DAIRY COMMERCIALIZATION IN MOUNTAIN FARMING ENVIRONMENT OF BUMTHANG DISTRICT: PROSPECTS AND CHALLENGES

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ABSTRACT: *Developing smallholder mountain dairy farming is of paramount importance for commercialization and livelihood sustenance of dairy farmers. With the objective to understand the prospects and challenges to commercialize mountain dairy farming, a study was conducted in Bumthang district involving 40 dairy farms covering 14 villages. All the sample farms were categorized into small and medium sizes based on number of milking cattle and was purposively sampled for data collection. The result indicated that Jersey cross breed is the most preferred breed accounting to 65% of total crossbred population. The mean number of milking cows reared was 3±1.08 and 7±1.5 (Mean±SD) for small and medium farms and the corresponding daily milk production was 19 l/day and 47.7 l/day respectively. There was significant difference (p<0.000) in monthly gross income between the two categories of farms. The availability of high proportion of Jersey cross heifers (51%) in the sampled farms is an evident of quality stock available for herd replacement and dairy commercialization. To further enhance milk production, 88% of the respondent farmers were keen to upgrade their herd genetics, improve dairy nutrition and strengthen farmers institutions for venturing into sustainable dairy farming with economy of scale. However, there are socio-economic and environmental factors that limit dairy farmers in maximizing their production efforts. Nevertheless, pivotal role played by Milk Processing Units in absorbing maximum milk from dairy farmers had increased volume of milk production and collection over the years. Hence, a concerted effort from farmers and extension staff is crucial to overcome the current challenges, while at the same time strengthening the dairy value chain management will encourage farmers in transitioning from subsistence to commercialize dairy farming for its sustainability.*

Keywords: Challenges; Dairy commercialization; Mountain farming; Prospects

1. INTRODUCTION

Agriculture is still a dominant sector that employs almost half (49.2%) of the Bhutanese population (NSB 2021). The rural economy of Bhutan is traditionally based on smallholder, primarily subsistence-oriented mixed farming systems, managing crops and livestock for sustenance. Among livestock keeping, dairy cattle farming enjoys a favourable environment with no religious stigma. It is therefore taken up by a majority of Bhutanese population (78%) or about 40,721 rural households in Bhutan rearing cattle (NSB 2021).

To address the issue of low productivity of the local cattle, crossbreeding initiatives in Bhutan was taken up since 1st Five Year Plan (FYP) (1961-1965) with the supply of Jersey and other dairy breeds of cattle and pursued over successive FYPs (GNHC 2016). In 1974, Brown Swiss (BS) cattle farm was established in Bumthang to breed and supply breeding bulls to upgrade local cattle in temperate areas. However, visible impact of crossbreeding program was seen with the initiation of National Artificial Insemination Program in 1987 (Samdup 2018).

To augment cattle breed improvement under difficult mountain farming environment, Royal Government's strategic move for rural development was also to build farmers' institution through formation of dairy groups/ cooperatives (Tamang et al. 2013). Rai et al (2020) mentioned that improved dairy herds in villages enhanced milk production that triggered dairy farmers self-help group formation to advance milk related agri-business. Thus, with extended support from the Royal Government, dairy farming is gaining momentum across the country.

Bumthang located in Central Bhutan, is a dairy potential district of the country. It has temperate climate favourable for fodder cultivation and dairy farming. The district has cattle sizeable population of crossbred cattle distributed in its four *Gewogs* (sub-districts). Chokhor *Gewog* has maximum 34 percent (2,182 heads) and Tang *Gewog* has 30 percent (1,917 heads) of the district's total crossbred cattle population (NSB 2021). Besides, the district has seven Dairy Farmers Groups (DFGs) with 483 dairy farmers registered as members, representing about 20 percent of households in Bumthang (Sherpa 2010) of which Chokhor and Tang *Gewogs* each have two DFGs with Milk Processing Unit (MPU).

While much progress has been made by the Bumthang district in dairy sector development, many of the farms still are small-scale subsistence types managing few cattle and not many have ventured into market-oriented commercial dairy farming. Until date, limited information is documented on the prospects and challenges faced by the farmers on dairy commercialisation. Hence, this study was undertaken to have a deeper understanding of the prospects and underlying challenges in commercialization of dairy farming in the district with the following objectives:

- Document milk production, daily milk production/sale, and gross monthly income earned by two categories of village dairy farms: small/ subsistence (<5 milking cows), medium/semi commercial (6-20 milking cows)
- Understand the prospect and challenges hindering the commercialization of dairy farming in the district
- Identify intervention areas for up-scaling the current farming type into commercial venture

2. MATERIALS AND METHODS

2.1 Study area and study period

Based on the higher population density of crossbred cattle, this study was carried out in 14 villages and 40 village dairy farms at Chokhor and Tang *Gewogs* of Bumthang District (Figure 1). Informal discussion was conducted with dairy farmers to gather relevant data which was guided by a checklist. The study was conducted twice in May 2023 and in June 2024.

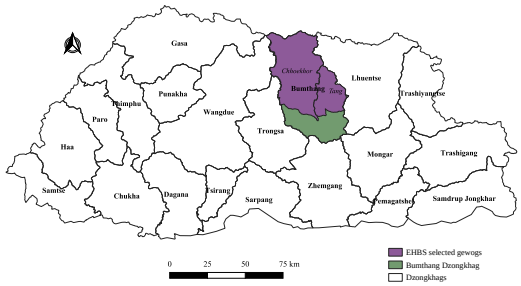

Figure 1: Study area (shaded in colours)

2.2 Sampling of farms/ households for interview

A list of households owning crossbred cattle (especially Jersey crosses) was obtained from livestock census records of the respective *Gewogs* (NSB 2023). Subsequently based on the distribution pattern of crossbred milking cows, 40 dairy farms from 14 identified villages were categorised into two strata: small farms with <5 milking cows (27 farms) and medium /semi commercial farms with 6-20 milking cows (13 farms). Large/commercial farms with >20 milking cows as per

categorization of village farms (MoAF 2019) did not exist in the district and was not sampled. The farmers involved were purposively sampled and interviewed with open and closed-ended questionnaire, visiting every identified farm/household.

2.3 Data collection method

Primary data on crossbred cattle population (focusing on Jersey cross); milking cattle, daily milk production, milk retained for home consumption and milk sold in a day, farm gate price and gross monthly income, prospects and challenges in dairy commercialization were collected through face-to-face interview with the selected farmers. Besides, focussed discussions were held with the office bearers of DFGs at Thangbi, Tamsing and Tang to validate the information. Additionally, three women out of seven, engaged in processing *Chugo* (hard cheese) from skimmed cow were individually interviewed. The secondary data were collected through review of published documents related to dairy farming in Bumthang.

2.4 Data Analysis

The qualitative data related to prospects and challenges in dairy commercialization were analyzed using descriptive statistics. Analysis of Variance was applied for quantitative data on milking cattle, milk production and monthly gross income for farm categories (statistical software MINITAB version 18). Observations and impressions on village dairy farm management, milk collection, processing and sale were described.

3. RESULTS AND DISCUSSION

3.1 Characteristics of village dairy farms

The majority 65 percent (n=26) of farms had mixed herd of Jersey Cross (JX) and Brown Swiss (BS) crosses whereas 23 percent (n=9) had Jersey crosses. However, 12 percent of the farm also owned Mithun cross *(Jatsham)* and Holstein Friesian cross cows in addition to JX and BS.

Overall assessment revealed that Chokhor and Tang *gewogs* owned 57 percent of crossbred population in the district. JX was preferred, accounting 65 percent of total crossbred population in these sampled *gewogs.* Among the JX population, 1558 were found to be of breedable age to support breed intensification for dairy commercialization (Table 1).

Choden and Tamang (2018) confirmed that 92 percent of Bhutanese farmers prefer Jersey cross cattle (521/ 566 households surveyed). Further, Bebe *et al.* (2003) reported that Jersey is one of prominent dairy breeds in countries where cattle are primarily kept for milk production.

3.2 Milking cattle, daily milk production and monthly gross income

The mean number of milking cows reared was 3±1.08, 7±1.5 (Mean ± SD) with herd average daily milk production of 19 l/day and 47.7 l/day from small and medium farms respectively. The respondents retained small quantity ranging from 0.67 to 0.77 l/day for home use and sold rest of the produce to the MPU which is processed into butter and cheese. Average gross monthly income earned through the sale of milk was approximately Nu. 29,000 and Nu. 75,000 by small and medium farms respectively (Table 2).

Table 1: Jersey cross cattle population in sampled *Gewogs*

Sampled *Gewog*	Total Jersey Cross (JX) Cattle (Nos)	Breedable JX female (Nos)	Elite heifers and Cows ≤ 2nd lactation (Nos)	Elite heifer + cows (%)
Chokor	1185	652	292	45
Tang	1648	906	361	55
Total	2833	1558	653	100

Table 2: Milking cattle, daily milk production and income from two farm categories (Mean± SD)

Farm category	N	Milking cows (Nos)	SD	Milk Production L/day	SD	Monthly gross income (Nu)	*p*-Value
Small farm	27	3	1.08	19	12.4	28880	0
Medium Farm	13	7.15	1.51	49.7	20.72	74538	

The main sources of income for the sampled households were from sale of farm fresh milk to MPU besides potatoes and some vegetable. Increasingly, dairy farming is playing dominant role thereby contributing over 50% of annual household income. The present result was found higher than the finding of Bhujel and Sonam (2018) who estimated household income of 18% contribution by dairy farming in mixed smallholder farming system of Bhutan. It is noteworthy that over the years, more focus has been given to dairy farming sector in Bumthang district which could have contributed to higher household income.

3.3 Prospects of commercialization of mountain dairy farms

3.3.1 Availability of quality breedable crossbred heifers and cows

The study found a high proportion of good quality crossbred heifers in the sampled farms (51%) followed by cows in 1st and 2nd Lactation (Figure 2).

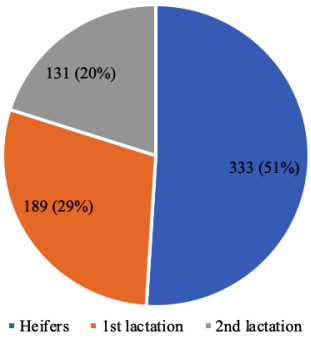

Figure 2: Heifers and younger cows in sampled farms

Tamang and Dorji (2022) reported that among crossbred cattle population in Bhutan, heifer constituted 35% while adult females in the national herd constituted 60% of total cattle population, which is lower than the finding of present study. These differences could have been attributed due to localised dairy priority areas targeted in this study.

3.3.2 Organised milk collection

Milk collection sheds were established near every hamlet with group of households contributing milk to MPUs. However, the collection sheds were found to be old with floor and roof made of wooden planks with partial enclosures. It is reported to be convenient for farmers as they could reach the milk and collect empty cans that are picked and dropped by DFG or private MPUs vehicles. FAO (1993) suggested that an open shade is sufficient for collecting small volume of milk, simple testing and transporting to the processing centre. Thus, with the increased volume of milk collected, the study suggests that improvising the milk collection centre with chilling facilities is necessary to ensure the quality of milk at the centre and also encourage farmers to increase production.

3.3.3 Value added products development initiatives

Most of the milk collected by DFGs were skimmed and sold to women members who processed into semi-hard cheese *(Chugo)* applying traditional method. Besides about 500 litres were processed into Gouda, Emmental and Michelle type cheese and marketed in urban centres. However, value added products especially *Chugo* lacked knowhow on improved processing techniques. Studies elsewhere suggested that for transition

of traditional dairy farmer to a producer of a differentiated value-added product; imparting of required skills and other multi-dimensional development supports is necessary (Dinneen 2016). In addition, Chimboza and Mutandwa (2007) suggested that for effective dairy products diversification, product quality, branding and brand awareness are effective tools. Hence product standardization including product quality control, proper packaging and branding as natural products could fetch better premium for diversified products.

3.3.4 Dairy products marketing and market channel

Most of the milk produced (67%) was sold to Dairy Group's MPUs while private MPUs absorbed the rest, paying a fair price (Figure 3). MPUs further processed and sold the dairy products locally and markets in other districts mostly through informal market channels. Phanchung *et al* (2001) supported the views that for smallholder farmer in Bhutan, not all market outlets and MPUs are equally accessible and thus milk and dairy products are usually marketed through formal as well as informal market outlets based on the convenience of sellers/producers.

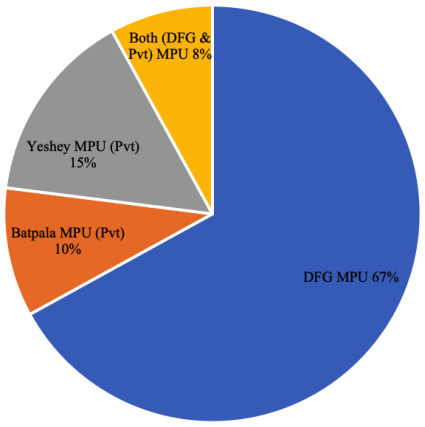

Figure 3: Milk marketed to MPUs

Over the years, the volume of daily milk collection was found to have increased by three folds to 3300 l/day compared to 1010 l/day collected in 2010 (Sherpa 2010). This could be an indication of steady progress in dairy intensification program in the district.

3.3.5 Improvement of herd quality for higher productivity

To enhance milk production, improving their herd with quality cows was a priority of most respondents (88%) owing to sub-optimal yields of most of the present cattle stock. Pema (2000) supported the view that 85% of the dairy farmers in Punakha district of Bhutan were ready to increase their milk production capacity. In addition, Moran (2009) stated that in smallholder farms in developing countries average milk yields of 8-10 kg/cow/day is comparatively lower than in developed countries with average yields of 20-30 kg/cow/day and suggested that yields could be increased with better genetics and management. Promotion of Elite Heifers Breeders Scheme through application of sexed semen technology (NDDC 2024) therefore, appears to be a step-in right direction to improve quality of crossbred cattle to enhance productivity.

3.3.6 Strengthening of Dairy congregating platform (Dairy Groups MPU)

The MPU operated by DFG was the main congregating platform that acted as the interface for the network of farmers in the identified villages. Majority of DFG members (75%) expressed their willingness to strengthen it for a vibrant and sustainable group operation. ILO (2020) reported that in many developing countries, such milk processing facilities is reported to have played a strategic role within the dairy chain management to maintain daily flow of milk, maintain milk quality, processing and channelizing to market outlet for sale.

3.4 Challenges to dairy commercialization

3.4.1 Limited landholdings

Limited landholding was one of the key challenges faced by smallholders to upscale

dairy farming. Even progressive farmers in the district were unable to optimally feed and manage milking cows beyond 10 heads and their followers. In similar environment of Haa district of Bhutan, Wangchuk *et al* (2019) mentioned that land was major constraint in dairy farming to grow exotic pasture and rear more number of improved dairy cows. Likewise, land shortages were identified as the single most important limitation that deterred fodder development for improved dairy farming in Bhutan (Phanchung 2002; Ugyen 2020). Further, Dugumba (2022) reported lack of land, diseases/ parasites and improved genotypes had affected smallholder dairy production system in Ethiopia. Hence the scope of large-scale dairy farming (>20 milking cows) in Bumthang district is limited unless Government facilitate in leasing out the feasible Government land for improved pasture development to promote dairy commercialization**.**

3.4.2 Labour shortages in the farm

Labour shortage had been a teething problem for over 18% (n=7) of the farmers. Aging members in the household, young children attending school and out-migration were some of the reasons. Business Bhutan (2017) reported that farm labour shortage is still a challenge for commercial dairy farming in Samtse district, as Bhutanese are reluctant to work on farms. In western world too, farm labour in dairy production system involves biggest costs and increasingly, it is one of the key challenges facing dairy farmers (DAERA 2024). Dairy farmers were finding it harder than ever to get the skilled workers to look after their cows and run the farms smoothly (David 2024). Therefore, it is suggested that improving labour efficiency and investment on labour saving technologies could address this issue to some extent.

3.4.3 Decline in milk production during winter

During winter milk production declined by about 40-50% when compared to summer months owing to cold weather and acute fodder shortage. Similar findings of low milk production in winter due to acute feed and fodder shortages were reported from temperate Haa district (Wangchuk *et al.* 2019). Sarkhar and Dutta (2020) supported the view that in Northern Hilly region of India, physical constraints such as steep slope, soil erosion, and intense cold affected rearing of dairy animals. Further, Murumo *et al* (2022) reported decreased milk yield when ambient temperature gets fluctuated. Thus, it is suggested that providing congenial environment during winter months through improved housing and a focussed intervention to promote winter fodder production could be some of the measures to address decline in milk yield during winter.

3.4.4 Constraints in products marketing

During summer months, higher milk production and corresponding dairy products (mostly butter and cottage cheese) processed for sale often exceeded absorption capacity of markets within and outside the district. Consequently, dairy farmer and dairy groups faced difficulties in marketing dairy product even at the reduced price. Wangchuk *et al* (2019) observed similar scenario in Haa district owing to largely informal market and limited effort made to diversify products beyond usual butter and cottage cheese. Sarkhar and Dutta (2020) supplemented the view that milk producer does not get desired price due to presence of middleman/ vendors in the dairy supply chain. Similarly, Dang (2014) reported that Vietnamese milk corporation, Vinamilk gained significant market share through application of marketing mix of 4Ps (products, place, price and promotion) with attractive packaging of dairy products. It is therefore suggested that dairy product standardization, branding and marketing as natural products may need to be given due impetus so that the farmers can have better market reach outs and fair price.

3.4.5 In-appropriate cattle breeding techniques

The study revealed that unplanned inter-crossing of available cattle breeds has resulted in progeny with no clear breed characteristics of any parental line. These consequences have been attributed due to unavailability of breeding bull of particular breed in the locality, abundance of stray bulls mixing with the herd while grazing or curiosity of some owners to observe how progenies of different breed crosses performed. Phanchung *et al* (2000) reasoned that due to requirement of animals for draught power and milk; inter-crossing of different breeds of cattle is a common feature in smallholder system in Bhutan. However, Moran (2009) mentioned that breeding schemes will be a failure if national and local breeding strategies do not address the associated disadvantages of unorganised crossbreeding. Therefore, for small cattle population-base in Bhutan, organized and more systematic dairy cattle breeding strategies may have to be advocated to the farmers and then rigorously implemented in the field with proper record keeping system in place.

3.4.6 Limited fodder resources

The study found out that about 47% of the respondents faced fodder shortage during winter months which led to the reduction in milk production. Unavailability of fodder seed in adequate quantity to renovate pasture on time; herd size beyond carrying capacity of pasture were some of the reasons cited by the respondents. The findings were in line with Sarkhar and Dutta (2020) who reported that shortage of quality feed and fodder, quality bovine breed are challenges faced by Indian Dairy Sector. However, Tamang and Gyeltshen (2015) mentioned that fodder shortage is more pronounced in temperate mountain environment where winter were longer and alternate fodder resources were limited compared to sub-tropical areas of Bhutan. Thus, it is suggested that supply of sufficient quantity of winter fodder seeds, herd management based on existing pasture carrying capacity, pasture management strategies, promotion of promising technologies on fodder conservation are some of the strategic interventions required to sustain mountain dairy farming venture.

3.4.7 Limited access to Artificial Insemination (AI) services

In the study area, the limited access to AI services is reported by 60% (n=24) of respondents. Acute staff shortage to perform timely AI in the field was one of main reason cited by the respondents. However, it was observed that the presence of Community AI Technician at Tang area has eased the situation to some extent. To overcome this constraint, rearing of Jersey breeding bull was one of the options adopted by 23% (n=9) of the respondents which has helped other farmers to avail bull services on payment basis. Evidences from developing country in Africa suggest that engagement of farmers to support dairy extension work was an opportunity to complement extension workers (Banda *et al* 2011). The study suggests that placement of dedicated Govt AI Technician or training and deployment of Community AI Technicians (CAIT) may augment AI service delivery.

3.4.8 Conventional dairy herd management practices

The study revealed that many farmers still continue rearing cows beyond their productive age. As a result, such animals compete for limited fodder resources available and also compromise on herd productivity. Moran (2005) supported the view that system of retaining unproductive animals resulted in higher feeding cost that decreased the profit of the dairy farming. Such practices have impacted on the profitability of dairy farming in Bumthang as evidenced from this study.

The traditional practice of one-time milking even for higher yielding crossbred cows is also prevalent in 12.5% (n=5) of the village farms. Limited knowledge on calf feeding and

management and eagerness of farmers to enable female calf to grow fast allowing abundant suckling of their dam were underlying reasons. Tamang and Perkins (2005) also reported similar practices under traditional cattle management system in Bhutan, whereby a common practice was to milk local cattle once a day in the morning and let calf suckle the evening milk. Moran (2009) supplemented the view that in smallholder system feeding, housing and milking management were often not given adequate attention owing to various underpinning reasons. Thus, building knowledge and capacity of farmers on improved dairy farming practices is critical to enhance milk production and productivity and better returns.

4. CONCLUSION

Mixed herd of Jersey and Brown Swiss crosses dominated the village dairy farms though nine dairy farms (23%) raised only Jersey crosses of >50% exotic inheritance. However, high proportion of Jersey cross heifers and cows in 1st and 2nd lactation even in mixed herds indicate that there is a gradual transition from subsistence to dairy commercialization.

Gross income earned by farmers is propionate to number of productive crossbred milking cows reared and milk sold by the farm. This has been a propelling factor for majority of farmers to improve quality of milk from their herd. It is suggested that for continuous upgradation of cattle to reach desired production level, robust breeding strategy has to be advocated and state of art technologies such as sex sorted semen usage needs to be promoted in the eligible herds through adequate deployment of skilled AI Technicians.

In order to address fodder shortage especially during winter, interventions such as promoting fodder varieties that require less land, integration of fodder crops within the existing farming systems and application of fodder conservation techniques are suggested to improve fodder availability for upscaling of dairy farms.

The extension services may need to support farmers for wider adoption of labour-saving devices where feasible to overcome the current farm labour shortage for dairying. Adequate availability of fodder resources and promotion of modern technology including farmer's friendly labour-saving devices are the key drivers to upscale dairy farming into commercial venture.

Strengthening of farmers' institution along dairy supply chain and linking them with the producer groups (farmers) which requisite support such as their capacity building and support on vital infrastructures and chilling facilities are vital for making dairy farming more vibrant and sustainable. Besides, efforts to build capacity of DFG members to diversify value added dairy products having better self-life with proper packaging, branding and standardization of products such as *Chugo* is essential for channelling its sale through organised market/market outlets.

As current findings have indicated that dairy farming is gaining its momentum for sustainable livelihoods over the years, thus, providing appropriate technologies, imparting better farming skills and other technical support is foreseen to strive dairy farmers towards the changing economic and social needs for its sustainability.

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