mean age is 50.78, and the standard deviation (SD) is 13.162. This means that the ages of dairy farmers vary a lot, since the SD is far from the mean. Family size has a mean of 5.57 with a standard deviation of 2.180, land has a mean of 3.96 with a standard deviation of 6.280, cattle have a mean of 3.95 with a standard deviation of 1.887, which is close to the mean, and adult education has a mean of 9.12 with a standard deviation of 3.679. The structure of the cattle shed, full/part timer dairy farmers, and the establishment are presented in sl. no. 2,3 and 4 of the said table. Nearly 71% of the homes have cattle shed nearby, and almost 74% of the full-time farmers in the study area are dairy farmers. About 46% of dairy farmers set up their farms with money they already had. This is called "self-establishment." Nearly 86% of dairy farmers are not in a high-risk area because they vaccinated or insured their cows. This is shown in sl.no.5 of the table above.

Table 6.47: Artificial Insemination Adoption Categories

Categories	Adoption						Non-Adoption		Total	
	Full		Partial		Discontinue					
	F	%	F	%	F	%	F	%	F	%
No. of HHs	66	55.00	36	30.00	6	5.00	12	10.00	120	100

Source: Field Survey, 2019-2020

Note: F= Frequency

Figure: 6.28a

AI Adoption status of dairy farmers (%).

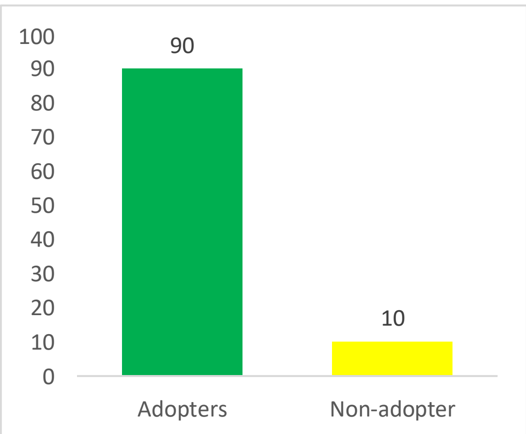
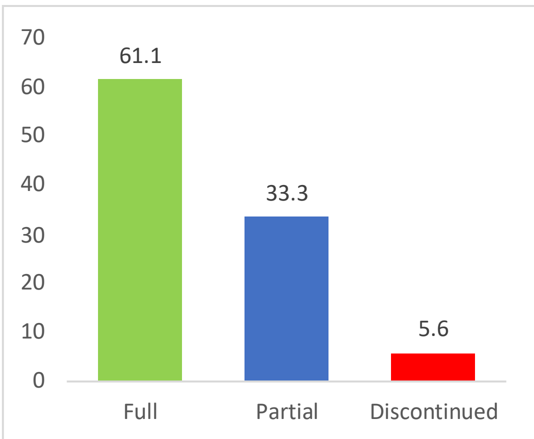


Figure: 6.28b

Categories of AI Adopters (%)



The table 6.47 shows how South Sikkim dairy farmers use artificial insemination. Of the total households surveyed, 55% of dairy farmers always use artificial insemination, which is called "full adoption." Another 30% of dairy farmers only use artificial insemination sometimes, and 5% of dairy farmers have stopped using it. Finally, 10% of dairy farmers are against artificial insemination for various reasons, and these farmers are in the "not in support of artificial insemination" category.

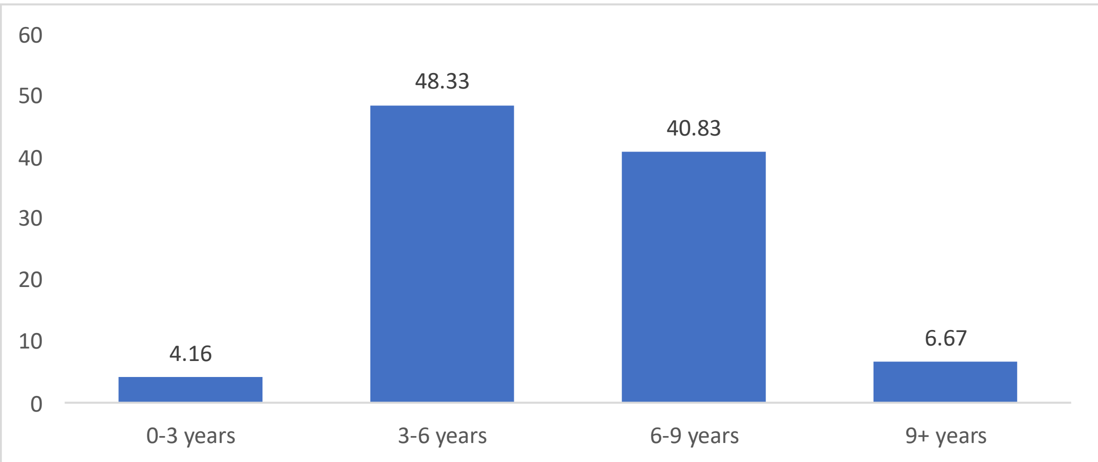
Table 6.48: Adoption Status of Artificial Insemination

Categories	0-3 years		3-6 years		6-9 years		9+ years		Total	
	F	%	F	%	F	%	F	%	F	%
No. of HHs	5	4.16	58	48.33	49	40.83	8	6.67	120	100

Source: Field Survey, 2019-2020

Note: F= Frequency

Figure 6.29: Adoption Status of Artificial Insemination (Years)



The number of South Sikkim dairy farmers who use Artificial Insemination is shown in the table 6.48. Nearly 4% of dairy farmers use artificial insemination on their cows between the ages of 0 and 3 years. The percentage is highest between the ages of 3 and 6 years, at about 48%. About 41% of dairy farmers use AI on their cows between the ages of 6 and 9 years, and about 7% use it on cows that are. According to the dairy farmers in the study area, the best age for artificial insemination integration of cattle is between 3 and 9 years. This can be seen in the table above.

Table 6.49: Results of the binary logistic regression analysis

Variables	Co-efficient	S.E.	Wald-$\square^{2}$	Odds ratio	Marginal Effects
Age	.017	.017	.928	1.017	0.004
Households size	.100	.100	.998	1.105	0.022
Land	.117	.142	.679	1.125	0.025
Cattle	-.029	.119	.061	.971	-0.006
Farmer type (Full=1, Part=0)	1.035**	.491	4.442	.355	0.223
Adult education	.115*	.061	3.573	1.122	0.025
Agriculture is primary occupation	-.221	.454	.237	1.247	-0.048
Constant	-2.355*	1.273	3.421	.095	-
-2 Log-likelihood= 148.368 Pseudo R square=0.175 Prob>chi square:0.01					

*P<0.1, **P<0.05, ***P<0.01
Source: Field Survey, 2019-2020

A logistic regression model was used to figure out which dairy farmers used Artificial Insemination (AI) and which did not. So, the variables that were thought to have an effect on whether or not AI was adopted were looked at. Out of all the variables, only two were found to be significant: type of farmers (full-time or part-time) (at P<5%) and the education level of adult dairy farmers (at P<10%). Other factors (age, household size, and land) have positive coefficients but are statistically insignificant.

The model showed a positive and statistically significant effect of farmer type (full and part timer dairy farmer) on the adoption of Artificial Insemination. This may be explained by the fact that in the study area both the full timers and part-timers' dairy farmers rarely reared breeding bulls. Both the categories of dairy farmers preferred Artificial Insemination as it helped them fetch greater quantity of milk per cattle and also saved the cost for keeping breeding bulls. Infact the situation is such that, due to the chance of the indigenous breed being extinct, Government has established centres at certain areas where indigenous breeding bulls are provided though, this too has not been able to convince the farmers to opt for indigenous breeding bulls than Artificial Insemination. Households with full timers' dairy farmers are 22.3% more likely to adopt Artificial Insemination because they are producing for commercial purpose as well as to raise their level of income. Education level is also positive and statistically significant. A farmer with higher educational level is 2.4% more likely to adopt AI technology. This may be because educated farmers are more aware, more receptive and able to understand better about the benefits of new technologies in order to enhance production and productivity. Other variables were not found to be significant. The log-likelihood value is 148.368 implying that the model is good fit to the data.

Cattle Insurance

There is a lack of awareness concerning livestock insurance, according to the information provided by respondents. The purchase of cattle insurance can assist dairy farmers in reducing the financial losses incurred as a result of insufficient animal health care, natural disasters, and other circumstances. Affordability of insurance is a factor in Dairy farmers' willingness to use new and better farming methods that can help them make more milk for their own use and to sell in local and faraway markets, as well as milk unions, are some of the things that make this possible (Kharel, 2022).

Table 6.50: Adoption Status of Cattle Insurance (N=120)

Sl. No	Village	Cattle Insurance			
		No (F)	%	Yes (F)	%
1	Chuba Phong	21	17.50	9	7.50
2	Tangzi Bikmat	27	22.50	3	2.50
3	Kewzing Bakhim	25	20.83	5	4.17
4	Ralong Namlung	20	16.67	10	8.33
Total		93	77.50	27	22.50

Source: Field Survey, 2019-2020
Note: F-Frequency

The table 6.50 shows how many South Sikkim dairy farmers have bought insurance for their cattle. From the study area of Namchi sub-division, Tangzi Bikmat GPU dairy farmers only insured about 3% of their cattle, while Chuba Phong GPU dairy farmers insured about 8% of their cattle in the same sub-division. In the same way, dairy farmers in the Ravangla sub-division, Kewzing Bakhim GPU, insured their cattle for about 4% and in Ralong Namlung GPU, they insured their cattle for about 8%. From the said table, it can be seen that most of the dairy farmers in the study area do not know about cattle insurance. About 78% of the dairy farmers whose homes were surveyed still haven't insured their cattle. Only about 22% of the dairy farmers in the study area have insured their cattle.

Credit Facility

Dairy farmers can obtain financial assistance from both institutional and non-institutional sources in the country, despite this, most of these options necessitate that the farmer pay back a portion of their loan in interest. When it comes to poor farmers in the Himalayan state of Sikkim, the government has been providing them with full support by supplying them with low-cost, high-yielding crossbred cattle, which has helped them support their livelihoods and, in turn, has helped to increase the state's overall productivity over a long period of time (Kharel, 2022).

Future vision, awareness, and research and development

As the world's population continues to rise, there will surely be an increase in the demand for dairy and dairy products. Assuming it holds up over time, it will help provide a stable economy for prospective farmers. Dairy is a crucial prerequisite for the production of organic commodities, therefore the current trend among today's generation toward organic farming has benefited the dairy industry. Given the following, it is commonly held that all well-informed people should make extraordinary efforts to persuade farmers to engage in dairy farming as a means of subsistence. There has been significant research and development in the dairy sector in Sikkim, and significant progress has been made in this area; however, there are still a few areas in which additional research and development is required in this state, such as the fodder crisis, water scarcity, and other issues (Kharel, 2022).

Participation of the Government:

It's promising that the Sikkim government is working with the dairy industry. Dairy cows are being offered free of charge to farmers who have expressed an interest in expanding their operations into dairy production. Cow barns are being constructed in villages as part of the MGNREGA programme. As part of a broader incentive package, the government has started providing a Rs 8 per litre incentive to dairy farmers who sell their milk to the Sikkim Milk Union.

Tests: (Dairy income group statistics, t-test, ANOVA)

Table 6.51: Dairy Income Group Statistics

	Sub Division	Mean	Std. Deviation	Std. Error Mean
Dairy Income	Namchi	3180.00	3258.67	420.69
	Ravangla	3998.33	3594.79	464.08
	N=120			

Source: Authors Calculation Based on Primary Survey

Table 6.52: Independent Samples Test

		Levene's Test for Equality of Variance		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of Difference	
									Lower	Upper
Dairy In-come	Equal variances assumed	.088	.768	-1.306	118	.194	-818.33	626.38	-2058.74	422.07
	Equal variances not assumed			-1.306	116.88	.194	-818.33	626.38	-2058.86	422.20

Source: Authors Calculation, based on survey data

From the table 6.52, we can see that the researchers did an independent sample test on the descriptive variables, such as dairy income, and found that the level of significance, or p-value, is greater than 0.05. This means that the assumption of equal variance in dairy income is not statistically significant, as it is almost the same in both sub-divisions. Again, the group statistics table 6.51 shows that the dairy income of the Ravangla sub-division is higher than that of Namchi sub-division. The mean for

Ravangla is 3998.33 and the mean for Namchi is 3180.00. The standard deviation for Ravangla is 3594.79 and the standard deviation for Namchi is 3258.67. This means that the standard deviation is far from the mean.

Table 6.53: Dairy income vs cowshed type

Dairy Income Groups	Type of Cowshed				Total
	Self-Established	Inherited	Family Owned	Other	
Upto Rs. 5000	47(39.17)	35(29.17)	12(10.00)	3(2.50)	97(80.83)
Rs. 5001-Rs. 10000	6(5.00)	9(7.50)	4(3.33)	1(0.83)	20(16.67)
Rs. 10001-Rs.15000	1(0.83)	0	0	0	1(0.83)
Rs. 15001-Rs.20000	0	0	1(0.83)	0	1(0.83)
Rs.20000+	1(0.83)	0	0	0	1(0.83)
Total	55(48.83)	44(36.67)	17(14.17)	4(3.33)	120 (100.00)
			Value	df	Asymp. Sig.(2-sided)
Pearson Chi-Square			10.934[a]	12	.535
Likelihood Ratio			9.599	12	.651
Linear by Linear Association			.636	1	.425
No. of observations/valid cases			120	-	-

Source: Authors Calculation, based on survey data
Note: Figure in Parenthesis is Percentage.

The cross-tabulation of descriptive statistics of the dairy revenue group by cowshed type is displayed in the table 6.53. In the said table for the dairy income category of up to Rs. 5000, Rs. 5001 to Rs. 10000, Rs. 10001 to Rs. 15000, Rs. 15001 to Rs. 20000, and Rs. 20000 and above. In contrast, the cowshed type is indicated by self-established, inherited, family owned, and other. It is evident from the table that the majority of households are self-established, followed by inherited, family owned, and other households with 55 (almost 49%), 44 (almost 37%), 17 (nearly 14%), and 4 (nearly 3%) households respectively. Similarly, the Chi-Square test was performed on it, and the calculated value is observed as 10.934[a]; its P-value is greater than 0.05, so we can conclude that there is no significant relationship between the income level of dairy farmers and the type of cowshed.

Table 6.54: Dairy income vs marketing outlet

Dairy Income Groups	Marketing outlet				Total
	Door to Door	Collection Centre	Local Retail Market	Distant Market	
Upto Rs. 5000	28(23.33)	66(55.00)	2(1.67)	1(0.83)	97(80.83)
Rs. 5001-Rs. 10000	3(2.50)	16(13.33)	1(0.83)	0	20(16.67)
Rs. 10001-Rs.15000	1(0.83)	0	0	0	1(0.83)
Rs. 15001-Rs.20000	0	1(0.83)	0	0	1(0.83)
Rs.20000+	0	0	1(0.83)	0	1(0.83)
Total	32(26.67)	83(69.17)	4(3.33)	1(0.83)	120 (100.00)
			Value	df	Asymp. Sig.(2-sided)
Pearson Chi-Square			34.599[a]	12	.001
Likelihood Ratio			12.975	12	.371
Linear by Linear Association			3.256	1	.071
No. of observations/valid cases			120	-	-

Source: Authors Calculation, based on primary survey data
Note: Figure in Parenthesis is Percentage.

The cross-tabulation of descriptive statistics of the dairy income group by the marketing outlet is displayed in the table 6.54. In the said table for the dairy income category as revenue of up to Rs. 5000, income of Rs. 5001 to Rs. 10000, Rs. 10001 to Rs. 15000, Rs. 15001 to Rs. 20000, and Rs. 20000 above. Alternatively, marketing outlet/channel is represented by door-to-door, collection centre local retail market, and distant market. It is evident from the table that most dairy farmers (83 households about 69%) used milk collection centres through dairy cooperatives as their milk marketing channel, followed by 32 households (about 27%) using door-to-door sales, local retail markets (four households 3%), and distant markets (one household nearly 1%) respectively. Similarly, the Chi-Square test was performed on it, and its calculated value is found as

34.599[a]. Its P-value is less than 0.05, so we can conclude that there is an association between income group and marketing outlet.

Table 6.55: Dairy income vs full and part time dairy farmers

Dairy Income Groups	Full time-Part time		Total
	Part Time Employment	Full Time Employment	
Upto Rs. 5000	28(23.33)	69(57.50)	97(80.83)
Rs. 5001-Rs. 10000	3(2.50)	17(14.17)	20(16.67)
Rs. 10001-Rs.15000	0	1(0.83)	1(0.83)
Rs. 15001-Rs.20000	0	1(0.83)	1(0.83)
Rs.20000+	0	1(0.83)	1(0.83)
Total	31(25.83)	89(74.17)	120(100.00)
	Value	df	Asymp. Sig.(2-sided)
Pearson Chi-Square	2.736[a]	4	.455
Likelihood Ratio	3.621	4	.347
Linear by Linear Association	2.487	1	.426
No. of observations/valid cases	120	-	-

Source: Authors Calculation, based on primary data
Note: Figure in Parenthesis is Percentage

It can be seen from the table 6.55 that the dairy income and dairying techniques intersect (full time or part time). In the said table for the dairy income group incomes up to Rs. 5000, Rs. 5001 to Rs. 10000, Rs. 10001 to Rs. 15000, Rs. 15001 to Rs. 20000, and Rs. 20000 and above. On the opposite side, part-time employment and full-time employment. In conclusion, a maximum of 89 (74%) dairy farmer households are active in dairy production on a daily basis, and their primary source of income is also derived from dairy production; this is represented as full time. While 31 households (26%) have dairying as a secondary source of income, their primary source of income is not dairying, as seen in the table above. According to the chi-square test, the estimated chi-square (2,734[a]) is greater than the P=0.05 values provided. We can therefore conclude that there is no association between dairying practises and income group.

To examine the statistical significance between the group means of subdivision intensity. The results of an estimated one-way ANOVA are presented in the table 6.56.

Table 6.56: One way ANOVA – Between Green Fodder and the sub-division

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3307.500	1	3307.500	.031	.861
Within Groups	12697125.000	118	107602.754		
Total	12700432.500	119			

Source: Authors Calculation, based on primary data

As we can see from the table 6.56 that the value of F-cal is (.031) and its P-value is ≥ 0.05, which is statistically insignificant. It indicates that there is no significant difference in the group means.

6.8 Factors affecting the milk income per kg of milk produced in South Sikkim dairy farms: The Regression Analysis

The regression analysis in the study region is based on the following factors:

Total cattle, value of feed, in-season milk, the average price of milk, family size, only the adult's members of the family and income generated through milk sale only.

Dairy farming is an important animal sector. It has a long history of providing consumers with important foodstuffs. The viability of agricultural businesses depends on the efficiency of agriculture. Total milk income is especially vital for farms, notably dairy farms, during financial difficulties like those facing national agriculture. Long-term survival and total milk income are more likely for well-organized, total milk income farms in the current economic climate. Dairy farming's importance in developing the Common Agricultural Policy's rural development policy will grow. The following considerations necessitate a thorough analysis of dairy cow farming, focusing on the total milk income per kilogramme of raw milk produced (Stankov. *et al.*, 2015).

Statistical analysis was applied to calculate total milk income per kilogramme of milk: Kolmogorov-Smirnov test and logistic regression. Regression reveals cause-and-effect links between variables. The test is aimed to solve general problems, such as determining the relationship's function and parameters quantitatively. Dependent variables must be explained or predicted. Regression analysis determines how dependent variables change based on the fixed variable (Gatev, 1991).

Correlation and regression assess interdependence and causal effects among several variables. More than one independent variable can be used to evaluate one dependent variable. Correlation coefficient is r. -1 to +1 were valid values. When negative, the connection reverses. One variable affects the other. When one variable grows or shrinks, the other does also. Stronger link between variables when r approaches -1 or +1. As the link weakens, r approaches zero. Correlation coefficients between 0 and 0.3 indicate a weak relationship, 0.3 to moderate, and over 0.7 -strong. Both positive and negative values apply.

Y is the dependent variable and X_i is the independent variable, or factor. Let's assume z independent variables. $b_1X_1 + b_2X_2 + ... + b_zX_z$ is the linear combination of all independent variables.

Regression equation: $Y = b_1X_1 + b_2X_2 + \dots + b_zX_z + a$ where a is a regression constant.

Number of regression coefficients equals independent coefficients plus constant.

Multiple correlation involves several dependent variables. Multicollinearity occurs when independent variables are significantly correlated i.e., $r > 0.9$ (Stankov, *et al*, 2015). Regression analysis: the impacts of several parameters on the total milk income per 1 kg milk produced was assessed in cross breed cows from the study region, which are among the highest production dairy cattle breeds in the study area and are reared as much as possible in the study area. Total milk income 'P' is the dependent variable, denoted by Y, while the independent variable, the influencing factor, is marked by X.

X_1 — The size of the farm as measured in terms of the number of cows

X_2 - The productivity per hour for everyone who is employed.

X_3 – Feed costs on a per-cow basis

X_4 – Milk production, in kg, per cow

X_5 – Average purchase price of milk

These parameters have the greatest impact on farm total milk income and cow productivity. Size and production concentration affect farm organisation, management, and milk production administration (Todorov, 2003). Productivity per employed person is directly related to milk production, yield, quality, and cow health. Labour and production organisation is crucial, as is agricultural worker and specialised qualification. Feeding animals has a direct effect on productivity and milk outputs and is a considerable part of milk production costs. The milk yield of a cow is one of the most important elements affecting total milk income since it affects overall production. Milk quality also affects the farm's economic condition. The average milk purchase price defines the farmers' output threshold after accounting for production expenses, 1 kg milk production cost, and farm total milk income (Stankov, 1997).

The dairy farmers' farm total milk income, denoted by the letter 'Y,' was subjected to a standard multiple regression analysis to estimate its influence on the following variables:

The size of the farm as determined by the number of cows (X_1), the productivity per hour for each person who is employed on the farm, and the total number of cows on the farm (X_2), Feed expenses on a per-cow basis (X_3), milk production measured in kilogrammes per cow (X_4), and the normal cost to buy one kilogramme of milk in today's market (X_5). During the preliminary investigation, it was made certain that the assumptions for normal distribution, linearity, multicollinearity, and homoscedasticity did not conflict with one another in any way (Stankov, 2015).

Table: 6.57: Analysis of multiple correlation coefficient

Regression Statistics	
Multiple R	0.946247552
R Square (R^2)	0.890795967
Standard Error	29205.89722
Total Observation (N)	120

Source: Author's calculation, based on primary data.

The multiple correlation coefficient, abbreviated as R, is a statistical tool that measures the degree to which the independent variables and the dependent variable are associated with one another in a linear fashion. R = 0.946247552, and the coefficient of determination, R^2, is 0.890795967. This number, when multiplied by 100, illustrates what percentage of the variance of the dependent variable might be predicted on the basis of the independent variables (factors) of the model. R = 0.946247552. In other words, the model is able to account for around 89 percent of the earnings. The high value demonstrated that the chosen independent variables in the model were responsible for determining the total milk income.

Table 6.58: The Dispersion Analysis: (ANOVA)

ANOVA					
Model	Sum of Square	df	Mean Square	F	Significance F
Regression	8.3226E+11	5	1.66452E+11	195.1407	3.72073E-54
Residual	97240225279	114	852984432.3	-	-
Total	9.295E+11	119	-	-	-

Source: Author's calculation based on primary data

Table 6.59: Factors affecting the milk income per kg of milk: (The Regression Analysis)

Factors	Coefficients	SE	t-Stat	P-value	Lower 95%	Upper 95%
Intercept a	-80097.08	27361.74	-2.93	0.00	-134300.48	-25893.68
The size of the farm as measured in terms of number of cows (b_1)	9318.81	3473.91	2.68	0.00	2437.02	16200.60
The productivity per hour for each individual who is employed (b_2)	-0.24	8.82	-0.03	0.97	-17.71	17.24
Feed costs on a per-cow basis (b_3)	8860.41	418.25	21.18	2.48	8031.86	9688.96
Milk production, in kg, per cow (b_4)	779.42	517.15	1.51	0.13	-245.06	1803.89
Average purchase price of milk (b_5)	-2528.16	1240.02	-2.04	0.04	-4984.64	-71.69

Source: Author's calculation, based on primary data

The ANOVA table 6.58 presents the results from the dispersion analysis. The dispersion parameter F=195.1407 has a level of significance p=0.04128, which means that the model is statistically significant.

The calculated regression coefficients are

$a=-80097.07905$, $b_1=9318.813574$, $b_2=-0.237816851$, $b_3=8860.409915$, $b_4=779.4185947$ and $b_5=-2528.163005$

and the following regression equation were obtained:

$Y= b_1X_1 + b_2X_2 + \dots + b_zX_z + a$

or, $Y= 9318.813574X_1 -0.237816851X_2 + 8860.409915X_3+779.4185947X_4 - 2528.163005X_5 -80097.07905$

the regression equation was statistically significant as the calculated level of significance are $F=0.004128<0.05$.

It can be seen from the table 6.59 that the coefficients X_2, X_3, and X_4 were not statistically significant. This is something that should have been expected based on the respective levels of significance shown in the table. This means that the effect that these variables had on Y was so small that it was possible to leave them out of the model entirely. This was made clear in the table by their respective levels of significance, denoted by the symbol p (sign.): $p_2 = 0.978537$, $p_3 = 2.48E-41$, and $p_4 = 0.134543$ all have values that are greater than 0.05. On the other hand, the coefficients of X_1 and X_5 were found to have a level of statistical significance that was statistically significant, as shown by their respective levels of significance in the table. As a result, one may draw the conclusion from the data shown in the table that is above b_1 that the production of dairy cattle has a favourable effect on the revenue of dairy farmers. Therefore, it is a dependable source of income for multiple generations in a family. On the other hand, one might draw the following conclusion from table b_5: even though dairy farming has a beneficial effect on the household that practises it, the size of the family has a negative effect on the income. implying that even if there are more people in a household, the amount of work that gets done won't change much. It's possible that this is because no one in the family wants to take responsibility for anything since they all believe that someone else in the family is more qualified to undertake the job. "Too many cooks spoil the broth," as the saying goes, which ultimately leads to decreased production.

Chapter 7

Role of Dairy Cooperatives and Sikkim Milk Union

This chapter examines the role of those dairy cooperatives and specific attention has been paid to the Sikkim Milk Union for providing support to the dairy producers in the state. This chapter accomplishes objective number 3.

Role of dairy cooperatives and Sikkim Milk Union in supporting dairy farmersin the state.

The production of milk is an ongoing process that begins with feeding the cow, continues with marketing the cattle, and concludes with the milk being sold either to a neighbouring cooperative or to private parties. This approach not only helps rural farmers acquire a consistent income, but also provides employment chances for those living in remote areas. The growth of India's dairy industry and milk marketing activities got its start in 1970 with "Operation flood." Dairy cooperatives are an essential component of both of these endeavours. The general growth of the rural economy relies heavily on the functioning of the milk cooperative as a key institution. The manure that is produced by dairy animals can be sold immediately for cash and provides essential nutrients to the soil. The primary objective of the SMU is to provide a market that is profitable for milk producers in far-flung and remote villages, as well as to make hygienic milk and milk products available to consumers in urban areas at prices that are affordable to them. This will allow the SMU to accomplish the following goals:

1. Maintain price stability of milk by establishing connections between regions with milk excess and towns and cities with milk shortages.

2. Raise the amount of milk that farmers get from their milk cow by enhancing their genetic potential via the use of artificial intelligence and by supplying pedigree bulls for natural service.

3. Unlike other agricultural products, provide a guaranteed market for milk produced by farmers during the entire year.

4. Create employment opportunities in rural areas by employing people to work as dairy farmers and by employing people to work for the MPCS as secretaries, testers, and helpers.

5. Improve the socioeconomic situation of the rural poor by increasing the income they receive from the sale of their milk; increase the milk production of milch animals by providing technical inputs such as balanced milk ratios, fodder seeds, and fodder saplings; this will help increase the income of farmers (Raj, 2021).

The SMU performs the following functions and activities in Sikkim

A. The formation of cooperative milk-selling organisations.

B. Make arrangements for the transport of milk from the communities.

C. Education and preparation of members of the managing committee

D. Instruction to secretaries and examiners

E. Providing farmers with training in the management of dairy animals

F. As part of the farmers induction programme, organise an excursion for local farmers to visit places outside the state (Chettri, 2017).

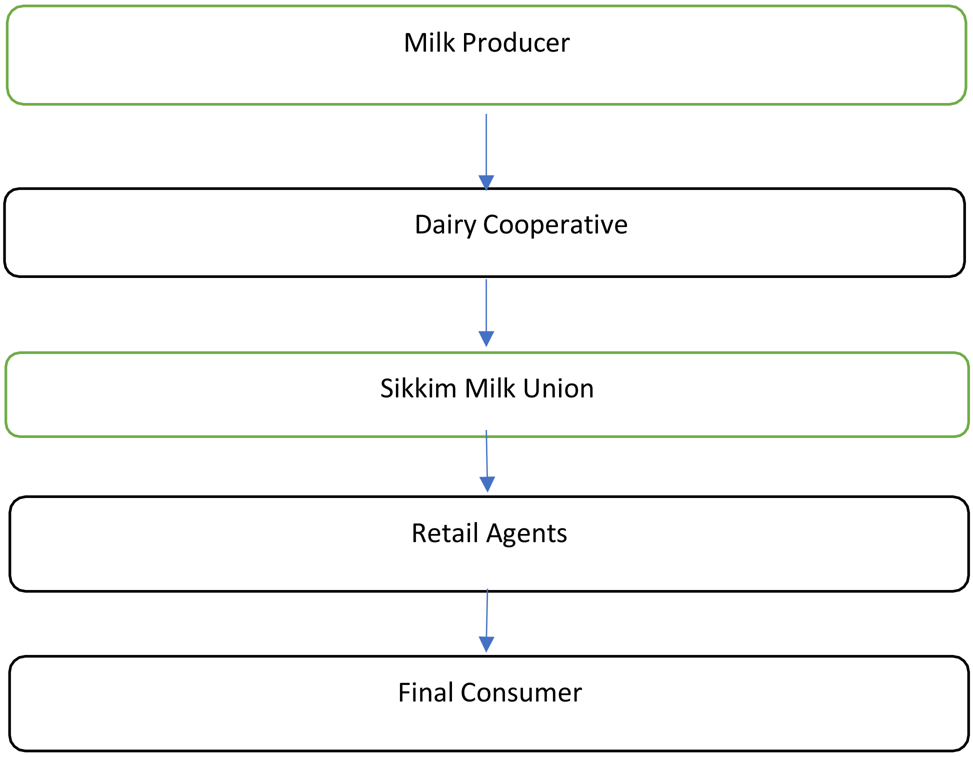
Sikkim Cooperative Milk Producer's Union Ltd.'s Organizational Philosophy.

The Sikkim Milk Union was established with the primary goals of creating a market that compensates milk producers located in remote rural areas and making it possible for urban consumers to obtain hygienic milk at a price that is affordable to them. The Sikkim Milk Union also aims to make it possible for milk producers located in remote rural areas to sell their products on the market.

- Farmers have the potential to boost their income by increasing milk production on their farms. This can be accomplished with the assistance of specialised inputs such as balanced milk ratio, forage seeds, and forage saplings.
- The genetic potential of a farmer's milk cows can be improved using artificial insemination and the incorporation of hybrid bulls into the farmer's herd for the purpose of natural service. Both practises are done to raise the farmer's milk production.
- In contrast to most other agricultural products, it is anticipated that there will be a market for milk throughout the whole year.

Milk has a relatively short period of time that it can be stored. The steep geography of Sikkim, as well as the numerous landslides that take place over the monsoon season, makes it difficult to produce milk in the state. As a direct consequence of this situation, the Sikkim Milk Producers Union has been compelled to rely on grants and subsidies from both the central government and the state government to continue operating as a company. It is true that milk production and sales have witnessed significant advancements, which has resulted in improved revenues, better utilisation of plant resources, and fewer losses. These positive outcomes have been brought about as a direct result of these advancements.

Structure of milk supply chains from producers to SMU through cooperatives



Above, we see how cooperatives play a role in the distribution of milk from farmers to SMU. To put it another way, it shows that dairy farmers make milk on the farm, provide it to the collecting centre/dairy cooperative, and then deliver it to SMU for processing and sale to retail agents and, finally, to consumers. The importance of the intermediate man was determined to be minimal in Sikkim.

Milk Procurement by SMU: The data regarding milk procurement by SMUhas been collected and presented below.

Table 7.1: Milk Procured from Society

Sources of Milk	In KG
Gangtok Dairy Plant	7588549.00
Jorethang Dairy Plant	11847683.10
Total	19436232.10
Average Procurement per day	53250

Source: Annual Report SMU, 2021-2022

To meet the rising need of its residents, Sikkim imports milk from dairy farms both within and beyond the state, including the aforementioned Bhagirathi Milk Union, Delight Dairy, and Barauni Dairy. On a daily basis, it collects an average of 53250 litres of milk from all of the facilities.

Milk Collection system by SMU: Sikkim Cooperative Milk Producers Union collects, processes, and markets milk from rural farmers based on the Anand model in Gujarat. The SMU connects areas of surplus milk to milk-deficient towns and cities, thereby stabilising milk prices and providing a lucrative market for farmers in outlyingareas to sell their products. In order to ensure the smooth operation of the milk cooperatives, SMU appoints secretaries and presidents at the village level. Their primary function is societal management, and this includes milk farmers. They are in charge of keeping the books for their community. Executives and secretaries in high society can learn the ropes at Union. Milk quality can be gauged in large part by its SNF (Solid Non Fat) and fat content. The secretary of the society does a taste test on the milk. Each farmer's milk price is set by the union based on quality testing. Everything from a farmer's daily milk production to their monthly income is recorded. Milk is delivered daily from each milk cooperative to SMU for processing.

Marketing of dairy product by SMU: SMU gives cooperatives market access to both within and outside the state. Deputy General Managers and employees oversee SMU's market. Milk is promoted by commission agents. The three districts of South, West and East have a total of 331 selling Agents and 11numbers of Army units both in the state and outside. They use conventional and refrigerated vehicles to deliver milk and its products on many routes. SMU hires private transporters to deliver milk to Jorethang, Namchi, and Geyzing. At 2:30 am, SMU distributes milk. Route assistants arrive first. The dispatcher gives the route worker his milk quota. Route assistance and dispatch compare milk load to daily demand. For products, a challan indicates quantity and recipient to the route helper and dispatcher. Milk is delivered at 3:20 am. The driver delivers milk based on the demand sheet. Milk delivery generates sales. Various agencies collect dues. Milk distribution ends at 9:30. The agent's driver and route assistant enter the next day's milk and milk product needs in the daily demand sheet. Once the daily demand sheet is generated for the marketing vehicle, a collected plant demand sheet is prepared for milk and milk product packing. Milk and milk products are refrigerated overnight after packaging. 80% of Gangtok's east district's marketing agents have a deep freezer for plant milk. 47 deep freezers were given as union support to agents without chilling facilities. Farmer, cooperative, and SMU interviews confirmed this.

Product mix of the dairy plant: Pasteurized fresh cow milk, toned milk (3% fat and 8.5% SNF), high cream milk (4% fat and 8.5% SNF), Butter, Paneer, Churpi, Curd,Lassi, Cream, etc. are all manufactured at the factory, as stated in the annual report of SMU, 2021-2022. Similarly, the breakdown of 2021-2022 fiscal year Production is as follows, in kilogrammes:

Table 7.2: Production made by various plant

Product	Mfd. in Gangtok Plant	Mfd. in Jorethang Plant	Total
Butter	12390.00	29316.50	41706.50
Paneer	153.20	48474.00	48627.20
Churpi	24684.50	11104.00	35788.50
Curd	255746.00	148051.00	403797.00

Source: Annual Report SMU, 2021-2022

Similarly milk and its product sales in the year are;

Table 7.3: Sale of milk and its product by SMU

Month	Product							
	Milk	Butter (1 kg)	Butter (500g)	Paneer (1kg)	Paneer (500g)	Paneer (200g)	Churpi	Curd
Apr.'21	1511781.76	2494	215.00	1552	435.00	1559.60	1780.50	37330.50
May '21	1435319.31	3273	170.00	902	452.00	3260.30	2952.00	34716.00
June'21	1413070.11	3211	171.00	743	405.50	2168.80	3823.70	36584.50
July'21	1456459.03	2830	160.50	384	243.00	1277.80	3448.00	25277.50
Aug.'21	1475264.30	3043	142.00	605	436.50	1798.00	3703.50	24610.50
Sep.'21	1467045.94	34475	185.00	1063	761.00	1007.60	3484.00	32766.00
Oct.'21	1445110.16	3744	208.50	1391	1441.50	577.60	2472.00	28446.00
Nov.'21	1450801.86	3129	157.00	1495	1103.50	1879.00	1956.50	29510.00
Dec'21	1602187.70	2665	595.50	2374	656.00	2395.85	2821.50	30321.50
Jan.'22	1372834.37	2102	619.50	1663	710.00	2267.40	2545.00	26561.50
Feb.'22	1329283.44	2899	483.00	2305	612.50	2399.00	3104.00	31292.50
Mar.'22	1461900.74	2809	293.00	2007	697.50	2488.00	2579.50	61629.50
Total	17421058.72	35674	3400.00	16484	7954.00	23078.95	34670.20	399046.00

Source: Annual Report SMU, 2021-2022

Marketing margin and price spread of SMU:

The margin on milk and milk products varies with the highest margin on 200 gm paneer packet. On ice-creams the margin is invariably 18%. The detailed profit or margin to SMU and Selling agent on selling of milk and milk products is as under:

Table 7.4: Milk and Milk Products of SMU

SL No.	Milk and Milk Products	MRP (Per Pkt.)	Agent Rate	Margin (Per Pkt.)
1	High cream milk (1000ml)	62.00	60.00	2.00
2	High cream milk (500ml)	32.00	31.00	1.00
3	Curd (500ml)	55.00	54.00	1.00
4	Butter (1000gm)	670.00	660.00	10.00
5	Butter (500gm)	350.00	340.00	10.00
6	Paneer (1000gm)	400.00	390.00	10.00
7	Paneer (200gm)	100.00	92.00	8.00
8	Churpi (500gm)	160.00	158.00	2.00
Ice-creams				
9	Stick in wrapper (40ml) (Available in Vanilla, Strawberry and Mango flavour)	10.00	8.20	1.80
10	Cup (90ml) (Available in Vanilla, Strawberry and Mango flavour)	15.00	12.30	2.70
11	Vanilla and Strawberry (1000ml)	100.00	82.00	18.00

Source: Sikkim Milk Union Ltd., 2022.

Table 7.5: Milk and its product sale by SMU: Descriptive statistics

Product	Minimum	Maximum	Mean	Std. Deviation
Milk	1329283	1602188	1451754.83	67544.285
Butter (1 kg)	2102	34475	5556.17	9116.464
Butter (500g)	142	620	283.33	177.787
Paneer (1kg)	384	2374	1373.67	652.736
Paneer (500g)	243	1442	662.92	331.319
Paneer (200g)	578	3260	1923.33	735.314
Churpi	1780	3824	2889.25	656.971
Curd	24610	61630	33253.83	9853.353

Source: Authors calculation and compiled from Annual Report of SMU, 2021-2022

The average amount of milk sold by SMU in 2021-2022 is 1451754.83 kg, and the standard deviation is 67544.285 kg, which shows a high rate of change. Milk sales vary a lot more than other products. This may be because all other products are made from liquid milk, so the production and sale of liquid milk can only be used to measure the production and sale of subsidiary items. Similarly in a year, the maximum milk sale was recorded as 1602188 kg and minimum sale was recorded as 1329283 kg. Likewise, in all other products its mean is; butter 1 kg (5556.17) with SD (9116.464), butter 500g (283.33) with SD (177.787), Paneer 1kg (1373.67) with SD (652.736), paneer 200g (1923.33) with SD (735.314), churpi (2889.25) with SD (656.971) and curd (33253.83) with SD 9853.353) indicating high variation (except butter 500g). in butter 500g there is less variation during the survey period.

Future planning of SMU: The Sikkim Milk Union Ltd. through increased procurement plans to expand its marketing and aims to venture further into the states outside Sikkim and also plans to launch new dairy products.

Chapter 8

Rural-Urban Linkages through Dairy and the Constraints of Dairy Farmers in Sikkim

This chapter examines the linkages between the rural and urban economies established by dairy farming in Sikkim. The data used to support this analysis come from primary surveys. In addition, specific attention has been paid to the constraints of the dairy farmers in the rural economy of Sikkim. This chapter fulfils objective number 4.

Linkages between the rural urban economy created by dairy farming in Sikkim: Operation Flood was a development effort that was undertaken by the government of India in the 1970s. It was intended to operate for ten years and was focused on growing dairy production as a crucial rural-urban bridge. As part ofOperation Flood, a significant increase in the amount of milk produced in rural areas was successfully achieved through the formation of dairy cooperatives and the enhancement of infrastructure (Cunningham, 2009).

To put it another way, "rural-urban connection" refers to the movement of people and things across spatial boundaries, as well as the exchange of monetary and other resources, as well as the production of trash and its subsequent disposal. It has been established that there is a link between the vast array of company specialisations and areas of economic activity. One of the most major effects that urbanisation has on rural populations is a rise in the cost of food. This is one of the most significant effects, along with the demand for other natural resources (water, fuelwood, etc.). There has been an increase in the production of high-value perishable goods such as fruit, vegetables, and dairy as a direct result of the increased demand from cities in a great number of different countries all over the world. This increase in production can be directly attributed to the increased demand from cities. This is especially true in rural communities that are linked to metropolitan markets by a network of local traders, as well as by means of transportation, communications, and energy. There is little room for debate regarding the importance of making improvements to infrastructure as a primary focus of public policy in the context of fostering stronger connections between rural and urban areas. As a direct result of this, the contribution that agriculture makes to the incomes of rural areas is decreasing at an alarmingly rapid rate. Nevertheless, this shouldn't be confined to only connecting rural residents to large urban centres. It should also have other goals. This affords smallholder farmers the chance to make investments in agricultural output and reduces the degree to which they are dependent on the volatile nature of farming, both of which are to the smallholder farmers' benefit. Moving to a city could be required in a number of distinct circumstances if an individual wishes to expand their financial options and diversify their sources of income. However, in the best-case scenario, income diversification can be achieved by preserving the added value of agricultural products and generating employment opportunities within the local economy that are not related to agriculture. In order to cultivate mutually beneficial rural-urban relations, it is very necessary to provide assistance for the diversification of rural economies and to enhance the role of small to medium-sized communities. These pursuits are carried out in regions that are mostly populated by communities of a size between very small and very large (Cecilia, 2015).

It is impossible to conceive of any nation's GDP increasing in the absence of a relationship existing inside it between its rural and urban parts. Only in rural areas, where there is a greater supply of land suitable for agriculture, is it possible to cultivate crops for human consumption. The urban populous satisfies their daily nutritional requirements by consuming the food that is produced both on farms and in dairies. In a similar vein, the rural population is reliant on urban markets for the fulfilment of their fundamental requirements, such as procuring clothing, packaged food products such as sugar, salt, oil, etc., as well as medicine and a variety of other necessities.

The agricultural fields and lands in the rural areas are used to produce agricultural goods and to raise livestock. The raising of cattle serves two purposes: first, it helps boost agricultural production by providing farmers with much-needed manure; second, it acts as a buffer to farmers' income in times when agricultural production is low due to factors beyond their control, such as dry spells and other natural occurrences. Therefore, rural areas are the primary locations for the mass production of agricultural crops and dairy products. Because of the quantity of these products, they are sold through a variety of channels both inside and outside of the community, which results in cash being generated. The supply that comes from the rural population is handled through the following supply chains:

I. Products are sold directly from home
II. Sold by farmers from door to door
III. Send to nearby collection centres and
IV. Supplied to distant markets.

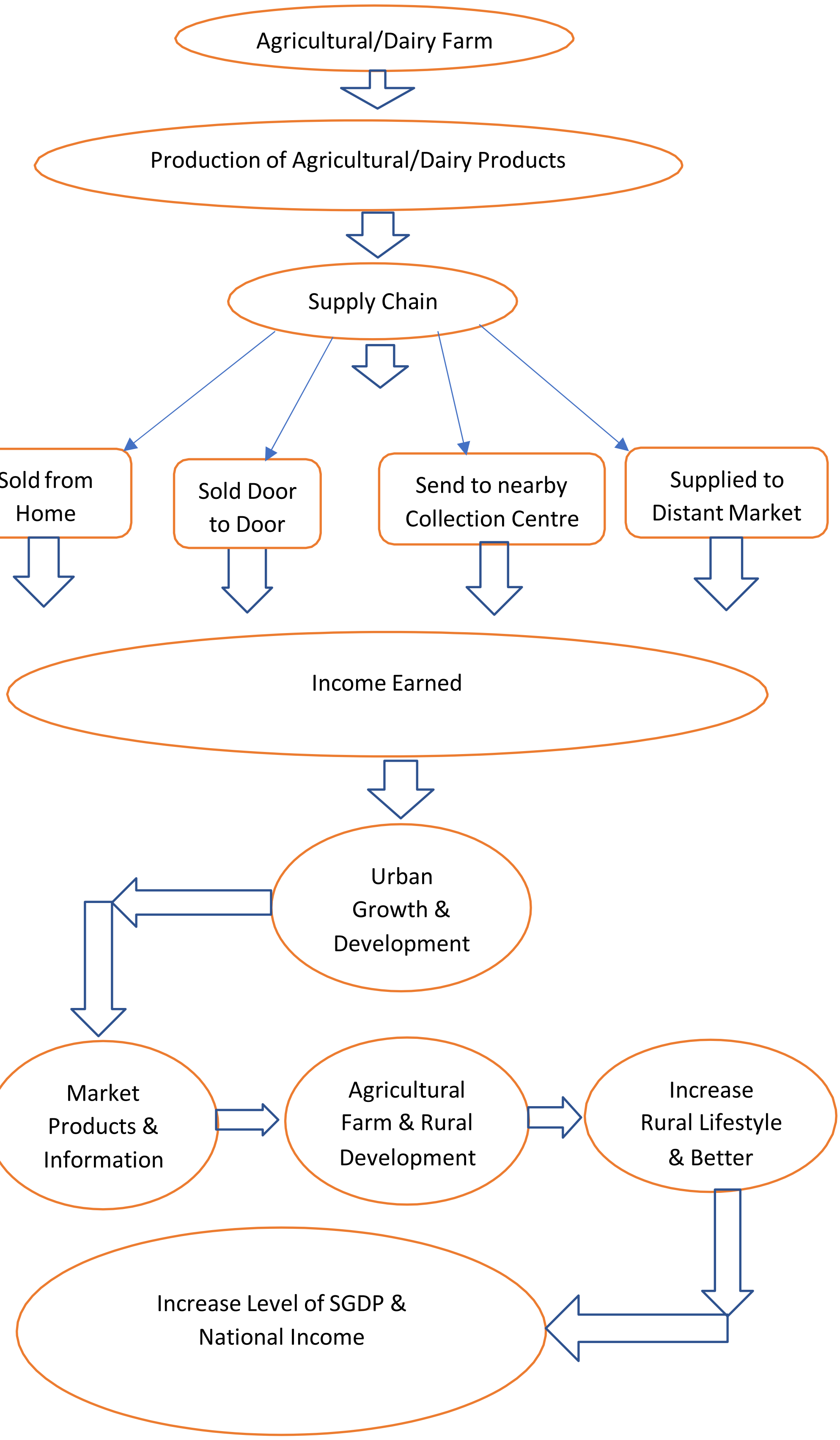
In their investigation, Pandey makes reference to the research conducted by Chopra *et al*. (2010), (2014), The supply chain is composed of any and all of the parties that are directly or indirectly involved in the process of directly or indirectly satisfying the demand of a consumer. Warehouses, transporters, retailers, and even the final consumers of the product are all considered to be participants in the supply chain. Other participants in the supply chain include producers and suppliers. The supply chain is comprised of all of the functions that are required within an organisation, such as a manufacturer, in order to receive and fulfil an order that has been placed by a customer.

One of the main goals of the supply chain is to ensure that all orders are processed in a timely manner. These functions may include, but are not limited to, the following: the creation of new products, the marketing of those products, the operation of those operations, the distribution of those products, the management of money, and the provision of customer support.

Both the production of dairy goods and agricultural goods are important sources of revenue for the population living in rural areas. The nutritional requirements of the urban population can be met, in part, by the items that are produced and sold by farmers in rural areas. They have access to fresh veggies and unadulterated milk, both of which contribute to their continued good health. Individuals who are healthy in both mind and body are able to perform at higher levels, which in turn contributes to the growth of cities.

Farmers in rural areas put the money they earn toward the purchase of a variety of goods accessible in towns and cities that are unavailable in their communities yet are essential to their way of life. They obtain the pertinent knowledge they need from the market in metropolitan regions, and then apply it in agricultural farms in order to further their development. Their standard of life has improved, and they are now able to pursue opportunities that are even more rewarding. This, in turn, raises the state's gross domestic product as well as the income of individuals, which in turn contributes to the income of the nation as a whole, so facilitating the expansion of the nation as a whole.

The graphic that is provided below can help a clearer picture of this idea.



Source: Field Survey, 2019-2020

Table 8.1: Supply Chain of Dairy Products

Sl. No.	Supply chain	Frequency	Percentage
1	Sold from home	3	2.50
2	Sold door to door	29	24.20
3	Sold to collection centre	83	69.20
4	Sold to distant/local retail market	5	4.10
Total		120	100.00

Source: Field Survey, 2019-2020

Table 8.1 throws the lights on the supply chain of dairy products from dairy farm to different places. It has been observed that about 69% of the dairy farmers sold dairy products to the collection centre followed by about 24% sold to door to door. The very less amount of milk sold to local retail markets of about 4% and from home is only about 2% in the study area.

Constraints on dairy farming perceived by dairy farmers in rural Sikkim:

Table 8.2: Present Dairying Limitation/constraints among Dairy-farmers

Area-Unit	Fodder-In-adequacy	%	In-adequate Vet. Service	%	Capital Short-age	%	Manpower Short age	%
RB	**2**	**1.35**	**6**	**4.05**	**1**	**0.67**	**5**	**3.38**
RN GPU	-	-	-	-	1	0.67	2	1.35
KB GPU	2	1.35	6	4.05	-	-	3	2.23
NB	**5**	**3.38**	**-**	**-**	**5**	**3.38**	**15**	**10.13**
CP GPU	4	2.70	-	-	2	1.35	10	6.67
TB GPU	1	0.67	-	-	3	2.23	5	3.38
SS DT	**7**	**4.73**	**6**	**4.05**	**6**	**4.05**	**20**	**13.51**
Area-Unit	Lack of Training	%	Low Milk-Yield	%	Low Milk Price	%	Low Milk De-mand	%
RB	**15**	**10.13**	**7**	**4.73**	**9**	**6.08**	**2**	**1.35**
RN GPU	5	3.38	-	-	9	6.08	1	0.67
KB GPU	10	6.76	7	4.73	-	-	1	0.67
NB	**10**	**6.76**	**17**	**11.48**	**-**	**-**	**-**	**-**
CP GPU	7	4.73	4	2.70	-	-	-	-
TB GPU	3	2.23	13	8.78	-	-	-	-
SS DT	**25**	**16.90**	**24**	**16.23**	**9**	**6.08**	**2**	**1.35**
Area-Unit	Poor Market Infra-structure	%	Poor Transportation	%	Other	%		
RB	**5**	**3.38**	**28**	**18.92**	**1**	**0.67**		
RN GPU	2	1.35	27	18.24	1	0.67		
KB GPU	3	2.23	1	0.67	-	-		
NB	**5**	**3.38**	**7**	**4.73**	**3**	**2.23**		
CP GPU	3	2.23	7	4.73	-	-		
TB GPU	2	1.35	-	-	3	2.23		
SS DT	**10**	**6.76**	**35**	**23.65**	**4**	**2.70**		

Source: Field Survey 2019-2020
Note: RB-Ravangla Block, NB-Namchi Block, SS DT- South Sikkim District Total, RN-Ralong Namlung, KB- Kewzing Bakhim, CP- Chuba Phong, TB- Tangzi Bikmat

The table 8.2 throws light on the present dairying limitation (single constraint only) among South Sikkim Dairy-farmers. The survey in the study area revealed almost a dozen dairy limiting factors among the farmers practising dairy farming in the study area. Poor transportation (road connectivity) was the most common factor which discouraged dairy farming. The farmers shared that the problem worsened in rainy seasons as most of their milk and milk products couldn't fetch them the expected income as much of it gets wasted due road blockages due to landslides during the monsoon season. Some reported that even during the dry season though they have potential for more milk production they get discouraged as no access to road network cripples them. Approximately 24 percent dairy farmers in the study area reported that poor transportation was the main dairy limiting factor for them.

Lack of training was second in the list. As approx. 17 percent dairy farmers reported that it limited their dairy farming potential greatly. Farmers in the study area shared that due to lack of training on animal health, milking hygiene practices, animal nutrition animal welfare management, housing and environment management, marketing, and financial management they could not get the optimum output from dairy farming. Thus, it was seen as a major limiting factor by approximately 17 percent of dairy farmers.

Cow milk yield from the cattle, despite putting in great effort in its care was seen as a major limiting factor by about 16 percent of the dairy farmers in the study area. However, no dairy farmer from Ralong Namlung GPU in the Ravangla Block complained of low milk yield from their cattle. About 14 percent of dairy farmers shared that the manpower shortage was the main dairying limitation factor now a days. Had they found sufficient manpower to assist them, they would have practiced their dairy farming activities in much larger scale. Approximately 7 percent dairy farmers revealed poor market infrastructure as a limiting factor for dairying. An efficient marketing system would minimise cost, ensure remunerative prices to the producers and provide good quality of milk and its products to the consumers at affordable prices. Nearly 6 percent of the dairy farmers in the study area felt that low milk price was the limiting factor for them. As they shared that the output from dairying did not fetch them sufficient/desired income and at times the income from dairy goes on deficit.

Almost 5 percent of dairy farmers shared that fodder inadequacy in the study area was limiting their dairy farming as it gets tough for them to arrange fodder for their cattle. The ban in grazing in the reserved forests area and sudden surge in construction and development activities happening in the village etc. are leading to less area open for fodder growth reported the farmers.

Approximately 4 percent of dairy farmers shared those inadequate veterinary services lead to improper/no treatment of cattle disease. It led to no/less yield from cattle. Instead of getting returns from cattle they are sometimes forced in invest more time and money in their treatment which discourages them from practising dairy farming. However, Kewzing Bakhim GPU from Ravangla Block has reported such limitation. Rest of the GPUs in the study area do not have such limitations. Similarly, approx. 4 percent dairy farmers from Kewzing Bakhim GPU shared that capital shortage was the limiting factor for practising dairy farming for them. They did not have adequate resources for capital formation, nor did they have any access to any other sources for providing them the capital required. Other factors apart from those detailed above like the migration of people from rural areas to the urban area in search of better lifestyle, good education for their children, to opt easy jobs, for better health facilities, etc. were also reported as the dairying limiting factors in the study area.

Finally, a few dairy farmers approximately 1 percent shared that the low milk demand in the vicinity is the limiting factor for the dairy farmers in both the GPUs of Ravangla Block. They revealed that even if they produce more milk, they don’t have place to sell it as almost every household in the locality rear cow for fulfilling their milk/dairy needs.

Therefore, they are discouraged to practice dairy farming in large scale. Further, this table reflects that the respondents have more than one problem. These all-dairying constraints were ranked with the help of mean score procedures which can be seen in table 8.3 and figure 8.1.

8.2.1 Constraints in Dairy Farming:

Different dairy farming constraints were faced by the dairy farmers of the state is elaborated in the table 8.3 below.

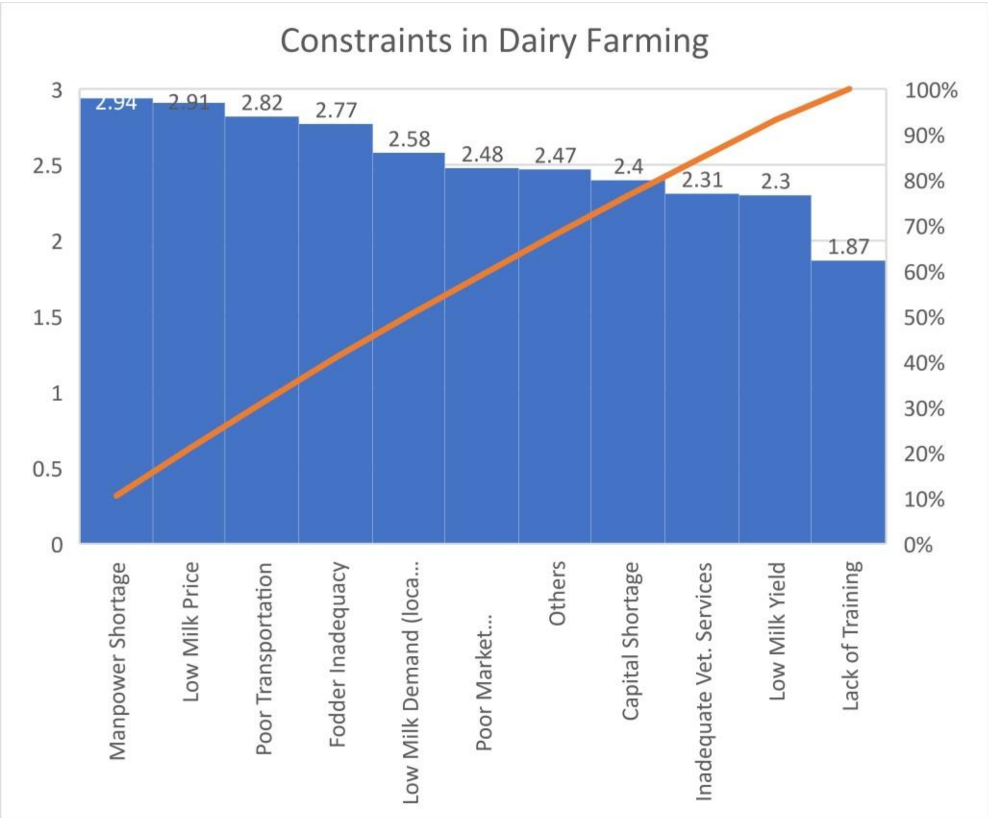
Table 8.3: Constraints faced by dairy-farmers

Sl. No.	Constraints	Least Severe		Severe		Most Severe		Total F	Total %	Mean Score	Rank
		F	%	F	%	F	%				
1	Fodder Inadequacy	6	5.00	15	12.5	99	82.50	120	100	2.77	IV
2	Inadequate Vet. Services	20	16.67	43	35.8	57	47.50	120	100	2.31	IX
3	Capital Shortage	21	17.50	30	25.0	69	57.50	120	100	2.40	VIII
4	Manpower Shortage	2	1.67	3	2.50	115	95.83	120	100	2.94	I
5	Lack of Training	15	12.50	15	12.5	90	75.00	120	100	1.87	XI
6	Low Milk Yield	27	22.5	30	25.0	63	52.50	120	100	2.30	X
7	Low Milk Price	3	2.50	5	4.17	112	93.33	120	100	2.91	II
8	Low Milk Demand (local level)	15	12.5	20	16.7	85	70.83	120	100	2.58	V
9	Poor Market Infrastruc-ture	21	17.50	20	16.7	79	65.83	120	100	2.48	VI
10	Poor Transpor-tation	7	5.83	7	5.83	106	88.34	120	100	2.82	III
11	Others	20	16.67	24	20.0	76	63.34	120	100	2.47	VII

Source: Field Survey 2019-2020 and Authors Calculation
Note: F-Frequency

All the above has been depicted through a Pareto chart below (Figure 8.1). It shows the distribution of the data in descending order of frequency, with a cumulative line on a secondary axis as a percentage of the total.

Figure 8.1: Constraints in Dairy Farming



Many problems persist for the dairy farmers in the study area, as illustrated in the table 8.3, which includes information on the most frequently encountered difficulties. It was decided that the limitations would be grouped into three categories: the least serious; the serious; and the most serious; To analyse the data collected on constraints, frequency and percentage counts was used, a weighted mean score was also made, as well as a mean score based only on the data. The ranking of the many limits and constraints has been broken down into categories and reviewed in detail at the end of this section. It was discovered by the survey's result that a lack of personnel (2.94) was identified as the most severe constraint faced by dairy producers in this area by the biggest number of respondents in the study area. Prior research has revealed similar results, which support this conclusion. A variety of causes have contributed to this issue, including low levels of education among family members, labour migration from rural to urban areas in search of better or more easy career prospects, and so on. During the survey, it was found that the farmers were unhappy with the prices of milk that were paid to them or set by the union (2.91). This was found to be the second biggest problem dairy farmers in this research region face. The survey found that poor transportation (2.82) and a lack of fodder (2.77), which was made worse by the fact that cattle grazing is completely banned in the state's designated forests, making it impossible for farmers to deal with the shortage, were the third and fourth most severe problems. A shortage in local milk demand (2.58), which is ranked as the fifth most severe constraint in the research region, is one of the most significant.

The scarcity of marketing infrastructure has been identified as the sixth major constraint, and it has been designated as such (2.48). Most dairy producers say that the other restraints (2.47) are the seventh most serious problem they are facing right now. According to the World Dairy Federation, the capital deficit (2.40) is the eighth most serious problem dairy farmers face. The lack of veterinary services (2.31), on the other hand, is the ninth most serious problem dairy farmers face. The ninth limitation was determined to be a low milk output of (2.30). According to the results of the field survey, the last constraint identified was a lack of appropriate training (1.87) (Kharel, 2022). Lastly, if we talk on its constraints as well as some suggestions, though there are a lot of problems in mountain economies, especially when it comes to dairy farming, a few of the biggest ones have been picked out: lack of roads, lack of water, problems with fodder, bad marketing, lack of knowledge about cattle/livestock insurance, lack of a good manure market, lack of designated meat markets, lack of a good gaushala, and bad waste management in poultry farms. If the government puts in a little more effort to strengthen these things, it will help the cattle industry in the mountains. Working closely together, the government and farmers will help the livestock economy stay strong in the long run, which will help the mountain economy as a whole reach new height.

Chapter 9

Conclusions and Policy Recommendations

The final chapter reviews the summary obtained from the overall research study, and makes suitable policy recommendations, within the limited perspective of the study. Future directions for further research on dairy farming have been suggested.

Conclusions

It can be inferred that livestock activities play a major role in the rural economy, with the new technology and innovation in the field of dairy farming having received a considerable boost. Dairy farming along with crop farming in the mountains provides a farmer with an avenue to multiply his/her combined source of income.

In certain areas, dairy farming is declining where the income from non-farm work is more remunerative than rearing cattle, especially near the industrial belt. Also, the restriction to the foraging of the cattle in the area has made on site fodder availability very less, thus burdening farmers to invest on pre prepaid fodders. Dairy farming is taken up as a secondary livelihood activity, thus having a subsidiary role in rural areas. Retail milk prices are not in comfortable with the higher cost of cattle feed, fodder, and veterinary services.

Most of the literature reviewed revealed that transhuman and community management grazing system has disappeared and a new trend of rearing cross breed cattle and exotic cattle for higher productivity is in place. The local breeds are being protected lest they might be extinct.

Umpteen literatures are available to dairy farming viz. dairy farm management, AI breed improvement, milk production marketing, animal health, dairy development, fodder management, however, very little information was available on the fodder self-sufficiency required to support higher nutritional needs of cross breed cattle in Sikkim.

The conceptual flow chart depicts the several interdependent factors linking the livestock economy to the rural economy and dairy development to the overall rural development process. Few of the relevant features of this framework commonly found in mountain regions have been examined.

An effort has been made through the thesis to study the role of dairy farming in the rural economy of Sikkim. To fulfil this task, the following four broad objectives were identified.

i) To examine the role of the livestock economy in mountain regions and the effects of climate change in dairy farming in mountain economy.
ii) To study the Socio-economic profile of dairy farmers and their pattern of milk production, technical efficiency, consumption, marketing, and income utilization system.
iii) To study the role of dairy cooperatives and Sikkim Milk Union in supporting dairy farmers in the state.
iv) To assess the linkages between the rural and urban economy created by dairy farming in Sikkim and to identify the constraints on dairy farming perceived by dairy farmers in rural Sikkim.

The research questions framed for the study were:

i) What is the role of the livestock economy in mountain regions and does the climate change has any impact in dairy farming in mountain economy?

ii) What is the Socio-economic profile of dairy farmers and how is their pattern of milk production, technical efficiency, consumption, marketing, and income utilization system?

iii) What is the role of dairy cooperative and Sikkim Milk Union in supporting dairy farmers in the state?

iv) Are there any linkages between the rural and urban economy created by dairy farming and what are the constraints on dairy farming perceived by dairy farmers in rural Sikkim.

This thesis has utilized both primary and secondary data for the purpose of analysis. The secondary data have been gathered from published sources and the primary data have been collected through survey using a structured questionnaire in the study area. The data have been analysed using SPSS software and other statistical tools.

The conclusion of the study are as follows:

i) The livestock economy does play a crucial role in mountain economy. It is the backbone of rural people which supports them in all fields of livelihood ranging from the food supply, family nutrition, as a means of agriculture traction, for soil productivity, as an asset saving and as a secure source of family income.

ii) Climate change is a global phenomenon which has not left the dairy farming untouched too. In mountain region, it has impacted it negatively due to rise in occurrence of disasters which causes environmental degradation that leads to shortage of green fodder, water crises, rise in intervention of wild animals.

iii) Socio-economic condition of a population is determined by factors such as gender, age, income level, education level etc. all these are enhanced through dairy farming. In Sikkim dairy sector contributes 17% of state GDP, it plays a crucial role in economic upliftment of the weaker section of the society, thereby helping them upgrade their education and health status which in turn improves their physical and mental health.

Dairy farming is found to be such an occupation which has no gender barrier and can be practiced equally well by both the genders. Also, all age groups can take up some role in the dairy farming process, thus aiding in saving implicit cost. Income from dairy farming is a reliable source of income as it is a fixed source of income for a dairy farming family involving very less risk. Also, education level is immaterial in dairy sector as, an illiterate person can fare equally well as the most literate person.

In the study area it has been:

a) Proved that both the genders participate in the dairying activities.
b) Observed that an average family size of a dairy farmer is 6 people of which 2 are children, 3 are adults and 1 elderly.
c) Found that all the different communities practise dairy farming. However, Hindus comprise about 77% followed by Buddhist 21% and Christians only 2%.
d) Found that Nepali language is the most preferred form of communication by the dairy farmers.
e) Observed that though farmers having different level of educational qualification are practising dairy farming, most of the farmers were found be educated only upto class- V.
f) Observed that irrespective of the family type, be it Nuclear or Joint or Extended, all of them practise dairy farming.

g) Certified that the dairy farming has the potential to provide better education avenues to the younger generation in the family.

h) Found that dairy farming has provided them with sufficient income to build a house on their own, be it kutcha, ikra, semi-pucca or pucca.

i) Found that a dairy farmer can afford all the basic amenities through dairy farming.

j) Seen that practicing dairy farming has led to the reduction in the non-operational land.

k) Observed that dairy farmers are invariably opting for allied farming which is boosting their income.

l) Observed that in rural family 85% of income is earned from livestock sector.

m) Seen that dairy farmers have inculcated the habit of saving their income. Majority of them approximately 61% of them are regular savers.

iv) The Scheme Operation Flood was launched by the Government of India in the 1970s, which was extended to the state of Sikkim in the year 1978-1980 through Operation Flood phase-II. It was a powerful scheme which created and strengthen the link between rural and urban area of the state as in the mainland India. This led to the sprouting of dairy cooperatives that helped the growth of economy in villages which in turn helped the urban economy grow, through exchange of revenue in purchasing items/good found in these two areas.

v) It has been found that in a family which owns more than 2 cattles, they produce milk all year round, however, those rearing less than 2 cattles have few months of dry period in a year.

All the households were found to have an average consumption of 2.6 litres per day irrespective of numbers of cattle they owned.

A dairy farmer is seen to sale, approximately 7 litres per day of milk to different consumers viz. individual households, collection centres, local retail market and distant markets.

It is seen that the income earned from dairy is utilized first to fulfil the basic needs of cattle itself, thereafter for further expansion of livestock, a major part of household expenses and a few for occasional expenses.

vi) Connect areas with too much milk and areas with too little milk to keep milk prices stable. Use artificial intelligence (AI) and pedigree bulls to make more milk. Milk, unlike most other farm products, is sold all year long. Hire dairy farmers, secretaries for the MPCS, testers, and people to help in faraway places. Increase the income of farmers in rural areas by giving them balanced milk ratios, fodder seeds, and fodder saplings. This would help them sell more milk. In Sikkim, SMU does the following things: Milk cooperatives, set up milk delivery for the community, Educating and preparing the management committee, Instructions for secretaries and examiners, as part of the farmers' training programme, a trip out of state is planned for dairy farmers. The Sikkim Milk Union was made to help rural milk producers get paid and to give clean milk at a fair price to people in cities. The Sikkim Milk Union helps farmers in the countryside sell their milk.

vii) Though dairy farming has been prevalent in Sikkim since time immemorial, yet it has begun being practised as a profession only after the Operational Flood programme was launched in India and extended to Sikkim in the year 1978-80. The formation, cooperative societies led to the overall development of society and therefore helped each section of society benefit from it. Middlemen were eradicated and benefit reached the dairy farmers in totally thus encouraged them further. With the rapid employment of youth in the government sector through one family one job (OFOJ) scheme in 2019-20 dairy farming seemed to be declining through such data was not recorded. But during the COVID PANDEMIC 0f 2019 it was found that it was the dairy sector alone, which was able to support the rural people and the people who were seen difficult away from the dairy were found coming back to it yet again. Government too has been providing complete support to the dairy farmers right from providing them good breed cattle free of cost to setting up good veterinary services. Topping it all government in the year declared 1st July as "Gwala Diwas" to pay respect and acknowledge the Gwalas (Dairy Farmers) immense contribution to the economy of Sikkim.

viii) Sikkim has an overall land area of 709,600 hectares. 36 percent of the area is forest, 25.4% is barren, and 10.28% is pastoral, which is utilised for grazing animals by dairy farmers and pastoralists. However, the Sikkim government banned grazing in protected forest, plantation, and water source regions after enacting conservation policies in 1998. In order to feed their cows, dairy producers who were reliant on forest land had to find other sources of fodder, such as planting it on their agricultural and barren land or leasing property. The government, knowing of the possible lack of fodder due to the ban, erected numerous fodder seed and propagation farms throughout the state to meet the cattle's needs. Increased nutrition for crossbreed cattle was addressed by propagating exotic fodder, such as hybrid Napier para grass, cow pea, guinea grass, etc., which is nutritionally superior and succulent and high yielding. Due to timely government action, the state has managed to avoid a fodder shortage despite the prohibition on grazing in forest regions.

However, the truth remains that many pastoralists have lost half of their household income since the Conservation strategy of 1998 was implemented.

In spite of its noble intentions, the government's decision to ban cattle grazing in forest regions was found to have been made in a hurry and without adequate research into the benefits of this practise. Since then, wild animals have invaded the inhabited land, posing a threat to farmers and preventing them from cultivating their fields. Cattle that are allowed to graze freely in the forest are also thought to be healthier and more likely to produce more milk.

Because of the ban on grazing in forest regions, pastoralists who were formerly self-sufficient in their livelihood are now depending on external sources such as tourist traffic, government subsidies and MGNREGA. As a result, many farmers were obliged to sell off their extra livestock at low prices. In spite of receiving some compensation, many people believe that they would once again return to their traditional livelihood of pastoralism if given the option. After the ban, only a few wealthy individuals who were able to construct hotels fared well, leading to an increase in the gap between the rich and the poor.

Rather than outright prohibiting cattle grazing on forest land, pastoralists argue that the government should have set a quota on the number of cattle per owner allowed to graze there.

ix) It is seen that prior to the formation of SMU, the rural dairy farmers were not able to earn much income through dairying activities alone. However, after the launch of Operational Flood by GOI and subsequent formation of SMU in the state the rural farmers could earn more profit as secure milk market for them was opened and the risks associated for far flung dairy farmers got removed through the establishment of dairy cooperatives in the villages itself.

x) Dairy farming helps in the formation of a healthy rural urban linkage, which is a prerequisite for an overall growth of a region, consisting of both rural and urban areas. The rural area practises dairy farming and produce milk and milk products and the urban areas provided the much-needed market and demand for these products. Thus, the need of both the areas rural as well as urban are well addressed through dairy farming.

xi) Various hindrances to dairy farming were shared by the dairy farmers in the study area. All the constraints in dairy farming cannot be removed overnight. However, through continued Government interference many of them can be removed at long run creating even better opportunities for dairy farmers in the state in the years to come.

Policy Recommendations

Agriculture in the rural parts of Sikkim has always included livestock farming as a vital aspect of the overall production of food. Sustainable Development necessitates the adoption of appropriate actions to improve the situation. The following suggestions/recommendations have been made considering the findings of the field investigation and are being considered.

- The potential to increase profitability is critical in pushing dairy farmers to increase their production. Regardless of the revenue or cost, profit is determined by the relationship between them. When it comes to collateral limits, bank loans for financing dairy farming should be straightforward, accessible, and quick. The loan's interest rate should also be reduced. It is also necessary to keep an eye on the rise in the market price of livestock feed. The price paid by the union to dairy producers will be altered, with an increase in some cases.
- A considerable association exists between improved diet and high genetic quality of milking animals and the quality of milk produced by them. Because of this, it is important to encourage farmers to breed and retain improved breeds of animals. Farmer information on better breeds and cross breeding, including information on artificial insemination, should be always made available to them. Researcher recommend that the government should launch a small initiative to introduce improved breed animals into a variety of sample Gram Panchayat Units throughout the state's diverse geographical regions.
- Farmers should be educated on how to properly utilise the fodder and food that they have grown themselves. It is possible to boost productivity with low-cost involvement by cultivating nutritional grasses on their own land rather than

relying on the purchase of expensive feed from the market. The skills in utilising crop by-products should be taught to them.

- Market centres must give the means for selling cattle and calves to be able to pay back their bank loans through the proceeds of the sale.
- Insurance coverage, as well as rapid and cheap credit supply, should be made available to livestock keepers.
- Encourage farmers to focus on raising the production of their animals rather than expanding the number of animals they have on their property.
- To curb the limitation of manpower shortage in one household, this could be compensated by letting his land be used by another household at a nominal fee.
- It is possible that animal sickness will cause severe economic loss to farmers. There should be improvements in veterinary facilities, as well as information on how to maintain a regular immunisation schedule. As per the interest of the National Dairy Development Board, animal medicines should be offered at a reduced cost. Besides that, the proximity of animal health centres to urban areas should be altered by the expansion of services to rural and peri-urban areas.
- Farmers should be encouraged to plant more fodder trees on their farm holdings by offering seedlings of high-quality fodder tree varieties. They should be given incentives on the success of such a fodder tree and those failing to keep the plants growing should not be given such benefits in future. Local Panchayats need to monitor it strictly for best results.
- Most farmers are ignorant of animal health and the importance of maintaining a clean environment for disease presentation. They are discovered to be completely oblivious to livestock management. It is also necessary to educate

people about safety and animal health. It is the responsibility of the farmer to utilise uncontaminated water, feed, and keep the shed clean.

- The adoption of contemporary animal husbandry technologies by farmers, as well as the raising of superior breeds, should be encouraged.
- Animal husbandry is fraught with danger due to the vulnerability of animals to disease, parasite bites such as snakes, food poisoning, and other dangers that can arise. Due to a shortage of animal insurance options, farmers are hesitant to increase their investment in livestock. Government agencies must develop effective insurance policies, as well as provide adequate guidance to farmers for awareness of these policies.
- Farmers are advised to stop milking their cows, two months before the start of the next lactation cycle. This leads to an increase in milk production in the following lactation as well as a reduction in the likelihood of any negative effects on animal health.
- It has been found that many farmers avoid breeding during the first few months of lactation. During the first 2 to 3 months of nursing, it is important not to miss the breeding time. The notion of a low milk field following breeding is erroneous.
- Farmers should form a cooperative to oversee the gathering and selling of their milk products. The government should provide technical and financial assistance to that cooperative.
- Farmers should be encouraged to engage in off-farm activities, such as small cottage industries, trading, and business, to alleviate the population pressure caused by agriculture while also increasing the level of income earned by farmers.

- Animal’s disease may result in catastrophic damage to farmer’s economy. Hence, better veterinary facilities along with advice for regular vaccination shall be provided.
- For the progressive dairy farmers, an awareness as well as training about dairy must be organised either by government or by milk union or by cooperative at local level.
- The rural farmer’s needs the better facilities of transport and communication to sale their products, which is very much important for the economic development. Hence, the government should focus on it.
- For low-income farmers in the agriculture, they should be adopting modern technology to increase their level of income.
- The farmers should stop the habit of borrowing, instead of borrowing they have to start saving by increasing the level of production from their land.
- It has been observed that the dairy farmers in the study area do not keep the record of actual income earned and expenditure done, hence, they should be given awareness regarding this so that shortcoming could be identified, and concrete measures suggested on case-to-case basis.
- Awareness needs to be provided for Rainwater Harvesting to the dairy farmers.

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ANNEXURE 1

QUESTIONNAIRE

DEPARTMENT OF ECONOMICS

SIKKIM UNIVERSITY

ROLE OF DAIRY FARMING IN THE RURAL ECONOMY OF SIKKIM

Place of Interview: ....

Date: ....

A. RESPONDENT AND FAMILY PROFILE:

1. Respondent : ....
2. Age .... years.
3. Gender : Male/Female ……………………………………….
4. Marital status: Married…………………….

   Unmarried…………………

   Separated………………….

   Divorced……………………

   Widowed...............................
5. (a) Mother-tongue: English

   Hindi/Nepali/Lepcha/Bhutia/Other..

(b) Other Languages Spoken:

English/Hindi/Nepali/Lepcha/Bhutia/Other..

6. Religion: Hindu/ Buddhist/ Christian/Other..

7. (a) Community: ……………………………..

(b) Category: SC/ST/OBC/Others ....

8. Literacy Level :

Nil/FL/upto CL5/CL8/CL10/CL12/CL12+/Other...................................

9. Family Type: Nuclear/Joint/Extended ……………………………………….

10. Family size: Children: M......................F.................Total....................

Adults: M......................F......................Total................

Elderly: M......................F......................Total.................

11. Education: (a) Children: Nil/ CL5/ CL8/ CL10/ CL12/ CL12+/ Other....................................

(b) Age-groups<5y………/5-10y......./10-14y… ..../14-18y………………….

12. Education: (a)Adults: Nil/ CL5/ CL8/ CL10/ CL12/ CL12+/ Other....................................

(b) Elderly: Nil/ CL5/ CL8/ CL10/ CL12/ CL12+/ Other....................................

13. Housing Conditions:

a) Residential House: Own/Rented/Other..........................

b) House-type: Kuccha/Ikra/Semi-Pucca/Pucca/Other.......................................

c) Number of rooms: ....

d) Amenities:

Drinking water/ Toilet/ Electricity/ Mobile phone/LPG

Connection/TV/2W-Vehicle/4W-Vehicle/Others.......................

B. LANDHOLDING AND ASSET HOLDING PROFILE:

---

1. a) Ownership Landholding:

    i) Total Farmland (approx. acres): ………………………………

    ii) Own Homestead (approx. acres): …………………………….

    iii) Panikhet (approx. acres): …………………………………….

    iv) Sukhakhet (approx. acres): ……………………………………

    v) Land under Tree-crops (approx. acres): ……………………….

    vi) Other Fallows (approx. acres): …………………………………

    b) Total Ownership Holding (approx. acres): ....

2. a) Operational Holding:

    i) Total Landholding: (approx. acres) …………………………….

    ii) Homestead Land (approx. acres): ………………………………

    iii) Land leased in as Tenant (approx. acres): ....

    i) Land leased in as Sharecropper (approx. acres): ....

    ii) Land leased out to Tenants (approx. acres): ....

    iii) Land leased out to Sharecroppers (approx. acres): ....

    b) Total Operational Farm land (approx. acres): ....

3. Irrigation Access: a) Irrigated Farmland (approx. acres): ....

    b) Unirrigated Farmland (approx. acres): ....

4. Farming Operation: Subsistence/Commercial and

    Semi-Commercial/Other.....................................

i) Major Crops grown: ....

ii) Food crop adequacy for subsistence: Yes/No …………………

iii) If insufficient, food grain types purchased.................................

5. Other Income-sources independent from land:

   In-Service employment/Petty Business/ Labour Wages/Animal Husbandry/ Other.......................................

6. Primary Occupation: Agriculture/ Private service/ Government service/ Petty Business/Trade/Wage Labour/Others: ....

7. Secondary Occupation: Agriculture/ Private service/ Government service/ Petty Business/Trade/Wage Labour/Others..

8. a) Monthly Income from all sources (Rs): ……………………………………

   b) Monthly Income by Sources:

   Crop Sales (Rs): …………… ....………………………………………….………

   Livestock Earning (Rs): ……........………………………………………….

   Labour Wages (Rs): ………………....…………………………………..

   Service Earnings Pvt. (Rs): ……………………………...………………..

   Service Earnings Govt. (Rs): …………………………………………...………

   Shopkeeping Profits (Rs): …………………………………………………….

   Trade Profits (Rs): …………………………………………………….……

   Rents for Ploughing etc. (Rs): …………….……………………..……….

   Land/House Rentals, etc. (Rs): …………………………………………………

   Remittances (Rs): ………………………………………………………………

   Other Sources -specify Types and Earnings (Rs): ……………………………

   Total Monthly Earnings (Rs): ………………………………………………….

9. Avg. Monthly Expenditure of Family (Rs): ……………………………………

Food Expenses (Rs): ……………………………………………….……………

Clothing (Rs): ….……………………………………………………………

Children's Education (Rs): ..…………………………………………………..

Healthcare (Rs): ……………………………………………………………….

House Maintenance (Rs): ……………………………………………………

Personal Transportation (Rs): ………………………………………………….

Commercial Transportation (Rs): …………………………………………….

Rents for Ploughing etc. (Rs): …………………………………………………

Land Rents, House Rents, etc. (Rs): ……………...……………………………

Remittances to Family-members (Rs): …………………………………………

Other Expenses (specify Types and Expenses) (Rs): ………………………..

Total Monthly Expenditure (Rs): ………………………………………………

C. SAVINGS AND INDEBTEDNESS:

---

1. a) Average Monthly Savings: Regular/Irregular ………………………

   b) Average Savings Amount (Rs): ....

2. Preferred Form of Investment:

   Bank Deposits/Personal Insurance/Other Financial Assets/Physical Assets………………...

3. Sources of Indebtedness:

   a) Consumption Loans (Rs): …………………………………………………

   b) Crop Loans (Rs): ………………………………...………………………

   c) Loans for Livestock Purchase (Rs): ………………………………………

   d) Housing Loans (Rs): …………….…………………………………………

   e) Loans for Land Purchase (Rs): …..…………………………………………

   f) Loans for Other Asset Purchase (Rs): ……………………………………

g) Other Loans amount (Rs): ………………………………………………

h) Other Loans Purposes (Rs): …………………………………………….

4. Total Burden of Debt (Rs): ………..……………………………………

Loans Outstanding (Rs): ..…..…………………………………….

Loans Repaid Principal (Rs): ……..………………………………

Loans Repaid Interest (Rs): ……..……………………………….

5. Sources of Personal Borrowing: Family/Friends/Neighbours/Moneylenders/ Others..

6. Sources of Institutional Borrowing: Banks/Cooperatives/Govt Scheme-Finance/ Others....................................

D. DAIRY FARMING OPERATIONS AND MANAGEMENT

---

1. a) Which animal other than dairy animal you own (Specify)...

   b) Dairy Farming Status: Full-Time/ Part-Time ………………..

2. Dairy-Farm Location: Village/ Peri-urban Area/Milkshed Area/Other...

3. Family Labour involvement:

   (i) In Farming: M....................F...............Total...............

   (ii) In Dairy Farming: M...................F...............Total...............

4. Hired Labour involvement:

   (i) In Farming M...................F...............Total...............

   (ii) In Dairy Farming M.........F.............Total...............

5. a) Total Dairy-farming Experience ....years

b) Nature of Dairy Farm: Self-established/Family- owned/
Inherited/Other.....................

c) Sources of Dairying Investment: Inheritance/Own Savings/Loan
Finance/Other....................

6. a) Total Animal Livestock-holding:

Cattle………………………Ovine……………………Porcine………

b) Cattle: Total Cows…………Yearling Calves……………..

Cows In-Milk……..…………….

Breeding Bulls………..Bullocks……………………

c) Cattle-stock by Breed

Indigenous……………..Exotic……………………..Crossbreeds……

d) Buffalos: Total Buffalos…………Yearlings………….……..

In-Milk……………………………….

Total Males ……………

7. a) Cattle shed structure: Approx. size .... sq. metres

Number of Cattle-stalls ……………………

b) Structural-type: Temporary with straw-roof/Permanent with GCI roof/Permanent with RCC slab roof/Other…...........................

c) Age of Cattle shed:.. years

d) Original Construction Cost:..Rs

e) Annual Maintenance Cost: .... Rs

8. Location of Cattle shed: Near Home/Within 1km from Home/>1 km from Home..

In Outside Paddock…………………………

9. Frequency of washing/bathing cattle: Once a week/Once a month/Occasionally ………………..

   Workers engaged in washing: Family: Males……/Females…………………

   Hired: Males……/Females……………………

10. Frequency of cleaning cattle shed:

    Daily/Weekly/Fortnightly/Monthly/Other……………………………………

    Workers engaged in cleaning: Family: Males……/Females………………..

    Hired: Males……/Females……………………

E. DAIRY FEEDING MATERIALS:

---

1. Principal Natural Feed Sources: ………………………………………………….
2. Principal Purchased Feed Sources: ....
3. Daily Grazing-hours:

   Summer: …………………

   Winter: ……………………..
4. Weekly Supplementary Cattle-feed Quantities and Feeding Materials

   <u>Mature Animals</u> <u>Yearlings</u>

   (a) Green Fodder: …………………………………………………………..

   (b) Fodder-grass: …………………………………………………………..

   (c) Dry Straw: …………………………………………………………..

   (d) Cereal-husks *[Choker]*: ……………………………………………………

   Others *(Specify)*....................Quantity…………………………………………

   Water [Daily Quantity for Drinking and Washing] Quantity …………………

   Total Feed Value...

F. DAIRY PRODUCTION AND MARKETING:

---

1. Duration of Prime Dairy Season: ……….(month) to .... (month)

   Total…..............................months

2. Duration of Slack Dairy Season: ……………(month) to .... (month)

   Total…..............................months

3. a) Average Milk Yield per day (In-season for all cows):

   ……………………………..………litres/day

   b) Average Milk Yield per day (Off-season for all cows):

   …………………………………litres/day

   c) Average Daily Milk Consumption by Household (litres):

   …………………………………

   d) Average Daily Milk Sold per day (Quantity in litres)

   ....In-season

   ....Off-season

   e) Average Milk Sale Value per day (Amount in Rs.)

   ....In-season

   ....Off-season

   f) Annual Income from Dairy Sales:

   (Milk Sales) …………..

   Other Dairy Products………………..

4. Normal Point of Milk Sales: Door-to-door/Milk Collection Centre/Local Retail market/Distant market ……………………………………………..

5. Utilization of Dairying Income:

Household Expenditure (Rs.) ……………………..

Average Animal Purchases (Rs.) ……………………...................... …..

Average Occasional Expenses (Rs) (Specify) Type): ....

6. What type of cattle do you sell from your farm? Weak/poor body condition/ Diseased/ Low productive/ Dry/Others..

7. Dairy animals purchased in the last 12 months: ....

   Ages..........................

   Condition: Young/Prime/Aged/Dry/Diseased

8. Dairy animals sold in the last 12 months: ....

   Ages: ……………….............

   Condition: Young/Prime/Aged/Dry/Diseased

9. Purchasers of Cattle: Relatives/Neighbours/Market Agents/Traders/Others (specify)..........................

10. Principal Cattle-marketing Locations: ....

11. Cow-dung pit: Open/Protected with shed Approx. Size:

    ………………………………………..(in sq.metres/feet)

12. (a) End-use of Manure:

    Own cultivation (Quantity/season): ………………………………….............

    Market (Quantity/season): …………………………..…………….............

    (b) Principal Agricultural use of Manure:

    Crop-farming/Horticulture/Floriculture/Vegetable-growing/

    Cash-cropping …………………………………………………………

13. Principal Buyers of Manure:

    Local Farmers/Government Agencies/Private Agencies..........................

14. Average Quantities of manure sold:

Raw Manure......................./Dry Manure...

15. How is Manure Price per *doko/bora* determined?

    Digging Costs..

    Labour Costs...

    Packaging costs......................................

    Transportation costs..............................

    Other Imputed Costs.............................

16. Principal Incentives for engaging in Dairying: Fodder Availability/Income Augmentation/Additional Employment/ High Profitability/Manure Provision/Others

    (specify)…………………………………………………………………

17. Principal Constraints faced in Dairy Production and Marketing:

    Lack of Personal Capital/Lack of Institutional credit/Lack of Training/Lack of Marketing Infrastructure/Fodder Shortage/Low Milk Yield/Low Milk Surplus/Shortage of Local Milk Demand/Poor Breed Quality/Poor Veterinary Services/Others

    (Specify);…………………………………………………………………

G. Animal Healthcare:

---

1. (a) What benefits are gained through Artificial Insemination?

   Improved Animal Health: Y/N ……………

   Improved Dairy Income: Y/N …………….

   Better Animal Survival: Y/N ……………….

   (b) Is Artificial Insemination [AI] being adopted to improve breed of milch animals? Y/N ……………..

   (c) If not, why not?:…………………………………………………………

2. Principal Livestock Ailments: ………………………………………………
3. Chemical Animal-feed Supplements used:……………………………………
4. Do you deworm your animals? Y/N. Average De-worming costs paid per animal? ....
5. Local Treatment Source for of Animals during Illness:……………………
6. Local Treatment Source for of Animals during Birthing:…………………….
7. (a) Usual Treatment for Animal Diseases

   [Sources]…………………………………………………………………………

   (b) Avg. Treatment Costs for All Animals

   [Last Six Months]………………………………………………………………….
8. Have there been any cattle deaths of cattle on the farm in the last 3 years? Y/N

   Total Deaths..............................
9. (a) Have all your animals been vaccinated? Y/N

   Typical Vaccination-Age...

   (b) Against which Cattle Diseases?

   Fevers: Y/N …………………………………………………………..

   Foot and Mouth Disease: Y/N …………………………………………

   Others...
10. (a) Persons typically providing Vaccination Services:

    Personally/Neighbours/Pvt. Veterinarian/ Govt. Veterinarian/ Others………..

    (b) Vaccination Fees paid: Y/N

    Avg. Vaccination Fee per Animal..
11. Level of Satisfaction with available Veterinary Service:

    Excellent/Good/Fair/Poor/NIL …………………………………………………

---THANK YOU FOR YOUR VALUABLE COOPERATION---

ANNEXURE 2

LIST OF CHOGYALS (KINGS) OF SIKKIM PRIOR TO 1975

SL. NO.	PERIOD OF REIGN	NAME
1	1642-1670	Phuntsog Namgyal
2	1670-1700	TensungNamgyal
3	1700-1717	ChakdorNamgyal
4	1717-1733	GyurmedNamgyal
5	1733-1780	PhungtsogNamgyal II
6	1780-1793	TenzingNamgyal
7	1793-1863	TshudpudNamgyal
8	1863-1874	SidkeongNamgyal
9	1874-1914	ThutobNamgyal
10	1914	Sidkeong Tulku Namgyal
11	1914-1963	TashiNamgyal
12	1963-1975	Palden Thondup Namgyal

ANNEXURE 3

LIST OF POLITICAL OFFICERS OF SIKKIM

SL. NO.	NAME
1	J CLAUDE WHITE
2	SIR CHARLSE BELL
3	MAJOR W L CAMPBELL
4	LT. COLONEL W F O CONNER
5	MAJOR F M BAILEY
6	MAJOR J L R WEIR
7	FREDERICK WILLIAMSON
8	SIR BASIL GOULD
9	ANTHONY J HOPKINSON

(Note: David McDonald, Capt. R K M Battye and H Richardson- also temporarily held the post)

ANNEXURE 4

Photographs of field survey


REDMI NOTE 5 PRO
MI DUAL CAMERA


REDMI NOTE 5 PRO
MI DUAL CAMERA


REDMI NOTE 5 PRO
MI DUAL CAMERA


REDMI NOTE 5 PRO
MI DUAL CAMERA


REDMI NOTE 5 PRO
MI DUAL CAMERA

ANNEXURE 5

Paper Presentation

Sl. no	Date	Presented by	Title of the Paper	Place
1	7th-8th January 2022	Narendra Kharel	A Study on the Production and Marketing System of Dairy Farming in Turung-Mamring GPU of South Sikkim	National Vocational Training and Technology Research Institute, Dhanbad, Jharkhand
2	22nd January 2022	Narendra Kharel	Significance of Dairy Farming in South District of the Himalayan State of Sikkim	Sree Narayana Guru College of Commerce, Mumbai 400089
3	4th-5th April 2022	Narendra Kharel	Role of Livestock Economy in the Mountainous State of Sikkim	Murarka College, Sultanganj
4	25th-26th June 2022	Narendra Kharel	Fodder Situation in Sikkim	M S Ramaiah Foundation Ramaiah Institute of Business Studies, Bengaluru, Karnataka
5	8th-9th July 2022	Narendra Kharel	Development of Dairy Sector through Milk Producer’s Cooperative Societies of Sikkim	Tarar College Tarar, Bhagalpur

ANNEXURE 6

<u>Paper Publication</u>

Kharel, Narendra and Choubey Manesh (2022). Economics of Production and Marketing Behaviour of Dairy-Farmers of the Himalayan State of Sikkim: A Case Study of South Sikkim District, *Indian Journal of Hill Farming, 35* (1), 182-190.

Kharel, Narendra and Choubey Manesh (2022). Constraints of Artificial Insemination in South Sikkim: A Case Study of Selected Village, *International Journal of Research Publication and Reviews, 3* (7), 3348-3352.

Kharel, Narendra (2022). Significance of Dairy Farming in South District of the Himalayan State of Sikkim, *International Journal for Innovative Research in Multidisciplinary Field, 7* (34), 298-305.

Kharel, Narendra (2022). The Livestock Economy's Role in the Mountains: A Brief Study of South Sikkim, *Journal of Fundamental and Comparative Research, IX* (IV) (V), 87-94.