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## Research Article

# Dairy Value Chain Analysis in Bench Sheko and Sheka Zones, South Western Ethiopia

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### Abstract

**Background and Objective:** Dairy production is low with very fragmented and uncoordinated value chain in Bench Sheko and Sheka zones despite of well suited agro-ecology and vegetation cover for the production. Thus, this study was intended to characterize dairy value chains and value addition practices with its determinants. **Materials and Methods:** A multi-stage random sampling technique was implemented to select 160 sampled households. Descriptive statistics and probit model were used to analyze the collected data. **Results:** Five and three main alternative marketing channels were identified for butter and cheese marketing, respectively. From the channels, dairy producing farmers' gross profit was highest when they directly sale butter and cheese in channel II and I, respectively. Among the sampled households, about 72% participated in dairy value addition practice. Probit model regression result shows that number of children below 6 years, type of dairy breed, number of dairy cows currently owned, distance from urban centers, milk yield per day, market information and extension services are the significant factors affecting participation in dairy value addition. **Conclusion:** Overall, the value addition practices were low as compared to the potential available for dairy production. Therefore, providing training on proper management and way of adding value on their product, demonstrations of improved livestock breed and organizing dairy marketing cooperative should be considered by concerned bodies.

**Key words:** Value chain, dairy value addition, probit model, Bench Sheko, Sheka Zones

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## **INTRODUCTION**

Ethiopia is repetitively exemplified as the most potential country in livestock resource in the Africa and home for livestock inventories with an estimated 55.03 million cattle, 27.35 million sheep, 28.16 million goats, 1.96 million horses, 6.95 million donkeys, 0.36 million mules, 1.1 million camels and 51.35 million poultry of livestock population<sup>1</sup>. Of the total cattle population, female cattle constitute about 55.38% of the national herd with 17, 407122, 12.13% dairy cows and 19.5% milking cows.

Dairy sector is an integral part livestock production in the country which is a major contributor to economic development<sup>2</sup>. In addition, dairy products have long been considered as a highly nutritious and valuable human food and is consumed by millions daily in a variety of different products in the Ethiopia<sup>3,4</sup>. According to CSA<sup>1</sup>, from total annual milk production 42.38% was used for household consumption, 6.12% was sold, only 0.33% was used for wages in kind and the rest 51.17% was used for other purposes (butter, cheese and the likes).

South Nations, Nationalities and Peoples Region is the third highest potential region of the country in livestock production having 11.04 million cattle population next to Oromia and Amhara<sup>5</sup>. The average productivity of cattle is 1.65 L/day/cow with total annual milk yield of 667, 562 t. According to SNNPR<sup>6</sup>, the total number of dairy cows in the region is 4, 943, 854, from which 933, 225 t of milk is produced/annum. However, the productivity of the livestock resources and the benefits obtained from the sector does not matching with the high livestock population<sup>7,8</sup>.

Unlike other part of the region, Bench Sheko (previous Bench Maji) and Sheka Zones are well known in livestock population with well suited agro-ecology and vegetation cover for many years that offer high potential dairy products<sup>9</sup>. Despite this high potential, milk production/cow/year is low and the production is very fragmented and uncoordinated in these zones as compared to its potential<sup>9,10</sup>. This may be due to poor livestock management, poor value addition practice and poor extension services. Even though the study area have highly potential for dairy production, factors affecting value addition across the dairy value chain is absent. The result of such studies will enable policymakers design and implement effective policies and programs. Though there are studies on regarding to dairy production in Southern and southwestern Ethiopia<sup>9,10</sup> none empirically investigated value addition practices across dairy value chain in Bench Sheko and Sheko Zones of Southern Ethiopia. Therefore, interventions targeting improvement of the traditional dairy sector are crucial for the development of the

dairy value chain and identification of root causes and specification of leverage points. Thus, this study was intended to identify value chain actors along dairy value chain and to map, to identify the determinants of participation in value addition practices, to identify opportunities and constraints along the dairy value chain.

## **MATERIALS AND METHODS**

**Description of the study area:** The study was conducted in Bench Maji and Sheka zones of the Southern Nations Nationalities and Peoples Regional State during July, 2018 to February, 2019. Bench Maji and Sheka zones are located in south west of Addis Ababa at 561 and 694 km, respectively. The altitude of Bench Maji ranges from 850-3000 m.a.s.l and whereas Sheka is 1200-3000 m above sea level. The annual average temperature of Bench Maji ranges from 20-40°C and the annual rainfall from 1200-2000 mm and that of Sheka ranges from 15.1-27.5°C annual average temperature and 1201-1800 mm annual mean rainfall. The Zone has high livestock population consisting of 447000 cattle, 73700 sheep and 69200 goats, 9700 equine and 254300 chickens<sup>11</sup>.

**Data collection techniques and data sources:** Qualitative and quantitative data were collected from primary and secondary sources. Focus group discussions, key informant interviews and personal observation were utilized to collect primary data. Secondary data were collected from reports of CSA as well as zonal and district livestock and fishery offices.

**Sampling method and sample size:** The sampled farmers were selected using a multistage sampling procedure. First, four districts were selected from two zones purposively based on their dairy production potentiality. In the second stage with the assistance of livestock and fishery office two kebeles were randomly selected from the selected districts. At the third stage, households were stratified in two categories; households that have lactating cows during 2017/18 production year are considered as dairy producers and the counterpart non-producers. Finally, 20 dairy producing households from each kebeles were selected randomly from the producers' group a total 160 sample dairy producers' households were used. A Rapid Market Appraisal was conducted for formal traders' survey.

**Methods of data analysis:** The collected data were analyzed using a value chain analysis approach for qualitative part and for quantitative part, probit econometric model was used to analyze the factors affecting dairy products in value addition practices.

## RESULT AND DISCUSSION

### Socio-economic characteristics of the sampled dairy households:

The survey result in Table 1 revealed that from the total of 160 sampled households, 68.13% were males and 31.87% were females. With regard to religion, about 47% were Orthodox Christian which affects the demand of dairy products consumption during fasting season. The average family size was about 6 members. The average age of the respondents was found to be 49.50 years. The dairy production experience of the respondents was about 21 years. The average annual income generated from selling of crops, livestock and non/off-farm activity (pension, petty trade and remittance) were 10083.13, 13276.56 and 5624.375 birr, respectively.

**Dairy production related variables:** A type of breed used is one of the important factors which determine productivity of dairy. Result in Table 2 shows that about 69.38% of the respondents were using local breeds, 25.62% used both local and cross breeds and the rest 5% only were using cross breeds.

About 87.50% of sampled households are non-users of improved forage may due low level of technology demonstrations in the study area. Feed supplementation was not commonly practiced in the study area. Most of the dairy producers depend on grazing only (59%). In terms of quantity of milk produced, most of the interviewed dairy producers in the study area produce on average 4.15 and 1.275 of milk/day/cow from crossbreed and local cow, respectively. This variation in the average milk yield per cow between cross breed and local cow is attributed due to the difference in breed, management and feed systems. Average lactation length of cross breed and local cows in the study area was found to be 8.75 and 8.13 months, respectively.

Table 2: Production related variables

Variables	Response/category	Frequency	Percentage	
Breed type owned	Local breeds	111	69.38	
	Both local and cross breeds	41	25.62	
	Cross breeds only	8	5.00	
Grazing land	Yes	152	95.00	
	No	8	5.00	
Feeding of practice	Grazing	94	58.75	
	Grazing+Supplementary feed (home left)	38	23.75	
	Grazing+Grain supplements	12	7.50	
	Purchased feed (wheat bran)	16	10.00	
Use of improved forage	No	140	87.50	
	Yes	19	12.50	
	Local (mean)	SD	Cross (mean)	SD
Number of milking cows	2.22	1.72	0.32	0.89
Milk yield (day)	1.275	0.46	4.15	1.24
Lactation length	8.13	1.42	8.75	0.745

SD: Standard deviation

### Dairy value chain analysis

**Dairy value chain actors in the study area:** The dairy value chain actors and the core function of their relationship tells who is doing what and which actors are participated in which functions of milk production, marketing and consumption (Fig. 1). Every value chain actor participated in one or more value chain activities for the purpose of value addition, market facilitation, product distribution and marketing activities in the study area. The value chain actors and value chain supporters are mapped together in Fig. 1 to illustrate the relationship.

The major core functions of dairy value chain actors are input supply, production, marketing, consumptions of the produces and Supportive service providers.

### Inputs providers (the major inputs supplied by input suppliers):

The study area is characterized as mixed crop-livestock farming system. In mixed farming system, private grazing is mainly used as source of livestock feeds together with natural pastures. In the study area there is no any formal feed supplier. The only input supplied in the study area are artificial inseminations and health services.

Table 1: Socio-demographic characteristics of sampled households

Variables	Response (four woredas)	Frequency	Percentage
Sex	Male	109	68.13
	Female	51	31.87
Religion	Orthodox	78	46.88
	Protestant	70	47.13
	Muslim	12	5.99
Variables	Observations	Mean	Std. dev.
Age	160	49.5125	8.612546
Educational level	160	2.64375	1.178139
House hold size	160	5.9375	2.53451
Experiences	160	20.8875	9.044952
Crop farming	160	10083.13	2611.277
Livestock farming	160	13276.56	2300.355
Non/off-farm activities	160	5624.375	3856.523
Total income	160	28984.06	5403.343

Std. dev.: Standard deviation

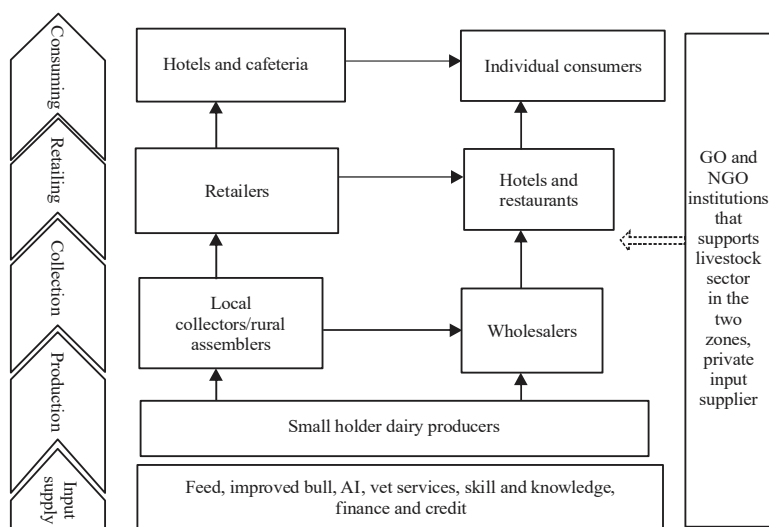


Fig. 1: Dairy value chain map in Bench-Sheko and Sheka Zones

**Dairy producers:** They are the primary or first link value chain actors and take part in producing dairy products and supply to ultimate end users and other market chain actors. Large proportion of dairy products are produced and processed from smallholder dairy farmers in study area by using both cross breed dairy cows and local breed.

**Collectors:** They are the important actors in the dairy value chain. Most of the times they collect butter from the individual milk producers in the study areas and they have collected, storing and transporting to urban market in districts and zonal markets by supplying for the wholesalers, retailers, hotels and cafeterias.

**Hotels/cafeterias:** They directly purchase fluid milk (morning and evening milk) from the producers. They also purchase butter and cheese from dairy producers and collectors. According to the information obtained from FGD and key informants' interview, hotels/cafeterias holds about 70% of the fresh milk market of the study site. They consider quality parameters such as freshness, adulteration with water, taste, hygiene and price in their decision to buy liquid milk.

**Semi-wholesalers:** They are important butter market intermediaries who perform the function of both retailing and wholesaling depending upon market conditions. The informal survey revealed that the existence of semi-wholesalers in butter market channels were functional in butter business at Mizan and Tepi market. Also, they were classified butter as *Yebesele*, *Mekakelegna* and *Lega* which was sold by on average price of 210, 175 and 155 ETB kg<sup>-1</sup>, respectively.

**Retailers:** They are the ultimate actors in the value chain that purchase and deliver butter and cheese to end consumers. Besides this they are known for their limited capacity of purchasing and handling products with low financial and information capacity as compared to semi-wholesaler.

Individual consumers are who consumes raw milk, butter and cheese from small holder dairy producers and they collect milk from the producer's gate.

**Supportive service providers along dairy value chain:** Service provision is necessary for value chain actors to perform the activities that add value and reduce transaction cost. The different supportive service providers in study areas are:

**Extension service providers:** These are livestock and fishery office and agricultural growth program. They are providing training on dairy cows feeding, management, market information, AI, improved forage based on extension perspective low in study area.

**Credit service providers:** Farmers' and traders in study area accessing credit from Omo micro finance and informal lenders like relatives. Due to limited supply of credit, bureaucracy (to save 20% of money), unavailability of credit agents and high interest payment (8%) specially to take credit from Omo micro finance institution most farmers aren't participating in credit.

**License providers:** Trade and Industry office play important role in providing license for the traders in study areas.

**Dairy products marketing channels:** A marketing channel consists of individuals and firms involved in the process of making a product or service available for use or consumption by consumers or industrial users. Here we focused on two important value-added dairy products (butter and cheese) in the study area. According to the survey result, five and three main alternative channels were identified for butter and cheese marketing, respectively in study area. It was estimated that on average 63360 kg of butter were marketed in Mizan, Shey-Bench, Temanja yathi, Tepi and Masha markets in 2017/2018 with the estimated percentage share of 12.38, 22.84, 31.8, 15.22 and 17.6%, respectively for the identified five channels.

Based on volume that passed through each channel, the channel three carry out the largest followed by channel two and five:

- Producers individual consumers (7845 kg, 12.38%)
- Producers retailers consumers (14470 kg, 22.84%)
- Producers local collectors wholesalers consumers (20150 kg, 31.8%)
- Producers wholesalers retailers consumers (9645 kg, 15.22%)
- Producers local collectors retailers consumers (11250 kg, 17.6%)

While, on average 37,550 kg of cheese were supplied to the same market center in study area in 2017/2018. It has lacked long marketing channel outside the districts because of its perishable nature and shortage of storage facility in study area. As the result, the large volume of cheese was sold to consumers through channel 1, 3 and 2 with the percentage volume share of 52.3, 22.5 and 24.9%, respectively:

- Producers consumers (19750 kg, 52.3%)
- Producers local collectors consumers (8450 kg, 22.5%)
- Producers retailers consumers (9350 kg, 24.9%)

**Distribution of dairy farmers by milk marketing channels:**

Market participation of dairy farmers in the study area shows that they could sell milk through different channels. Most of the dairy producers in the study area were preferred to sell their milk through informal chain where they get high price per liter of milk. Out of the total interviewed smallholder dairy producing farmers, 88% of the respondents sold their raw milk through informal milk marketing channels. Whereas 12% of the respondents' sold their milk through formal channels

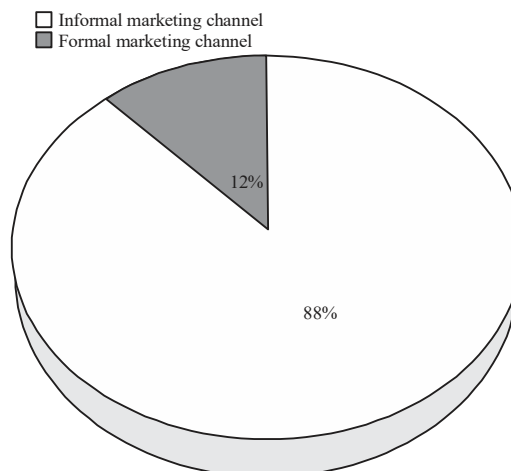


Fig. 2: Farmers distribution for milk marketing channels

which is limited to peri-urban areas as shown in Fig. 2. Debele and Verschuur<sup>12</sup> and Kindeya<sup>13</sup> also reported that the proportion of total production being marketed through the formal markets still remains small.

**Determinants of dairy value addition by farm households:**

Value addition refers to the act of adding value(s) to a product to create form, place and time utility which increase the customer value offered by a product or service. In case of this study, value addition is processing of fluid milk in to butter and cheese in from of product change. Milk value addition through traditional methods is often considered inefficient and it is associated with losses up to 12% due to low rates of butterfat recovery<sup>9</sup>. About 71.25% of sample respondents participate in milk value addition, decision making for processing depends on economic factors and meeting family needs for the products.

The maximum likelihood estimates of Probit model regression, with the likelihood function of the model is significant (LR  $\chi^2$  (13) = 363.40 Prob> $\chi^2$  = 0.0000) indicating the model is adequate because coefficients are jointly significant. Of the hypothesized variables, level of education, number of cross dairy cows, extension contact, distance from urban centers and milk per day were significantly affected dairy value addition (Table 3).

The model result depicts that number of cross dairy cows as expected had a positive and significant effect on milk value addition. The relationship between the two variables indicates that cross dairy cows could have more milk yield as compared to local ones which increases the probability of the household milk value addition. The marginal effect shows that when

Table 3: Maximum likelihood estimates of probit model of milk value addition

Variables	Coefficients	Marginal effect	P>z
Sex (male)	-0.244 (0.345)	-0.028 (0.038)	0.453
Education level	0.171 (0.1072)	0.041 (0.0334)	0.190
Number children below 6 year	-0.398 (0.149)	-0.049 (0.026)	0.045**
Household size	0.047 (0.113)	0.006 (0.014)	0.667
Experience in dairy	0.025 (0.022)	0.003 (0.003)	0.318
Average annual income (ln)	0.453 (0.835)	0.056 (0.104)	0.583
Number of dairy cows owned	1.949 (0.494)	0.294 (0.091)	0.001**
Perception on price VA product (+VE)	0.981 (0.812)	0.103 (0.083)	0.174
Improved forage utilization (yes)	0.183 (0.376)	0.023 (0.048)	0.630
Type of dairy breed owned (local only)	-1.223 (0.478)	-0.116 (0.051)	0.021**
Extension services	0.385 (0.167)	0.048 (0.023)	0.040**
Distance from urban centers	-0.508 (0.182)	-0.061 (0.028)	0.023**
Constant	1.367 (0.471)		0.004

Number of observation: 160 LR  $\chi^2$  (13) = 363.40 prob> $\chi^2$  = 0.0000, Log likelihood: -593.38679 Pseudo R<sup>2</sup> = 0.4344, \*\*significant

the number of cross dairy cows increases by one, the probability of participating in the milk value addition increases by 29%. This finding is similar with previous findings of Tadesse *et al.*<sup>10</sup> and Kuma *et al.*<sup>14</sup>.

Education level of household head influenced the level of participation positively and significantly at ( $p < 0.01$ ) level. The marginal effect also shows that a unit increase in year of schooling a dairy farmer would increase his/her likelihood of participation in value addition by 4%. The results therefore, suggest that expanding rural education will have a positive effect in increasing number of farmers who participate in value added products. The reason is that higher level of education enables to realize the importance of milk products as they are important source of nutrients. The effect of education has been supported by Duguma *et al.*<sup>15</sup> and Doti<sup>8</sup>.

Milk yield per day is positively associated and statistically significant with farmer's likelihood to add values to milk. As milk yield per day increases by a liter, the probability of adding values to milk increases by 23%. This result is consistent with Beyene *et al.*<sup>16</sup> and Mamo *et al.*<sup>17</sup>.

As expected, distance to the nearest urban center is statistically significant and positively associated with farmer's likelihood to add values to milk. This indicates that as farmer's distance from the nearest urban center increases by one km, farmer's likelihood to add values to milk increases by 6%. This finding was supported by Mamo *et al.*<sup>17</sup> but study by Debele and Verschuur<sup>18</sup> contradicts with this result. Finally, livestock extension contact is positively associated with farmer's likelihood to add values to milk. This indicates that lower frequency contact livestock extension service providers will decrease the probability of adding values to milk by 4.8%. This result has been supported by Seifu and Doluschitz<sup>19</sup> and Kuma *et al.*<sup>14</sup>.

**Constraints and opportunities of dairy value chain:** Dairy producers identified the major constraints and opportunity along the value chain. Major constraints identified along dairy value chain in study area are:

- Livestock disease such as mastitis, internal and external parasites
- Availability of improved dairy breeds is low
- Bad perception of farmers to use improved dairy breed due to fear of management
- Lack of improved breed bulls for farmers due weak extension services
- Lack of marketing and business skill of milk processing brought lack of market (buyer) for cream separated milk (skimmed milk) these also lead to lack of value addition practices
- Absences of women association cooperatives that participated in dairy production and marketing (lack market linkage for producers)
- Lack of know about utilization of crop residues as animal feed
- Lack of awareness creation to farmers about improved technology (breed, forage utilization churning materials, management)
- Lack of awareness on supplementary feed utilization practices
- Adulteration problem from traders' side

Despite the above constraints, in study areas there are also opportunities for dairy value chain development. The identified ones along dairy value chain in the study area are:

- There is long standing and strong culture of consumption of dairy

- The high demand for milk and milk products at the big zonal cities like Masha, Tepi, Mizan, Bonga and Jimma
- Relatively better focus given by the government structures including agricultural offices, cooperative promotion offices
- The increased urbanization population
- Development of infrastructural sector, such road access connecting towns with kebeles. The finding of this study was similar to the study of Getachew and Tadele<sup>20</sup> and Galmessa *et al.*<sup>21</sup>

### **CONCLUSION**

From the result obtained, it can be concluded that the roles and functions of all actors in the value chain are not clear and there is weak linkage between milk producers, traders and all stakeholders of the dairy value chain in the study area. The marketing margin result implies that the share of dairy producers from final consumer's price was low which implies that there is a need to reduce market intermediaries to minimize the marketing margins and thereby enhance the producers' income. The type of dairy breed, number of dairy cows currently owned, distance from urban centers and extension services are determinants to be considered to increase the value from dairy products.

### **SIGNIFICANCE STATEMENT**

This study provide information on dairy value chain actors functions, marketing channels and factors affecting value addition practice in the study area. This study will help the researcher to uncover the critical areas of value addition determinants that many researchers were not able to explore. It also helps livestock producers and dairy traders for their production and marketing planning and policy maker and development planner in drafting policy for input supply, production, marketing and processing dairy products.

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