Chapter I

INTRODUCTION

1.1 Background of the Study

The Chattogram Hill Tracts (CHT) areas consist of Bandarban, Rangamati and Khagrachari hill districts and is situated in the southeast of Bangladesh with a land area of 13,344.24 sq. Km covers about 10% of the country's total land area (Population and Housing Census, 2011). CHT is the disadvantaged and vulnerable region in Bangladesh in terms of almost all major development indicators (Barkat *et al.,* 2009). Development in the CHT has been slower than in other parts of the country because of several factors including lack of proper development (Rasul *et al.,* 2016). A long history of conflict and political unrest, combined with remoteness has resulted in weak integration with the mainstream developmental trends of most parts of Bangladesh (WFP, 2017). Many indigenous people like Marma, Chakma, Chak, and 47 types of communities live in the CHT region and many of them leave their livelihoods in poverty (BBS, 2022). About 3.401 million sheep heads are distributed throughout the country (DLS, 2017). A few crossbreeds are reared but most of the sheep are indigenous (Bhuiyan *et al.,* 2006).

In the CHT regions, rice farming prevails, with limited livestock production, while the pork-dominated meat industry faces challenges from tourism and religious restrictions, creating potential for sheep farming, albeit hindered by awareness and infrastructure issues. Sheep farming holds significant potential in Bangladesh's subtropical climate, offering opportunities to boost the economy, generate income, create jobs, and produce valuable wool for export, but increased production requires more research and investment.

1.2 Problem Statement

Sheep farming in Bangladesh's CHT regions has the potential to benefit small farmers economically but faces infrastructure challenges, limiting its profitability despite the global demand for mutton as a valuable protein source.

The demand for meat is on the rise in Bangladesh because of income and population growth together with increasing urbanization in the country. The per capita total meat consumption has more than doubled from 4.79kg in 2000 to 9.8kg in 2017 (Selvanathan *et al.,* 2020). Besides this present demand for meat in Bangladesh is 75.20 Lakh Metric tons (120 gm./day/head) and production is 92.65 Lakh Metric tons (BBS, 2022). Besides this, the annual sheep production is 37.52 million in comparison which is lower than goat and beef production (BBS, 2022). Therefore, production is beyond demand to create employment need to focus on the supply chain, getting good quality meat production in CHT regions. As a result, CHT people can consume good quality meat.

To meet the rising demand for meat, especially per capita meat consumption, there is a need to boost sheep production. Throughout the world the people use the undulant land for sheep production. However, unfortunately in our country the sheep population in the CHT is very low. Though the hill tract region of Bangladesh is abundant with green vegetation so there is a scope to increase sheep production both horizontal and vertically. Furthermore, CHT is a tourist place therefore, developing a sheep meat market in the CHT regions, catering to the demand for halal meat among tourists, can enhance economic stability through consistent income from the meat industry. In our country livestock contributes 1.90% of total GDP and it is increasing day by day (BBS, 2022). Besides this, there is no proper research on the livestock market of CHT regions which leads to the study of this problem.

1.3 Justification of the Study

Livestock products are increasingly important in Bangladeshi diets. In developing countries including Bangladesh, the consumption of beef, mutton and chicken products has grown by 5.8% per year over the last decade (Wondmeneh *et al*., 2016). To meet the growing demand for meat, particularly mutton, in Bangladesh, particularly in the CHT regions, which are well-suited for meat production, there is a need to focus on establishing a robust supply chain and implementing value addition techniques to enhance the meat industry.

The livestock sector has been playing a crucial role in the socio-economic development of Bangladesh. Livestock is an integral component of the complex farming system that

not only serves as a source of meat protein but also is a major source of farm power services as well as employment (Barua *et al*., 2021).

After describing the background many problems arise and to solve these problems research is essential. In comparison to other parts of Bangladesh in CHT, sheep production is very low. To increase sheep production and to meet the demand for halal meat in tourist places research on value addition and supply chain is very much needed for that region. Promoting commercial sheep farming in the CHT regions of Bangladesh, along with establishing a robust supply chain and value addition, can significantly enhance income sources, contribute to food security, and empower local communities, particularly women and children. The region's favorable conditions make it suitable for livestock development, with potential for improving livelihoods and addressing nutritional needs through increased sheep production and research on value addition.

1.4 Research Question

The research questions of the study raise were-

I. What was the socio-economic conditions of sheep farmers in hilly areas?
II. Was sheep farming in hilly areas profitable?
III. What was the effect of value addition in the sheep meat market?
IV. How supply chain regulated in the hilly area?
V. Were the people of CHT interested in sheep meat marketing?

1.5 Objectives of the Study

The overall objective is to identify "Supply chain management of value-added sheep meat in the CHT areas of Bangladesh". So, the specific objectives of the study are-

I. To assess the socio-economic demography of sheep farm owners.
II. To assess the profitability of selected sheep farming in hilly areas.
III. To know the effect of value addition in sheep meat in local market at the hilly area.
IV. To identify the supply chain for marketing sheep meat; and
V. To adopt the sheep meat marketing in hilly areas.

1.6 Organization of the Study

This study is organized into chapters. The first chapter introduces the background of the study, problem statement, justification of the study, research question, and objectives of the study and organization of the study.

In this study, the second chapter is about the review of literature related to the object of the study.

The third chapter is about material and methods which include the study area, study period, sampling technique, and data collection, preparation of questionnaire and data analysis using various econometrics equations.

In the present study, the fourth chapter is about the results of the present study where the objectives of the study are determined which include socio-economic condition, profitability of farms and value addition with sheep adaption in hilly markets.

Chapter fifth is about discussion of the study which includes a comparison of the results of the present study with another study and discusses the similarity and dissimilarity of findings.

The sixth chapter introduces the conclusion of the present study where the whole study is discussed in terse and constraints with remedies for problems also included.

Chapter II

REVIEW OF LITERATURE

The livestock sector is lagging in contributing to the growth of GDP because of not doing enough extension research. Lack of research leads people to shift from agriculture to industrial labour. In the poultry sector, lots of research work is done but in the farm animal sector to extend it, there is no such research has been done yet. In the CHT region, many projects and workshops are run by many NGOs and micro-financial companies but enough research work on livestock marketing is not done yet. Bangladesh, a developing country elevated from LDC by 2026 has achieved remarkable development in many sectors but day by day contribution of livestock is decreasing remarkably. So it's all our duty to increase the contribution of livestock to GDP growth.

Before exploring new things many factors related to new things need to be reviewed to get an idea of what is previously done in this field of research. Paper reviewing is the best option for getting ideas about new research work and by exploring old research work new ideas and work processes can be generated. This paper reviews such kinds of research work such as socio-economic characteristics, profitability, supply chain, and effect of value addition in sheep meat and sheep meat marketing.

2.1 Socio-economic Characteristics of Sheep Farmer

Hossian *et al.,* (2021) found in their study that average family size, male and female ratio and age was 5.58, 3:10, and 45.23 year, respectively. Family size, land size and yearly livestock income were found significant ($P<0.01$). Most of the farmers belong to primary education (46.70%) and illiterate (30.00%). Maximum numbers of farmers belong to smallholders (81.91 decimal of land). The average monthly income and expenditure of farmers were estimated at BDT10123.00 and 11476.00, respectively. The male partner was dominant over the female partner in different decision-making processes. The co-efficient of family size (-9843.99), land size (404.27) and yearly livestock income (1.02) were significantly different ($P<0.05$). It is implied that a unit increase in land size and yearly livestock income might help in increasing 404.27 and 1.02 a units in family yearly

income, respectively whereas, one unit increase in family size, resulted in 9843.99 unit decreases in yearly family income, considering all other variables constant.

Islam *et al.,* (2018) stated that most farmers were middle-aged categories (53%) and the education level of farmers was 63, 30, and 7% primary, secondary and higher secondary. Out of 30 respondents, 50% were farmers and 23% businessman. About 57% of farmers used their capital, 10%, of farmers took bank loans and 33% took NGO loans for sheep production. About 37% of farmers purchased sheep occasionally from local markets. Sixty percent of farmers used roadside grass and 40% used cultivated and roadside grass. Most farmers used mixed feed which was bought from the local market and 20% of farmers used vitamin-mineral supplementation. About 100% of farmers used natural breeding. Eighty and 80% of farmers practiced vaccination and deworming, respectively.

A study conducted by Haque *et al.,* (2020) found that ownership of cattle, and goats was higher (70.67% and 45.33% respectively) than sheep (18.67%), because cattle and goats are not affected by any ethnic, religious or cultural restrictions but the no. of sheep per family is higher (12.71%) than goat (4.94%) and cattle (3.74%). The frequency of keeping and flock size of sheep is inversely correlated to the amount of owning and accessing land because of requires minimum capital and easy management. In addition to cultural factors, sheep are less popular and thus less numerous than goats because of negative publicity of the taste and quality of their meat. Owners of sheep are less likely to be involved in off-farm activities (10.67%) and would often have no access to credit facilities. Women represented 63% of the keepers of sheep but they have fewer facilities (36%) to access the earnings. The results showed that middle-aged (56%), married (92%) household members especially women (63%) are more likely to own small ruminants.

In the study, Shivakumara *et al.,* (2020) found that the majority of the sheep and goat farmers belonged to the age group of above 40 years and are illiterate (50-52%). The family size of sheep and goat-rearing households is medium size with 4-6 members. The maximum number of farmers who had an income of less than 1 lakh per annum, belonged to the backward class, scheduled caste and scheduled tribe. The total number of sheep per household was 25, 67 and 27 under small, medium and large herd sizes with an overall average of 71 sheep per farm. Similarly, about 17, 29 and 43 goats were found in small,

medium and large flock sizes of goat with an average of 30 goats per flock. The majority of the farmers had a kaccha type of shed for rearing sheep (41.66%) and goats (80%).

Dhara. *et al.,* (2019) observed in their study that women were mostly (69.77%) engaged in sheep and goat farming and their financial condition was poor. The education status of these farmers mostly was below the 10th standard and they were mainly engaged in household work. The majority of these farmers (84.02%) had not received any training related to Animal husbandry practices and thus provision of suitable training in this area could be helpful for their livelihood security. As the land holding capacity of this farmer was low, sheep and goat farming can be an alternative tool to enrich their economic status. Analysis of the individual earnings of these farmers indicated that caste, family size, education status and knowledge about Animal husbandry had a significant effect on family income of these farmers either from agriculture or animal husbandry particularly sheep and goats. Education status and land holding capacity had a positive impact on the economic condition of these farmers.

2.2 Profitability of Sheep Farming

Morris *et al.,* (2009) said in their study that Sheep numbers have been declining throughout the world over the last five years, resulting in decreased sheep meat production and a resultant shortage of supply. There is evidence that demand in the short term will not be met by the major exporters (New Zealand and Australia). Although sheep numbers have declined in New Zealand, production has increased dramatically, with lambing percentages increasing from 98% in 1987 to 125% in 2008 and carcass weights from 14 to 17 kg, respectively. Despite this production increase, the return on capital in the farming business has been around 1% per annum. However, property values have increased by around 10% offsetting the low return on capital from farming sheep. There are a number of challenges facing New Zealand's sheep farmers, namely changing land-use patterns, climate change and greenhouse gas mitigation, all of which will potentially impact future profitability.

Milan *et al.*, (2014) stated that total annual cost and total annual return depend on the milk yield of dairy sheep and also found that total annual income was €194.4 ± 23.0 × 10^3/yr. from milk (78.6%), lamb (13.2%), culled ewes (0.5%), and other sales (0.8%, wool and manure), and completed with the European Union sheep subsidy (6.9%). Total costs were €185.9 ± 19.0 × 10^3/yr. to attend to feeding (61.6%), labour (18.2%), equipment maintenance and depreciation (7.6%), finances (3.0%), animal health (2.5%), energy, water and milking supplies (2.2%), milk recording (0.5%), and other costs (4.4%; assurances, shearing, association fees, and so on). The mean dairy sheep farm profit was €8.5 ± 5.8 × 10^3/yr. (€7.4 ± 8.3/ewe) on average, and varied between –€40.6 and €81.1/ewe among farms.

Rokicki *et al.,* (2014) described in their paper that the area of the farm did not affect the generated incomes. The performed analyses confirm a close relationship between the economic performance, the value of the farm buildings and the value of machinery and equipment. The farm income was negative in two farms with a loss of PLN 164 and PLN 306 per 1 ha of AL; whereas, the top farm generated PLN 3717 income per 1 ha of AL.

A study conducted by Uzunoz and Akcay (2009) found in his study that Net Present Value was 77.33 $/head; 149.06 $/head; 212.73 $/head and Cost-Benefit Ratio were bigger than 1 (1.07; 1.12 and 1.15). The IRR (Internal Rate of Return) was 12.92 percent. According to the results achieved by the study, it was determined that the investment is economically feasible and profitable.

Pamukova and Momchilov (2017) found that revenues from sales of milk had the greatest share in total revenues of the farm (45-52 %).In fact, this confirmed the profile of the farm as a dairy farm. The percentage of meat varied within a narrow range with lamb meat occupying the greatest share of meat revenues (26 - 29 %). The participation of other types of meat in the farm's revenues was minor. The share of wool as an element of revenues was insignificant over the 3-yar period. Wool production was rather a concomitant production therefore serious revenues from wool are not expected as at the time of the study, there is no market demand for this product. Among variable costs, the feed costs proportion was the greatest (40 – 44 %). Then followed labor, insurance and fuel costs. It should be mentioned that during the last year of the analyzed period, costs

for the purchase of shearing machines and sharpening devices are planned. Permanent costs did not change in 2016–2018. The share of depreciation costs from total costs was approximately 3 %.

Neudert and Allahverdieva (2009) found in their paper by analyzing the current profitability of transhumant sheep farming that cost revenue calculations show a strongly positive profit and satisfying net profitability under average conditions as a result of high prices of veal meat but also low labor costs. As investment deficits are obvious and for further competitiveness of farming enterprises investment in stables and machinery is necessary, scenarios with increased labor costs and investment are calculated to enrich the study.

Mondragon-Ancelmo *et al.,* (2014) found in their study that marketing margin of the final consumer price per kilogram of carcass meat, the producer obtained US$2.7/kg (47 %) of the utilities, while the intermediaries obtained US$3.1/kg (53 %). Considering the final cooked product in barbacoa (typical dish), the margin was US$6.3/kg (29 %) for the producer and US$15.2/kg (71 %) for the intermediaries. The B/C ratio was 1.0, 1.1, 2, and 1.3 for the producer, stocker, butcher, and barbacoa seller, respectively. It is concluded that the best marketing channel for the producer was the producer-stocker-processor (butcher and barbacoa seller). The highest marketing margin was for the intermediaries followed by the producer. The order of importance of the B/C kilogram ratio of meat was for the butcher first, then the barbacoa seller, and lastly stocker and producer.

2.3 Value-added Meat production and its Marketing

Buhr *et al.,* (2004) stated in their published case study paper that swine producers have recently expressed increased interest in gaining greater value from hogs raised by investing or aligning further up the market chain. Perceived advantages include increased control over their product, an opportunity to gain direct access to customers, and to capture a greater value of the final price of pork which has increased relative to farm prices. However, few participants in the market chain have a complete understanding of the challenges in controlling a greater part of the market chain.

Wegari *et al.*, (2021) found in their study that in the area of study, the major beef cattle value chain actors were input suppliers, producers, traders, fatteners, processors, retailers, consumers and governmental and non-governmental institutions. The core functions of the chain actors were input supply, production, marketing/trading, processing, retailing and consumption of the product. Therefore, the required recommendations were creating strong horizontal and vertical linkages/relationships between the chain actors and mutually beneficial actions for the smallholder farmers.

Richardson *et al.,* (1990) stated in their research manuscript that changes in eating patterns for reasons of cost, health or convenience, have resulted in reduced consumption of lamb. Carcass meat is being replaced by more processed, added-value meat in the home, but novel lamb products have been difficult to develop due to small muscle size, hard fat and strong flavours. If value is to be added to lamb, the texture and flavour of lamb and lamb products must be optimized. Whilst the use of electrical stimulation for beef carcasses, to avoid potential cold-induced toughening in modern chilling systems, is standard practice, little British lamb is stimulated in this way.

Restructuring can upgrade smaller tougher and or fatter parts of the carcass. It allows for regular portions of standard shape, size and composition, as in reformed hams, burgers, grill steaks or sausages. The small size of the lamb carcass makes it expensive to bone and trim fat and connective tissue for the production of such products. This could be an increasing disadvantage if high-quality, reformed, fresh products, using new binding technologies such as alginate or enzyme systems, gain a significant market share.

The ready meals market is expanding rapidly and although meat may not be the major component, it is usually the most expensive. These products may be fully sterile shelf-stable, cooked and frozen, or, more commonly, cooked and chilled with a shelf-life of a few days with carefully controlled refrigeration. Packaging has been highly developed for marketing these products. Unfortunately, traditional lamb products, such as moussaka and shepherd’s pie, are often now made from cheaper beef.

Larger lamb carcasses with lower fat, the use of mechanical bone removal or robotic butchery systems, innovative product or recipe design and the use of good packaging and presentation, would all aid in the development of lamb meat and meat product sales.

Goddard *et al.,* (2010) said in their final report that livestock industries are significantly by changes in consumer behaviour and also stated that In order to add value to meat and livestock production, many firms and farms are supporting the development of new products – these products can differ by credence attribute, by the degree of processing and by marketing strategies. He also found that income elasticities of demand for meat products purchased at grocery stores are negative in this study and that own and cross-price elasticities for certain meats, across processing levels for example, show strong substitutions. Thus introducing new meat products may not result in increased sales by animal species but may only result in the substitution of one meat type product for another product of the same meat type.

Sikone *et al.,* (2022) found in their study about value addition that each processing of one kilogram of fresh beef could produce 0.70 kg (shredded), 0.73 kg (jerky), and 0.68 kg (se'i). The added value obtained is USD 356 for shredded products, USD 403 for jerky products, and USD 291 for se'i products. The profit from shredded beef is USD 3, 34, with beef jerky of USD 380 and se'i (smoked beef) of USD 264.

2.4 Value Chain Relation with Value Addition

Sirajuddin *et al.,* (2015) established that the value added and profit of beef cattle supply chain actors were different according to the supply chain form. Value added and profit had not been proportionately distributed among all actors of the beef cattle supply chain. Supply chain actors in the supply chain downstream got bigger value-added and profit than actors in the internal supply chain and upstream supply chain.

Febrianto *et al.,* (2021) conducted a study in which they found that there were two distribution channels of the duck meat supply chain in Malang. The first distribution channel (Channel I) consisted of a duck farmer, a duck supplier in Blitar Regency, a fried duck restaurant and consumers in Malang; while the second distribution channel (Channel II) consisted of a duck farmer, distributor, duck supplier in Blitar Regency, fried duck restaurant and consumers in Malang. The results showed that the highest added value was found in Channel I, with 75.19% added value obtained. The study concludes that Channel I had a better distribution channel for the duck meat supply chain in Malang as indicated by the higher obtained added value.

Shashi. *et al.,* (2017) aimed to study the importance of value addition at different stages of the food supply chain to see what value addition practices mean across the food chain. His study affirmed that the farmer's value addition is positively related to supplier's value addition, processor's value addition, and distributor's value addition. Moreover, the supplier's value addition is positively related to the processor's value addition, and the processor's value addition is positively related to the distributor's value addition. Besides, the distributor's value addition is positively related to the retailer's value addition.

Khatun *et al.,* (2016) found that to achieve a margin of profit, average value addition for farmers cases 13% and 16.5% respectively for meat/kg and eggs/no; for whole seller/Aratdar added extra value of 5.09% and 0.28%; and for retailer 7% and 8% level and for the whole seller to consumer's added extra value near about 7% and 5.5% and for meat and egg finally processed poultry meat 30% and further processed meat 125% respectively. During value addition consideration each and every stakeholder production cost factor along with other management activities costing were considered before being marketed to one stakeholder or to others. Item-wise value-added poultry meat and eggs were found in different numbers and names. Average 5-6 no. meat type and 3-4 no egg type for hotels for Chinese restaurants 17-18 no meat products and 8-9 no. egg products, for fast food shop cases 28-30 no. meat products and 6-8 egg products; for chain supermarket 40-45 no. meat products and 7-8 no. egg products; The total value added was found higher in hotels, especially for meat cases. Production cost for the open market was found only 6.5% whereas the structured or processed market tends to estimate 40.5% because managing mental, transportation and publicity costs incur involvement.

Tekletsadik *et al.,* (2021) stated in their study that Ethiopia has a large number of small ruminant resources, but its contribution to the national economy is far less than its potential. This study was undertaken to analyze sheep value chain actors and their roles, to examine the market performance of actors and to find out the existing constraints and opportunities of the sheep value chain in Basona Worena District, North Shewa Zone, Amhara Regional State of Ethiopia. The primary data was collected from a sample of 366 farmers from five Kebeles and other 40 sheep value chain actors through structured questionnaires, focus group discussion, key informant interviews and personal

observation. The data was analyzed using descriptive statistics of mean, standard deviation, frequency, Value Chain Analysis and marketing margin. Results show that input suppliers, farmers, traders, processors, service providers and consumers were the main sheep value chain actors in the study area. The sheep production system was traditional and needed intervention to transform into a market-oriented one. Eight sheep market channels were identified in the study area and the share of farmers from the final sheep price was 35% which was very low.

Hasanah *et al.,* (2022) said that the sheep supply chain after and during the Eid al-Adha period, consisted of calculating the percentage margin price margin and supply chain efficiency because by knowing the economic and supply chain calculations you can see the difference in supply chain patterns and prices in livestock. The research method used is the survey method. The sample was determined by using the purposive sampling method, the provision involved marketing, wholesalers and retailers who were chosen by snowball sampling method. The result showed that there were three kinds of marketing channels in each period. Eid al-Adha namely pattern: I. Producers (Farmers) -wholesalers Consumers (Society). Pattern II. Producers (Farmer) ± wholesalers' ± agents outside of the town and province. Pattern III. Producers (Farmer) ± wholesalers' ± religious institution. High marketing margin Javanese Fat-tailed Sheep namely pattern III with marketing high margin IDR280.000 and marketing margin sheep female IDR 200.000. High marketing margin pasca Eid al-Adha male sheep namely pattern II marketing margin IDR320.000 and female sheep high marketing margin IDR 350.000. The most efficient of supply chain marketing Eid al-Adha period was pattern I with farmer price share 95, 24% and female 92, 29%. The most efficient pasca Eid al-Adha period was pattern I with a farmer price share of 88, 00 and female was pattern III with a farmer price share of 90, of 17 %.

Gebregziabhear *et al.,* (2018) found in their study that multiple actors from the public and private sectors were involved in the sheep value chain with diverse roles. Although a large population of sheep, increases demand for sheep meat in local and foreign markets, institutional support and extension service delivery are the opportunities that will enhance the system. The value chain is constrained by low genetic potential, shortage of feed in

quality and quantity, disease, lack of technology, both legal and illegal livestock marketing systems operating at different magnitudes, lack of market information and lack of integration among chain actors. It is recommended that chain actors should work together in an integrated way to design alternative sheep production systems, breed and feed improvement, disease control and strengthen sustainable market linkage. Therefore, empowering poor smallholder farmers will help to provide high-quality, sustainable livestock production with an identified market destination and access to basic production inputs, credit, capacity-building, and market-related information.

Bardhan *et al.,* (2019) found in their research paper that the chain actors involve farmers, peri-urban and urban dairies, aggregators, traders/sub-traders, retailers, restaurants/roadside stalls and export-oriented abattoirs. The quantitative mapping shows that aggregators constitute the main link between farmers and live animal markets and account for 72% of the total flow of buffaloes to livestock markets. Sub-traders/traders ship the bulk of the flow (94%) from markets to abattoirs. Of the total meat produced, 71% is shipped directly to importing countries and the rest to local markets; retailers take away 87% and restaurants 13%. Of the total value added, traders in the domestic value chains and export-oriented units capture a significant share.

Summary

After reviewing research papers related to the present study it was seen that there was not study found on hilly livestock sector and hilly meat market. The research papers of hilly crop agriculture were found. Although some research was conducted on hill livestock but research work on hilly livestock indicates there was research gap in the hilly area related to livestock marketing and supply chain. Therefore, it was essential to fill the research gap and hope present study can assist a better improvement in hilly livestock marketing.

Chapter III

Methods and Materials

3.1 Study Area

The present study was conducted in the CHT region, especially in sadar upazila of Bandarban district and Khagrachhari hill district. Bandarban is a district in South-Eastern Bangladesh and a part of the Chittagong Division. It is one of the three hill districts of Bangladesh and a part of the Chattogram Hill Tracts which are located between 21°11' and 22°22' north latitudes and between 92°04' and 92°41' east longitudes. Khagrachhari District is also a part of the Chattogram Hill Tracts which are located between 22°38' and 23°44' north latitudes and between 91°44' and 92°11' east longitudes.

Sheep farming is becoming popular in these areas because of the project funded by Krishi Gobeshona Foundation (KGF), CRP-IV: "**Increasing livestock production in the hills through better husbandry, health service and improving market access through value and supply chain management"** which initiates farming by providing input that is sheep, sheep houses, feed supplements, necessary training, and veterinary services. Besides these two-mini slaughterhouse cum selling center built by the CVASU part of the project for slaughtering, processing, preservation and selling the sheep meat and to develop a supply chain and marketing of sheep meat.

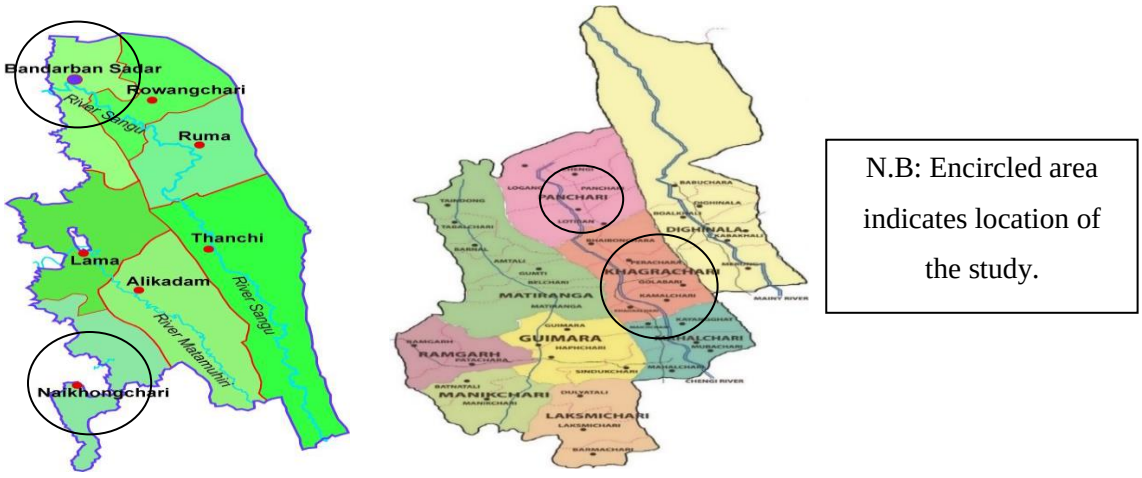

Fig.3.1 Bandarban District and Khagrachhari District

3.2 Study Period

The study was conducted during the period of December 2021 to August 2022.

3.3 Sampling Technique

There were 128 farmers rearing sheep in Bandarban and Khagrachari hill district under the KGF funded project CRP-IV. From the project beneficiary farmers, the studied sample were chosen for studying the supply chain and marketing of sheep and its product (meat). The sample was chosen from the areas by using a multi-stage sampling technique.

Only three villages from each selected union were chosen randomly to collect 20 households' data from each district. That is a total of 40 households were selected as samples for this study. Within each village, only 6 to 7 project beneficiary farmers were chosen as samples.

3.4 Preparation of the questionnaire

For data collection, an open-ended questionnaire was developed. It is developed in both English and Bangla for better communication. The questionnaire was pre-tested before data collection. In questionnaire, to evaluate the socio-economic demography of sheep farmers, the questions were included age, household income, educational qualification, household size, occupation etc. Moreover, in the questionnaires, questions regarding the fixed cost, variable cost depreciation cost return from selling sheep was also included.

3.5 Socio-economic Characteristics

For estimating the socio-economic demography of sheep farmers in hilly areas, descriptive statistics (average, maximum and minimum) were used.

3.6 Profitability analysis

The profitability per sheep farm was estimated by the following equations:

Gross Return = $\sum$ MP+ $\sum$ BP+ $\sum$ CI…… (1)

Here,

MP= Value of Main Product (Sheep)

BP= By-product Value of By-product (Manure) and CI= Change in Inventory.

Again,

Change in Inventory= (Closing stock + Sold+ Consumed) – (Beginning stock+ Purchased)

Net Return = $\sum$ GR─$\sum$GC…… (2)

Gross Margin= $\sum$ GR - $\sum$TVC…… (3)

BCR (Full cost basis) = $\frac{\sum \mathrm{GR}}{\sum \mathrm{GC}}$ …… (4)

BCR (Cash cost basis) = $\frac{\sum GR}{\sum TVC}$ …… (5)

Where, GR= Gross Return, GC= Gross Cost, TVC= Total Variable Cost and BCR= Benefit Cost Ratio.

3.7 Cost Estimation

Interest on operating capital and total variable cost

The Bank interest rates (4%) were used to estimate the cost of capital which was provided by them and used as working capital.

Interest on operating capital = (Operating capital*0.04)/2 …… (6)

TVC = Operating capital + Interest on operating capital……. (7)

Where,

TVC= Total Variable Cost and .04 means bank interest.

Fixed Cost

Costs on sheep house and utensils/equipment were included as fixed costs.

The cost of housing was calculated by taking into account the depreciation cost of housing. The cost of equipment was expressed as equipment cost, which was calculated

by taking into account the depreciation cost of equipment. Depreciation cost on house and equipment was worked out as follows:

Depreciation = $\left[\frac{Original\ value - Salvage\ value}{Life\ \ of\ the\ house\ or\ equipment}\right]$ ………………………………… (8)

3.8 Value addition analysis

Value addition is an economic term to expresses the difference between the value of goods and the cost of materials or supplies that are used in producing them. It is a measure of economic activity which eliminates the duplication inherent in the sales value figure which results from the use of products of some establishments as materials or services by others. Value added is thus defined as the gross receipts of a firm minus the cost of goods and services purchased from other firms. Value added includes wages, salaries, interest, depreciation, rent, taxes, and profit.

For calculating value addition on marketing cost along with profit and loss of all intermediaries needed to include in the marketing chain. For determining the marketing margin of sheep meat, the following formula was used-

$GM = P_{Ri} - P_{pi}$ ……………………………………………………………………………………………….(9)

Where,

GM= Gross margin (Tk/kg) for i^{th} intermediary

PR_i= Price received (Tk/kg) by i^{th} intermediary

PP_i= Price paid (Tk/kg) by i^{th} intermediary

$NM_i = GM_i - MC_i$ ………………………………………………………………………………………….. (10)

Where,

NM_i= Net margin (Tk/kg) for i^{th} intermediary

MC_i= Marketing cost incurred (Tk/kg) for i^{th} intermediary.

Marketing cost includes electricity cost, labor cost, packaging cost, water and cleaning cost, transport cost, other cost etc.

$$\text{Percentage of producers' share} = \frac{\text{Ppi}}{\text{Pri}} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (11)$$

Where,

P_{pi}= Net price received by producers

P_{ri} =Price received by the slaughterhouse.

3.9 Supply Chain Analysis

Different market actors whose were involved in the supply chain were identified by the questionnaire from the sheep farmers and percentages of selling sheep to which market actors acted were determined. The information on buyers of meat from the slaughterhouse also collected. Through this process, the market actors in the supply chain were identified.

3.10 Adoption of Sheep meat in the Market

For the assessment adoption of sheep meat in the market of hilly areas, a 6-point Likert Scale was used. The scales were weighted in order of importance from; Strongly Agree=6, Agree =5, Somewhat Agree =4, Neither Agree or Disagree=3, Disagree=2 and not know=1. The respondents were asked to answer seven different questions concerning responsiveness to adopting sheep meat in the hilly area.

3.11 Data collection

The supply chain of sheep meat is regulated by farmers through middlemen and slaughterhouses/processors, where consumers buying value-added meat. Data was collected from farmers, middlemen and slaughterhouse owner and customers through a well-constructed questionnaire.

3.12 Data Analysis

To analyze data first, the questionnaire was rechecked for completeness and then the data was cleaned, organized and coded. MS-Excel and STATA (Stata 14, Stata Statistical Software, Stata Corporation, College Station, Texas 77845 USA) were used for analyzing data. To attain the objective of the study descriptive statistics and econometrics methods were used.

Chapter IV

RESULT

4.1 Socio-economic condition

Chattogram Hill Tracts including Rangamati, Bandarban and Khagrachhari are one of the most backward regions of Bangladesh and most of the people are involved with crop agriculture. From the studied areas the following demographic information was presented as:

4.1.1 Age

The sample farmer's age was categorized into four groups such as the first, ranged from 18-25 years similarly second, third and fourth groups ranged from 25-35 years, 35-45 years and above 45 years, respectively. The study revealed that the sheep farmers were belonged to 25-35 years (35%) age group, 30% of sheep farmers belonged to 35-45 years age group and 27.5% of sheep farmers were belonged to ages above 45 years and 18-25 years aged people engaged only 7.5% (Table 4.1).

Table 4.1 Age range of farmers

Age range	No. of farmers	Percentage	Maximum	Minimum	Mean
18-25 years	3	7.5			
25-35 years	14	35	55	24	38
35-45 years	12	30			
Above 45 years	11	27.5			
Total Respondents	40	100			

4.1.2 Level of education

The level of education of farmers ranged from illiterate to H.S.C or above. The farmers who raised sheep were classified into three categories. Figure 4.1 shows that 52.5% sheep farmers were illiterate, 15% had qualification of H.S.C or above. Among them 35.5% of the total population have secondary education level.

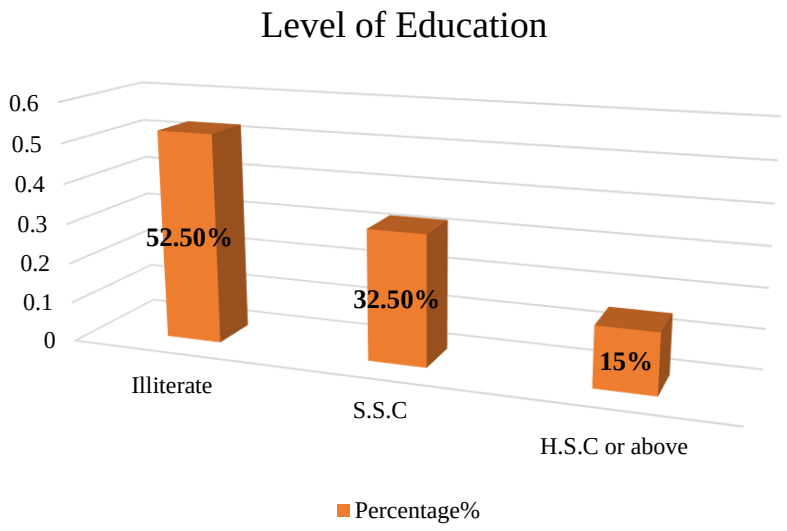

Figure 4.1 Percentage of Level of Education

4.1.3 Household Size

The household size varies from family to family, and it ranges from 4 to 7 members. The average mean of household size in the study area was 5.57. On the basis of family members, sample families were categorized into three categories such as small family up to 4 members, medium family up to 5 members and large family containing 6 to 7 members. Table 4.3 shows that 17.5% of farmers had small-sized families, 27.5% had medium-sized families and 55% in large large-sized families.

Table 4.2 Household size (N=40)

Categories	No. of Respondents	Percentage	Mean
Small family (up to 4)	7	17.5	
Medium family (up to 5)	11	27.5	5.57
Large family (up to 7)	22	55	
Total respondents	40	100	

4.1.4 Occupation

In the studied areas the occupation was categorized into four categories. In study area found that those who raised livestock were mainly farmers, day-labors, NGO workers and drivers. Figure 4.2 displays the occupation of sheep farmers in the study area.

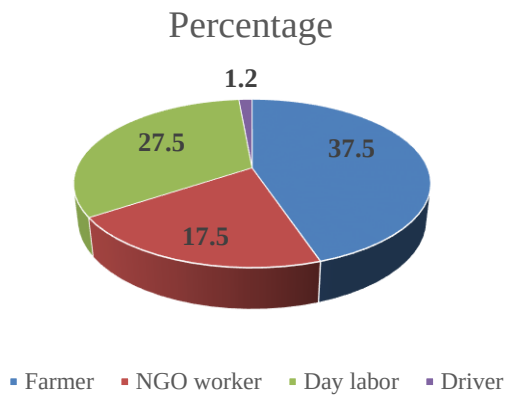

Figure 4.2 Percentage of Occupation

4.1.5 Monthly Income

The monthly income of the households in the studied samples varies from month to month and ranges from BDT 9000 to BDT 34000.00. The average monthly income of sheep farmers in studied area was BDT 17510.

Table 4.3 Monthly income of sheep farmers

Range of Monthly Income(N=40) (BDT)	Frequency	Percentage	Maximum	Minimum	Mean
9000 to 12000	11	27.5			
12000 to 15000	9	22.5			
15000 to 18000	5	12.5			
18000 to 21000	4	10	34000	9000	17510
21000 to 24000	3	7.5			
24000 to 27000	2	5			
Above 30000	6	15			
Total Respondents	40	100			

4.2. Profitability of sheep farmer

Cost and return analysis for operating sheep farmers are shown in Table 4.5 and all the 40 respondents were considered.

4.2.1 Cost of the sheep farmers

Operational Cost

In cost analysis the total average operational cost was accounted for BDT 8760.46 and in which feed cost was highest. Among the operational costs the average feed cost accounted for BDT 6195.29. The other operational costs such as labor cost, veterinary cost, transport cost and other costs accounted for BDT 1642.5, 201, 228.75 and 492.92 respectively.

Fixed Cost

In fixed cost housing cost and equipment costs were accounted for. So, the Price depreciation cost for housing was BDT 800 and the price depreciation cost for equipment was BDT 600, as the total fixed cost was accounted for BDT 1400.

Total Variable Cost

In total variable cost interest on operational cost was also included and it was valued at BDT 175.20. As a result, total average variable cost was valued at BDT 8935.67.

Gross Cost

Gross cost was calculated by the addition of total variable cost with fixed cost. The average gross cost was valued at BDT 10335.68.

4.2.2 Revenue

In revenue, the return was earned by selling live sheep at price per kg body weight to the slaughterhouse and selling sheep to bepari and market. Additionally, sheep manure was also sold to enrich the return. Besides this in revenue closing stock was accounted for. So total average gross return was valued at BDT 19178.85.

Net Return

Net return was accounted for deduction of gross cost from gross return of the farm. The average net return per farm per year was valued at BDT 8948.25(Table 4.5) a farm costs of on an average 5 to 6 sheep.

Gross Margin

Gross margin is the difference between gross return and total variable cost which accounted BDT 10523.46 for per farm per year (Table 4.5).

Table: 4.4 Cost and return per farm per year (N=40)

Cost item	Mean± SD BDT	Percentage	Minimum BDT	Maximum BDT
A. Variable Cost	8935.67±337.69		8249.76	9735.39
Feed cost	6195.29±276.05	59.94	5750	6800
Labor cost	1642.5±125.06	15.89	1400	1990
Veterinary cost	201±25.35	1.94	165	250
Transport cost	228.75±101.83	2.21	150	450
Other cost	492.93±80.96	4.77	350	750
Operating cost	8760.47±331.07		8088	9544.5
Interest on Operating cost	175.21±6.62	1.69	161.76	190.89
B. Fixed cost	1400	11.61	1400	1400
Depreciation of Housing	800		800	800
Depreciation of Equipment	400		600	600
Gross cost (A+B)	10335.68±337.69	100	9649.76	11135.39
Gross Return	19178.85±3345.071		15247.2	35047.2

Table 4.5 Profitability of Sheep per farm per year (N=40)

Item	Mean± SD BDT	Minimum BDT	Maximum BDT
Net Return	8948.25±3357.72	15732.2	52814.86
Gross Margin	10523.46±3357.16	6116.2	26317.2
BCR (full cost basis)	1.87±0.33	3.40	1.42
BCR (net cost basis)	2.20±0.39	1.66	4.01

BCR (full cost basis and cash cost basis)

The benefit-cost ratio (BCR) is a ratio used in a cost-benefit analysis to summarize the overall relationship between the relative costs and benefits of a farm. In study, it is indicative that if a sheep farmer invests BDT 1 then in return, he got an average BDT 1.87 according to full cost basis along with a maximum BCR is BDT 3.40 and a minimum BCR is BDT 1.42. If a farmer invests BDT 1 then in return, he gets an average BDT 2.20 according to cash cost basis and maximum is BDT 4.01 and minimum is BDT 1.66.

4.3 Value addition and its effect

Value addition in sheep meat is done by slaughterhouses to produce quality meat. Value-added sheep meat is sold by slaughterhouse situated in the CHT. The product (meat) was sold by adding the costs of, slaughtering, processing, and packaging the sheep meat. Value addition includes proper slaughter, proper processing and packing of sheep meat. The marketing cost, the price paid by the slaughterhouse owner, price received by the slaughter after processing is shown in Table 4.6 and 4.7.

Table: 4.6 Marketing cost of Slaughterhouse

Items of Marketing cost	Bandarban Slaughterhouse	Khagrachhari Slaughterhouse
	Tk/kg	Tk/kg
Electricity Cost	7.81	7.91
Labor Cost	13.64	12.46
Packaging cost	10.91	8.95
Water and cleaning cost	23.63	22.82
Transport cost	5.45	5.64
Other cost	23.15	20.73
Total	84.59	78.51

Table 4.6 shows that there is a slight difference in the marketing cost of sheep meat between the two districts. In Khagrachorri district slaughterhouse is near the town and

sheep are slaughtered less than Bandarban district. As the slaughterhouse is far from town, marketing costs become higher in Bandarban district.

The main revenue comes from carcass meat selling along with liver, lung, kidney and heart selling. Besides, revenue also comes from selling skin, stomach with intestine and head of sheep to the local people.

Table. 4.7 Marketing costs and margins of the slaughterhouse

Particulars	Bandarban District BDT/Kg	Khagrachhari District BDT/Kg
Purchase Price of live sheep	310.00	300.00
Sale Price after value addition	700.00	650.00
Marketing Margin	390.00	350.00
Marketing Cost	84.59	78.51
Net Margin	305.41	271.49
Percentage of producers' Share	44.29	46.15

The live sheep brought to slaughterhouse from farmers via the sheep collector (field assistant). Table 4.7 shows that after processing sheep meat in the slaughterhouse net margin per kg of meat is BDT 305.41 in Bandarban and BDT 271.49 in Khagrachhari district. The marketing margin is higher in Bandarban than Khagrachhari district. It is indicative that the slaughterhouse bought live sheep which was valued at BDT 310.00 per kg in Bandarban and BDT 300.00 per kg in Khagracharri district. The slaughterhouse sells the final product (meat) at BDT 700.00 in Bandarban and in Khagrachhari district at BDT 650.00. Producer shares 44.29% of the final price of meat in Bandarban district and in Khagrachhari district producer shares 46.15% of the final price of sheep meat.

Value addition in sheep meat improves quality and shelf life, leading to higher prices and increased profitability, thereby enhancing sheep production and farmers' economic well-being.

4.4 Supply chain Identification

The supply chain of sheep and sheep products in hilly areas was developed according to survey data. The structure supply chain of sheep meat is given below.

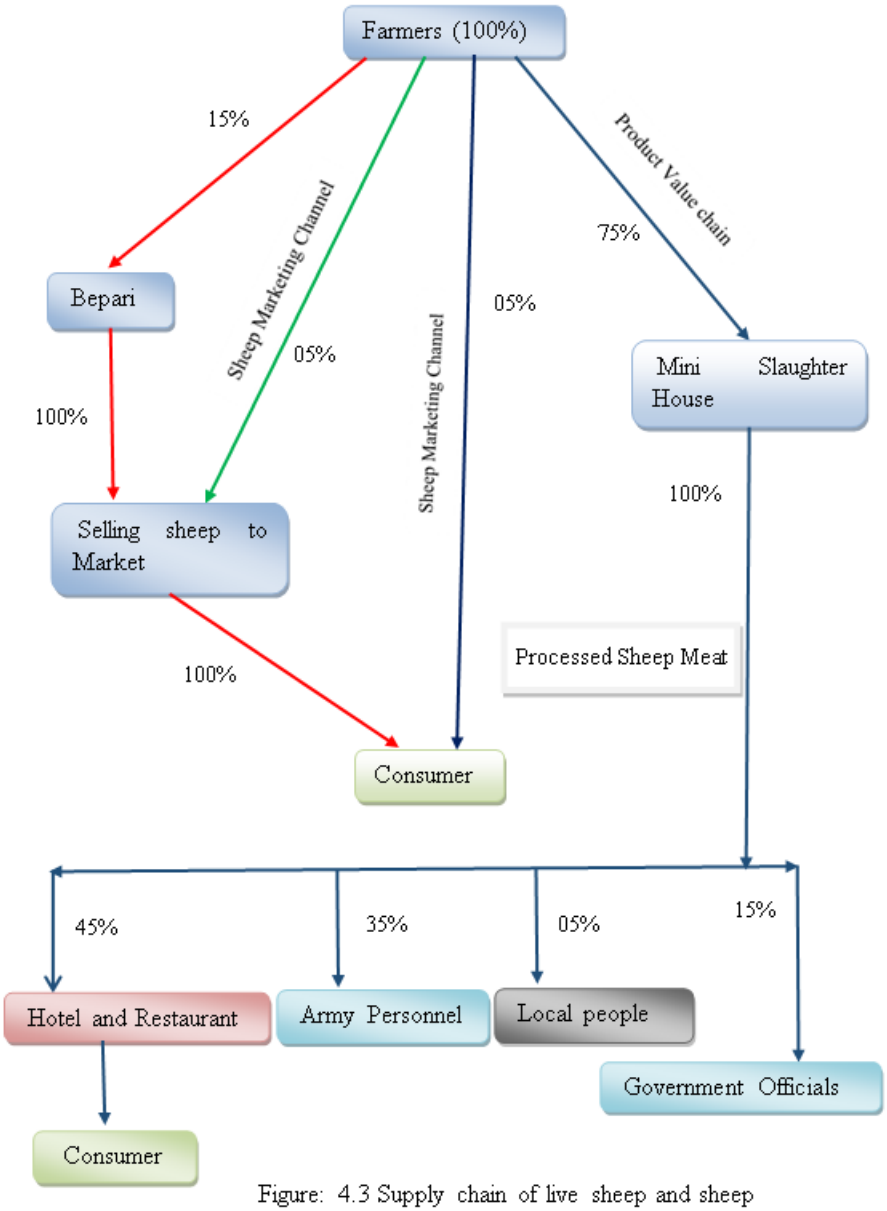

Figure: 4.3 Supply chain of live sheep and sheep meat

Supply chain is the way of flowing products or pathway of products from farmers or producers to the consumer as the final product. In the supply chain, there were many market actors to reach the product to the end consumer.

In study area sheep meat supply chain is very much orientated. There were two types of marketing channels that existed in the hilly area was sheep marketing channel and the product value chain.

4.4.1 Sheep Marketing Channel

Producer: In CHT sheep is very much uncommon but now farmers are raising sheep for economic solvency. As a result, sheep farming is becoming popular day by day. Besides this CHT slaughterhouse was established by KGF funded project CRP-IV to encourage the local farmers to raise sheep with proper husbandry practices. About 5% of sheep which are raised by farmers are sold to farmers directly.

Direct selling sheep in Market: Producer sells their sheep in the local market which is not so far from the farm place. In CHT there is a market day every week and they sell their sheep on that day. About 5% of the reared sheep, direct sell their sheep in the market. From the market, consumers bought sheep as needed. In the market, farmers sell sheep at the market rate.

Bepari: The Farmer also sells sheep to bepari on other day of the week as there is a market day. On the other day there fewer buyers in the market so 15% of the marketed sheep, farmers sell their sheep to the Bepari, and the Bepari sell it to the market.

Producer to Slaughterhouse: It is indicative that about 75% of sheep producers sell their sheep to the slaughterhouse. The mini slaughterhouse was established by the project "Increasing Livestock Production in the Hills through better husbandry, health service and improving market access through value and supply chain management" and field assistant of the project worked as a collector of sheep for the slaughterhouse.

The marketing channels of sheep in hilly areas are given below in short:

Channel 1: Producer → Bepari → Selling in Market → Consumers.

Channel 2: Producer → Selling in Market → Consumer.

Channel 3: Producer → Consumer.

Channel 4: Producer → Slaughterhouse→ Consumers.

4.4.2. Product Value Chain

Slaughterhouse owner buys Sheep from farmers at a price per kg live weight of the sheep and sells it to different customer after value added. At the processing centre sheep, live weight was taken using a top loading balance and recorded and sacrificed the sheep using the halal method. After dressing the carcass, the meat was cut into small pieces then packed in a zipper bag and kept in the refrigerator at four degrees Celsius for marketing to the farmers, and the excess packed are kept in the deep fridge for selling the next day. Mainly Chattogram Hill Tracts was famous for tourism as a result processed meat had demand in hotels and restaurants.

Hotel and Restaurants: Hotel and restaurant owners prefer processed meat because of its quality. As per knowledge pork meat is famous in the local community, sheep meat is not so popular. As a result, hotel and restaurant owners cannot provide halal meat for customers. Because of that 40% of processed meat was bought by the hotel and restaurant owner to provide quality meat for their customer. From hotels and restaurants, tourists consume sheep meat as final consumers.

Armed Forces Personnel: Armed forces personnel such as Police, Armed battalion police, Ansar, Army etc. also buy sheep meat from slaughterhouses because most people are Muslim as a result, they cannot consume pork meat. So, they prefer sheep meat to poultry. They are customers of about 30% of processed meat.

Local People: Local people who can afford the meat also act as farmers of processed meat. But in the local community pork meat is so popular that local people do not buy sheep meat. Only on occasion, 5% of processed meat was sold.

Government Officials: Maximum government officials posted in CHT are Muslim in religion. As a result, they cannot consume pork meat and prefer other meat such as chevon, mutton beef etc. Slaughterhouses for processed sheep meat create an opportunity

to meet the demand for red meat. So many government officials bought sheep meat from slaughterhouse and 25% of processed meat was bought by them.

The product value chain means sheep meat value chain in hilly areas was given below:

Channel 1: Producer→ Mini slaughterhouse→ Hotel and Restaurants→ Consumer.

Channel 2: Producer → Mini slaughterhouse → Army personnel.

Channel 3: Producer → Mini slaughterhouse → Local people.

Channel 4: Producer → Mini slaughterhouse → Government Officials.

4.5 Sheep meat adoption in Hilly Market

Sheep meat was not so much popular in the hilly area. By implementing slaughterhouses and providing sheep farmers with other facilities, sheep production was introduced in the hilly area. Table 4.9 shows the adaptability of the sheep meat in the market by the sheep farmers. The study population included 40 sheep farmers.

A majority (60%) of hilly area farmers support increasing sheep production for income generation. Around 40% of respondents perceive a difference between local and packaged sheep meat, favoring the latter for its hygiene. Satisfaction with sheep production varies, with approximately 30% expressing contentment and 35% citing dissatisfaction as a barrier to expansion. Some farmers (32.5%) find sheep meat superior in tenderness and juiciness, attributing this to proper dressing and hygiene in slaughterhouses. The study underscores the need for targeted efforts to raise awareness and promote sheep farming and consumption in the hilly areas, addressing varying perceptions among farmers.

Table 4.8 Adaption of sheep meat by Hilly farmers

Indicators	Strongly Agree	Agree	Somewhat agree	Neither agree or disagree	Disagree	Do not know
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Encourage increasing production of sheep	15(37.5)	9(22.5)	7(17.5)	3(7.5)	3(7.5)	3(7.5)
Differentiation in quality of local sheep meat and packaged sheep meat	10(25)	6(15)	8(20)	4(10)	7(17.5)	5(12.5)
Sheep production is at a satisfactory level	5 (12.5)	7 (17.5)	10(25)	4(10)	8(20)	6(15)
Sheep meat is more tender and juicy than other meat	2(5)	5(12.5)	13(32.5)	9(22.5)	6(15)	5(12.5)
Satisfaction regarding meat quality	3(7.5)	4(10)	12(30)	8(20)	6(15)	7(17.5)
Reasonable price for the consumer	1(2.5)	5(12.5)	7(17.5)	9(22.5)	6(15)	12(30)
Enhancement in consumption of sheep meat	2(5)	3(7.5)	5(12.5)	8(20)	12(30)	10(25)

Note: Parenthesis indicates percentage and N = indicates population.

Chapter V

DISCUSSION

5.1 Socio-economic condition

The economy of the CHT area largely depends on agriculture. The biggest problem in the area is acute poverty, and as a result people have limited access to basic services (Shelly *et al.,* 2000). In three districts of the hilly area, there was not so much opportunity due to infrastructure lacking. Their socio-economic condition can be improved if we properly nourish the human resources and natural factors which is very much suitable for small ruminant rearing.

The present study revealed that most of the sheep farmers' age in the hilly area ranged from 25-35 years and the average age of sheep farmers were 38 years which is similar to the study conducted by Islam *et al.,* (2018) and not similar with average age (38) to the study conducted by Chowdhury *et al.,* (2015) in which he found that average age of sheep farmers was 42 years.

The result shows quite clearly that most of the sheep farmers were illiterate which represented 52.5% of sample farmers. Only 15% of sample sheep farmers had qualification of Higher Secondary Certificate or above. It indicates that well-educated people were not interested in sheep farming. The study of Chowdhury *et al.* (2015) found that the maximum goat farmers in the study area had experienced 6 years of schooling but in the hilly area, the maximum sheep farmers were illiterate. It is also indicative that in hilly areas percentage of illiterate sheep farmers (52.5%) was higher than in the study conducted by Hossian *et al.* (2021) where he found illiterate percentage only 30% of the sample farmers. In my study percentage of secondary and higher secondary or above were 35.5% and 15% respectively. In the study, Islam *et al.* (2018) found that only 30% and 7% of farmers have secondary and higher education or above which was slightly higher in my study.

The average family members of sample farmers in the CHT area were 5.57 whereas the study conducted by Islam *et al.,* (2021) found that the average family member was 5.08

which is nearly the same in the hilly areas and southwestern areas of Bangladesh. In the hilly area, most of the family consists of 7 or more members which comprise 55% of the total sample population. Whereas Kamal *et al*. (2012) observed that almost half (49.3%) of the farmers had a medium size family followed by a small size (34%) and large size (16.7%) family. Islam *et al.* (2020) found in their study that 45% of the total sample population had small-sized families compared to the hilly areas where the study found maximum study population had a large-sized family.

No other service holders were involved in sheep farming but NGO workers were much closer to the farmers in hilly areas. Many NGOs inspire to raise livestock such as sheep, poultry, bovine and goats. As a result along with farmers NGO workers also started sheep rearing in hilly areas.

The average monthly income of sheep farmers in the hilly area was BDT 17510. Islam *et al.,* (2020) reported that the average monthly income of sheep farmers in the southwestern region was 8463.75 BDT which is lower than the hilly area. Although the maximum number of farmers (27.5%) belongs to the range between BDT 9000/- to 12000/-.Higher income such as above 30000/-BDT had only 15% of the total population. There is a dissimilar between the results Islam *et al.,* (2020) found in his study. It is also dissimilar to Kamal *et al*., (2012) who observed that the majority (64%) of the respondent belonged to the low-income group followed by the medium (26%) and high (9.3%) income groups.

5.2 Profitability of sheep farmer

In the present study, it was found that feed cost covers almost 59.94% of total gross cost which is the maximum cost of all costs. In Milan *et al.,* (2014) found that in sheep farming feed costs comprise almost 61.6% of total variable costs.

In the present study, the depreciation cost was valued at BDT 1400 which was 11.61% of the total cost. But Pamukova et al., (2017) found that depreciation costs share only 3% of total expenditure.

The study stated that profit was earned from selling sheep meat and live sheep in the market besides that revenue earned from selling sheep manure. But in Milan *et al.,* (2014)

maximum revenue was earned from selling milk of sheep and then culled ewes. In our country sheep were not so productive for milk that's why sheep farming for milk was not so popular. In Bangladesh sheep was raised only for meat. There is quite a difference in profit between the study and Milan *et al.,* (2014).

The cost-benefit ratio of the study was 1.88 according to the full cost basis. In study, Uzunoz and Akcay (2009) found that the cost-benefit ratio was 1.07 which indicated profitability in the sheep business. The study supports the present study. Anees *et al.,* (2017) stated that the benefit-cost ratio of his study was 0.45 which indicates a loss in the sheep business and is dissimilar from the present study. Rokicki *et al.,* (2014) also found that positive economic effects were obtained in most sheep breeding enterprises.

The study shows that sheep farming is profitable in hilly areas. Operational cost is much lower than in other region of Bangladesh, especially feed cost. As well as land costs and equipment which needed to construct houses for sheep.

In the study, the net profit is resulted 81.68 USD which is quite enough for a sheep farmer in Bangladesh. But Milan *et al.,* (2014) found that farm profit was 9192 USD which was much higher than the study.

5.3 Value Addition in sheep and its effect

The study found that value addition in sheep meat is profitable to slaughterhouse owners. The marketing margin of slaughterhouse owners of Bandarban and Khagrachhari districts was BDT 390.00 and BDT 350.00 respectively. Producer shares 44.29% of the final price of meat in Bandarban district and in Khagrachhari district producer shares 46.15%% of the final price of sheep meat.

Mondragon-Ancelmo *et al.,* (2014) found that the producer shares 47% of the final price which is not similar to the study. Ashenafi *et al.,* (2013) also found in their study that Sheep producers obtain only about 64.83% of the final price of the processed sheep meat sold by the hotels/butcheries. Beneberu e*t al.,* (2012) found that The analysis of costs and margins along the different sheep market channels also shows that the proportion of final sheep price that reaches producers from export abattoirs, butchers and supper markets were 58%, 66% and 68%, respectively.

Duguma *et al.,* (2013) stated that sheep producers obtain only about 55% of the final price of the processed sheep meat sold by the hotels. Nigus *et al.,* (2021) also stated that the share of farmers from final sheep price was 35% which was very low.

The study also found that there is little difference in net margin between the two districts but Duguma *et al.,* (2013) found quite a difference in various market actors.

Sheep meat per kg sale price in the slaughterhouses was BDT 700.00 and BDT 650.00 in Bandarban and Khagrachhari districts respectively which does not support the finding of Sen *et al.,* (2022) stated that sheep and goat meat are premium meats in India and sold at around Rs. 800 to Rs. 1,000 per kg across the country.

Most of the edible offal or by-products produced from sheep and goats are also marketed and consumed in India. Hence, the wastage from this sector is minimal. However, a major chunk of the sheep and goat meat in India is produced in local slaughterhouses, which are in very poor condition and lack basic facilities resulting in improper disposal of inedible offal and liquid waste (Sen *et al.,* 2022).

The study also stated that comparatively marketing cost is higher in Bandarban district than Khagrachhari district and in other study, many market actors did value addition but in the study, only one market actor who is a slaughterhouse owner did the value addition in sheep meat. Ashenafi *et al.,* (2013) stated in his study that there was value addition in various market actors.

In my study, there is no value addition at the producers' level. In present study state that the selling price of meat in Khagrachhari and Bandarban district of Bangladesh was BDT 700.00 and 650.00 and earned a profit BDT 305 in Bandarban and BDT 271 in Khagrachhari district. Slaughterhouse owner gets a margin equivalent to 150,000 VND (Vietnam Dong) for a goat (Khai and Truong, 2010).

5.4 Supply chain Identification

Chattogram Hill Tracts are one of the most backward regions in Bangladesh. People of that region solely depend on agriculture and livestock production is limited to backyard farming. As a result, there is no well-organized supply chain in that region but there is a supply chain which is not so structured.

The study found that in the CHT region, there are many market actors in the live sheep marketing channels and they are- Bepari, Secondary traders in the Market. Due to the poor transport system, sheep farmers sold only 5% of raised sheep to market and to repair.

In India, sheep and goat value chain actors are producers, primary traders, secondary traders, small butchers, and urban butchers (Sen *et al.*, 2022).

Gebregziabhear *et al.*, (2018) stated in their study that the market actors of in his study area were export abattoirs, big traders, Small traders, and retailers.

In the study, three following live sheep marketing channels are identified

Channel 1: Producer → Bepari → Selling in Market → Farmer.

Channel 2: Producer → Selling in Market → Consumer.

Channel 3: Producer → Consumer.

Duguma *et al.*, (2013) stated that six marketing channels of live sheep in Ethiopia were detected. They are-

Channel 1: sheep slaughtered at hotels.

Channel 2: sheep slaughtered at butchers.

Channel 3: Sheep purchased by individual consumers.

Channel 4: sheep purchased to Addis Ababa markets.

Channel 5: sheep purchased by other farmers for breeding purposes.

Channel 6: sheep slaughtered at export abattoirs.

It was all over the marketing channel of sheep and sheep meat in Ethiopia. After analyzing two studies it can be said that in both studies the shortest channel is producer to direct individual consumers.

In the study area, four marketing channels are also identified for the sheep meat value chain and they are-

Channel 1: Producer→ Mini slaughterhouse→ Hotel and Restaurants→ Farmer.

Channel 2: Producer → Mini slaughterhouse → Army personnel.

Channel 3: Producer → Mini slaughterhouse → Local people.

Channel 4: Producer → Mini slaughterhouse → Government Officials.

In the study area, the maximum sheep slaughtered at the abattoir were brought from sheep farmers. The abattoir owner did not buy any sheep from the market or bepari. They bought sheep directly from farmers.

Ashenafi *et al.,* (2013) found that in their study area, there are no private slaughterhouses that supply sheep meat to the community. There are government slaughterhouses where hotel owners slaughter their sheep but in the study area, abattoir owners slaughter and process sheep themselves.

5.5 Sheep meat adaption in the market of hilly area

The egg was the most frequently consumed; 77 per cent of respondents ate egg once daily. Chicken was the second most consumed (62 per cent), whereas fish was third (59 per cent). Mutton was in the fourth place of consumption frequency level. However, 24 per cent of respondents did not consume mutton (Islam *et al.,* 2018).

The study shows that the maximum number of consumers (40%) agree that there is no improvement in sheep meat consumption in hilly areas. The reason behind no improvement in sheep meat consumption was the popularity of pork meat among hilly peoples and pork meat is cheaper than mutton.

Kadanal *et al.,* (2015) measured problems and expectations, factors affecting sheep sales and production related to sheep production by adopting a six-point likert test table. In the

study sheep meat adaption was measured by six point likert test table. By this test, the result found that the maximum number of farmers (60%) wanted to increase sheep production in hilly areas. Only 30% of the total respondents were satisfied with their sheep production.

Sheep production was not increasing in the hilly area due to a lack of proper connectivity and proper market structure where producers could get at least production cost by raising sheep. Besides that pork production was so popular that most farmers were not interested in sheep production.

To adopt sheep meat in the hilly meat market KGF took a project named Increasing livestock production in the hills through better husbandry, health service and improving market access through value and supply chain management" which was trying to increase sheep production by adding value in sheep meat. The result shows that sheep production in hilly areas is profitable and value addition in meat is also more profitable.

The result shows that most consumers could differentiate between local sheep meat quality and packaged sheep meat provided by slaughterhouse owners and most consumers were not satisfied with the quality of sheep meat.

Sheep meat could be popular in the hilly market if local hotels and restaurants were to start putting mutton items on menu cards. Besides that mutton price is reasonable for local poor people.

Chapter VI

CONCLUSION

The socio-economic demography study indicated that mostly illiterate peopled aged 30-35 year of age were involved with sheep farming and their households' monthly income ranged from BDT 9000 to BDT 12000. Maximum low-income families could not provide basic need of their family members because the maximum family consist of five to seven members. In the hilly area, the average household size was 5.57 and the average age of sheep producers was 38 years.

Sheep production in hilly areas was profitable, an average BDT 40,000 was found in a year by rearing sheep. Sheep production is becoming popular in CHT day by day. The BCR ratio was almost 4 which indicates the farmer was profitable in sheep production.

The present study shows that value addition in sheep meat is also profitable in the CHT region and better profit than farmers who sell live sheep in the market. In that area, sheep meat is sold at BDT 700 in Bandarban district and in Khagrachhari sold at BDT 650 after value addition and slaughterhouse owners get more than around BDT 300 than farmers in terms of per kg body weight of sheep meat. Marketing cost is cheaper in that region. Value-added sheep meat was sold by hotel and restaurant owners because it has demand from tourists. Maximum producers agreed that sheep production should be increased as it is more profitable than any other farming. Less cost in production encourages farmers to produce sheep in a hilly area. Maximum consumers thought that value addition in sheep meat could enhance food variation in hotel food chain management. Value addition in sheep meat increases demand for meat in the hotel as halal meat is provided to consumers. Consumers are ensured about safe meat consumption being not afraid of consumption of pork meat mistakenly.

6.1 Major Constraints

CHT region, characterized by its backwardness, poses significant challenges for sheep farmers due to inadequate infrastructure and limited veterinary services. Farmers face issues such as a lack of market infrastructure, insufficient capital, poor transportation

connectivity, and a monopoly market structure, hindering sheep production. Addressing these constraints is crucial to promote and enhance sheep farming in the CHT region, requiring efforts to improve infrastructure, access to veterinary services, and market conditions.

6.2 Policy Recommendation

In CHT veterinary service should be increased and mobile veterinary clinics should be introduced in that region. Infrastructures related to the livestock sector need to be reconstructed and developed with modern equipment. The market structure needs to be reformed and should emphasize on producers' share in the final price of the product. Roads and transport systems need revolutionary change to enhance the market environment.

Providing long-term credit at an affordable rate to small-holder and poor farmers is also essential to enhance livestock production. The political unrest situation needs to improve, and armed forces need to concentrate on the political situation of CHT.

So, to increase sheep production and consumption in CHT it is essential to decrease the marketing cost as local people can easily afford the processed meat

Integrated approach among Universities, NGOs, research organization, and Department of Livestock Services should work together in the CHT region. For increasing sheep production and the value chain of sheep meat in hilly region more research facilities including veterinary service, infrastructures, and related facilities should be created by the government. Increase in research work related to the production and value chain of sheep in CHT region.

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