Opportunities and Constraints of Cow Milk Value Chain: The Case of Laelay Maichew District, Central Zone of Tigray, Ethiopia.

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Abstract
The objective of this study was to identify the key opportunities and constraints of dairy production and marketing on 110 smallholder dairy producers in Laelay Maichew District, Central Zone of Tigray, Ethiopia. Ranking Analysis Index has been applied for this research for the purpose of to identify constraints of milk production and marketing. The milk production and marketing was constrained by various challenges. According to the survey, producers are suffering from lack of marketing, lack of supplementary feed, water scarcity, low breed milk productivity and shortage of grazing land. Despite the numerous challenges the dairy production still remains profitable business for the smallholders.
Keywords: *smallholder dairy producers, Ranking Analysis Index, Constraints and Opportunities*

Introduction

CSA (2011/12) reports that, Ethiopia is endowed with the largest livestock population in Africa. Although (Berhanu *et al.,* 2007) explain that, Ethiopia ranks first in Africa and tenth in the worldwide with respect to the livestock population. And (CSA, 2011/12) reports that, the cattle population was estimated at about 52.13 million. The indigenous breeds accounted for 98.88 percent, while the hybrids and pure exotic breeds were represented by 0.93 and 0.012 percent, respectively. From the total cattle population, 44.43 percent are males and 55.57 percent females.

However, there are a number of fundamental constraints underlie these outcomes. These include traditional technologies, limited supply of inputs (feed, breed, stock, water) poor or non-existent of extension service, high diseases prevalence, poor marketing infrastructure, lack of marketing support service, lack of market information and limited credit services affect the livestock marketing conditions (Berhanu *et al*., 2007).

Despite the above, Berhanu *et al*., (2007) discusses the growing domestic demand, which results from increased urbanization, higher income due to economic growth, and rising population, offers significant incentive for increased market oriented livestock production.

Moreover, Ethiopia produced 3.3 billion liters of milk in 2011/2, worth \$1.2billion and imported an additional \$10.6 million of dairy products. At 19 liters per annum, per capita, annual milk consumption is well below the world average of 105 liters and the African average of about 40 liters (FAOSTAT, 2011).

According to LDMPS (2007), the major sources of milk in Ethiopia are produced from cows (83% of total milk production in Ethiopia) and the remainder from goats and camels in certain regions is particularly in pastoralist areas. As dairying play significant role in the lives of the urban and peri-urban poor households (Yitaye *et al*., 2007), promotion of the dairy sector in Ethiopia can therefore contribute significantly to poverty alleviation as well as, availability of food and income generation.

Materials and Methods
Description of the study area

The study was conducted in Laelay Maichew District and the District has a good agricultural potential and has relatively better agricultural marketing activities due to its location advantage in being closer to the main road and Aksum town. Four kebele's were selected for the study. The nearest, medium and distant kebele's from Aksum town in order to see the key opportunities and constraints of milk production and marketing. These kebeles are Dura, Medego, Debrebirhan and Mahibereselam respectively. Dura and Medego are from the nearest distant kebeles the main reason to select these two kebeles from the nearest distant was, both of them are potential in cow milk production but the socio economic of the smallholders in the two kebeles are different. Dura have large irrigation land this is one of source income and this have an advantage to have high dairy green feed therefore these two kebeles are selected from the nearest distant to Aksum town through this reason in order to reduce selection bias.
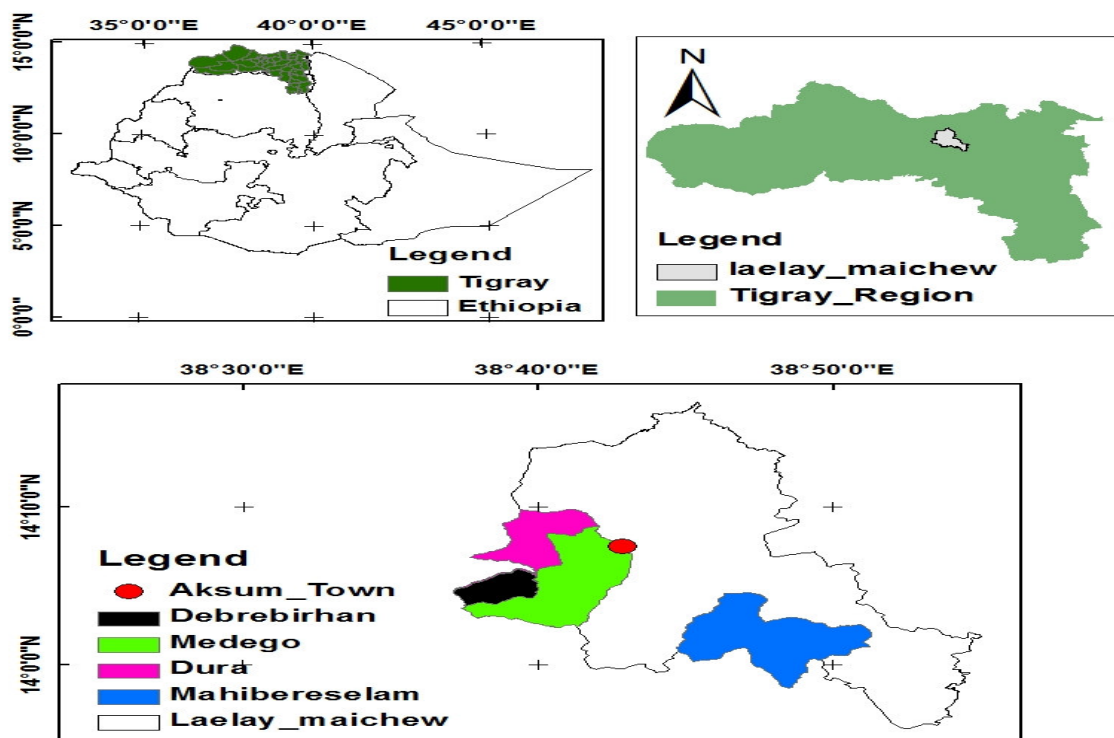
Figure 1: Map of study area

Farming system

Agriculture is the mainstay of the community. The economic activity of the study area is predominantly crop and livestock production (mixed farming system).The crop production system of the study area is dependent on both rain fed and irrigation. Of the community members, 7466 male household head and 1369 female household head a total of 8835 households are irrigation users. The average landholding for households was 1.37 ha with minimum of 0.5 and maximum of 2.25ha (Laelay Maichew woreda OARD, 2014).

Crop production

The major crops grown in the district include Teff, wheat, barley, field pea, faba bean, lentil, fenugreek and maize. Teff and wheat are the major sources of daily food of the population. Farmers of the district use different soil fertility management practices such as inorganic fertilizing (Urea and DAP) and organic like farmyard manure, compost, crop rotation, intercropping and to build up the supply of available nutrients so as to increase crop productivity as poor soil fertility is one of the crop production constraints in the district their crop production system is integrated in such a way that crop residue and straw feeds their animals while the animal waste used as manure and to prepare compost to improve their crop productivity by improving soil fertility (Laelay Maichew woreda OARD, 2014).

Livestock production

Livestock constitute an essential part of the farming system in the study area. Major livestock herds in the district are cattle, goats, sheep, donkey, chicken, camel, mule and beehive. Oxen are the main source of farm power for plowing, and threshing. In general the study area practices both grazing and cut and carries system for their livestock management (Laelay Maichew woreda OARD, 2014). Hence farmers of the area are a potential prepare compost from the animal wastes and crop residue as both production system are well practiced.

Commodity description in the study area

Simple assessment was conducted by ILRI on Commodities development potential at kebele levels. The three clusters of action district in the central zone of Tigray consist of 63 Kebeles. The field survey showed that dairy is potentially produced at about 77.78% and poultry on about 82.54%. The survey also showed that small ruminants potentially produced on about 77.78% and irrigated crops on about 77.78% of the total kebeles.

The clustering kebele potential for specific commodities showed a clear pattern of commodity

combinations. For instance, in most of the irrigated sites of Laelay Maitchew district, dairy and poultry has been reported as potential commodities in synergy with irrigation development (Table 1). In the less irrigated potential kebeles, small ruminant and poultry has been reported as dominant commodity combinations. The same is true for Adwa and Ahferom action district. Thus, the delineation of kebeles into commodity potential combinations or recommendation domains is useful for developing context specific livestock and irrigation interventions.

Table 1: Relative potential of Kebeles for livestock and irrigated crops commodity development in Laelay Maitchew District, central zone of Tigray

Farming system type	Kebeles	Relative potential of kebeles for commodity development				Key target commodity
		SR meat/ live animals	poultry	dairy	Irrigated crops	
Midland irrigated with mixed crop-livestock FS	Lesalso	1	3	3	2	Poultry, dairy, sheep and irrigated agriculture
	Hatsebo	2	3	3	3	
	Medego	2	3	3	3	
	Debre Birhan	2	3	3	3	
	Dura	3	3	3	3	
	Dereka	2	2	3	3	
	Mahibere Selam	3	3	2	3	
Lowland rainfed with mixed crop-livestock FS	Edaga Arbi	3	3	2	2	Small ruminant and poultry
	May Weini	3	2	2	1	
	Sagilamen	2	1	1	1	
	Adi Tsehafi	2	3	1	1	
	Ketema Dego	1	3	1	1	
	Mihe	3	1	1	1	
	Natika Bilae	3	2	1	1	
	Awlieo	3	1	1	1	
	Welel	2	1	1	1	

Relatively commodity potential of Kebeles was assessed using 0-3 scales. Scores indicating 0 = no potential, 1= limited potential, 2 = medium potential and 3 = high potential.
Source: LIVES project enteral zone report, June 2013.

Sampling design and procedure
To address the objectives of this study, a multi stage sampling method were used to obtain the necessary information. In the first stage the study area (district) was selected purposively considering its agro ecological suitability for dairy production and dairy production potentials. Secondly, stratified sampling was also adopted in order to come up with homogenous kebele's. Hence, the kebeles were selected based on two basic criteria, one distance to Aksum town and potentially for dairy production. Thirdly, smallholder dairy producer households were selected by using simple random sampling.

Lastly, sample size of smallholder dairy producers was determined using the table developed by (Bartlett *et al*. 2001). According to those authors for 1500 population size at 95% confidence interval; 110 sample sizes were determined. By doing so, in this study from 1286 population size, 110 of smallholder dairy producers were selected. Finally respondents were proportionally and randomly selected from each kebeles and stated as follows.

Table 2: Proportion of farmer households in each kebele that are produce milk

Name of Kebele	Total number of households	proportion of households sample
Dura	339	29
Medego	561	48
Debre Birhan	234	20
Mahibere selam	152	13
Total	1286	110

Source: Disrtict Agricultural Office, kebele administrations and own computation, 2015
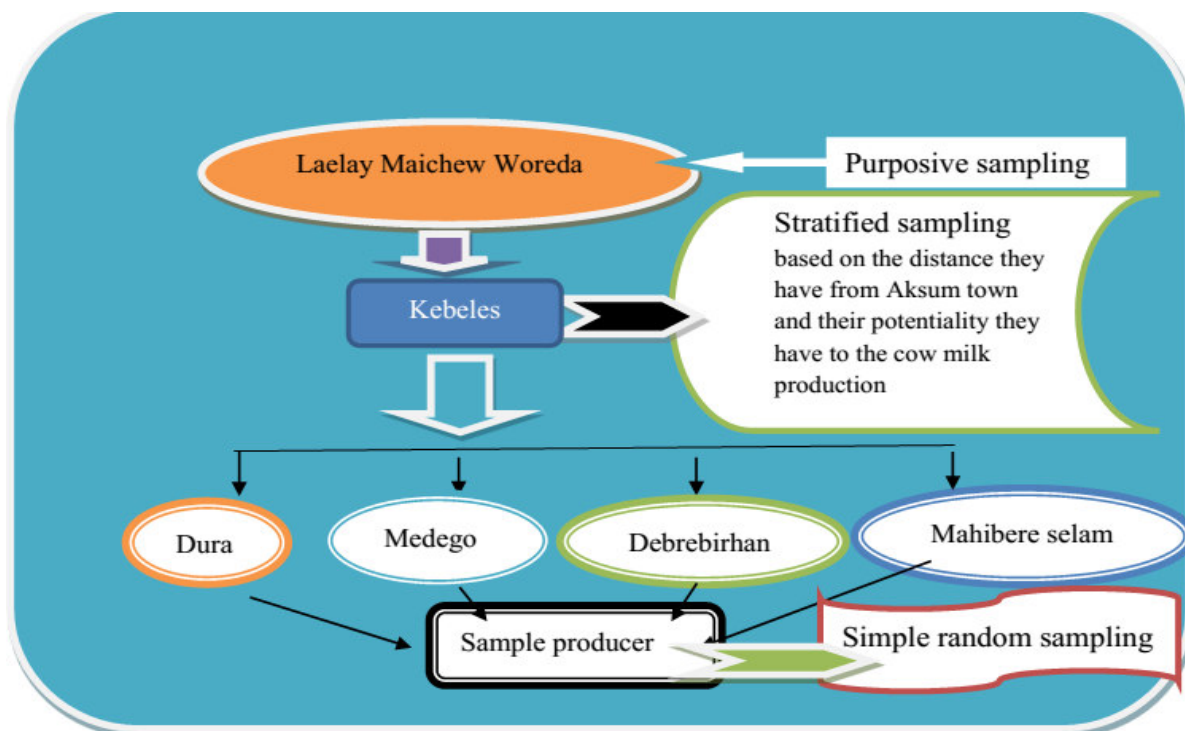
Figure 2: Sampling frame

Data type; source and collection instrument

For this research the main sources of data was primary data sources; And, qualitative data was used. Primary data was collected using semi-structured questionnaires from smallholder dairy producers.

Data collection method

A survey questionnaire for collecting data on the socio-economic characteristics of the target population was designed with a scope limited to only the information that the researcher thought vital for the study. Trained enumerators administered the questionnaire and the essence of each question was discussed before the data collection was actually begun.

This fact requires studying the main aspects of a questionnaire viz., the general form, question sequence and question formulation and wording in addition in designing the questionnaire, a series of stages was involved. First, initial set of questions were settled for each respondent group which is then discussed with advisors. Next the questionnaire was translated through translation techniques first prepared in English then forward translation was done in to Tigrigna, then debriefing was conducted on the translated questioner. After that backward translation was also conducted in to English. Finally, comparison was conducted with the original questioner prepared in English. Then, the questionnaire was pre-tested on the study area on 10 randomly selected respondents (approximately 10% of the sample size). And further, it was refined and distributed.

Method of data analysis

Rank analysis

Constraints of cow milk value chain in Laelay Maichew District were ranked based on the principle of weighted average using MS excel 2007 auto ranking method. The following formula was used to compute index as employed by Musa *et al* (2006):

Index = Rn*C1+Rn-1*C2…. +R1*Cn / Σ Rn*C1+Rn-1*C2…. +R1*Cn;

Where, Rn=Value given for the least ranked level (example if the least rank is 10th, then Rn=10, Rn-1=9, R1 = 1). Cn = Counts of the least ranked level (in the above example, the count of the 10th rank =Cn, and the count of the 1st rank = C1).

Results and Discussion

Constraints of cow milk value Chain in the study area

In the discussion part, dairy productivity face problems with plethora of constraints impeding a flourishing the cow milk value chain, of which those considered as major bottlenecks are presented briefly in table 12. The existing constraints was identified and stated in the selected kebeles and district level and the extent and significance of the problems and constraints was found differed between Kebeles in the ranking result. Hence, one constraint may be

a problem for one kebeles but the constraint may not be necessary a problem for the other kebeles.

According to the respondents, there were different challenges in dairy production and marketing system and these are ranked as the major problems and constraints from first to thirteen as stated in table 9. However, the top five constraints recognized by stallholders are critical problem for dairy production and these are the common problems in the selected kebeles. Thus, rank analysis depicts that, the top five constraints are lack of market, lack of supplementary feed, water scarcity, low breed performance and Shortage of grazing land respectively. This is in line with Nardos (2010) reported that, shortage of feed, high costs of feeds, lack of raw materials (ingredients like maize boon and meat, vitamin premix,) for concentrate preparation, milk demand seasonality, lack of formal marketing systems, limitations of land for sustainable dairy development, shortage of animal drug and high price, knowledge gap regarding improved dairying and access for credit for expansion., which leads them to reduce the dairy cow milk productivity.

Lack of milk market

The research revealed that lack of milk market was the topmost problem facing the dairy producers and other market agents (dairy cooperative, hotel and café and consumer) in laelay maichew district. The reason is that, low milk productivity, seasonality of the product, religion of the society exist in the district market, lac of milk market information, lack of transport, high travel distance to district market and perishable nature of the fluid milk these makes it difficult to get accessible market.

In the study area, fluid milk reaches to customers through one or a combination of close to 6 marketing channels. Accordingly, the major market participants of milk trade include producers, cooperatives hotel and café (as milk retailers) and consumer. Generally, the marketing chain for fluid milk in the study area remains relatively short, with the majority of consumer purchases made directly from producers, which in turn confirms the relatively unsophisticated nature of the market.

Almost all smallholders dairy producer households engage in milk value chain confirmed that there is marketing problems in milk value chain and they ranked it first (Table 12). The major milk marketing constraints mentioned by producers are related with the, problem in information flow and lack of support from concerned bodies and lack of processing and short chain condition of the market.

Table 3: Ranks of producers' constraints/ problems in district level

Constraints/Problems	Selected Kebeles								District level	
	Dura		Medego		Debre Birhan		Mahibere selam			
	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Shortage of grazing land	0.1286	5	0.1325	6	0.1376	7	0.1538	3	0.1189	5
Disease	0.1225	6	0.1101	8	0.1818	1	0.0977	6	0.1085	7
Scarcity of labor	0.1051	7	--------	-----	-------	----	-------	-----	0.101	9
Predator	--------	-----	0.1363	5	0.1474	5	-----	-----	0.1135	6
water scarcity	0.141	2	0.138	4	0.1625	4	0.1282	5	0.122	3
lack of supplementary feed	0.1301	4	0.1488	2	0.166	3	0.1333	4	0.1249	2
Market	0.1452	1	0.1492	1	0.1393	6	0.1726	2	0.1313	1
low breed performance	0.1379	3	0.1448	3	0.1696	2	0.1777	1	0.129	4
lack of shelter	0.1018	9	0.113	7	0.1284	9	0.0444	9	0.102	8
drought	0.0982	10	0.1	10	0.1338	8	0.0888	7	0.1007	10
lack of veterinary service	0.1025	8	0.106	9	0.0787	10	0.0666	8	0.0919	11
Mastitis	0.0769	11	0.0822	11	------	-----	-----	-----	0.0805	12
Abortion	--------		-----	-----	-----	-----	-----	-----	----	-----
Dystocia	0.0769	11	----	-----	-----	----	------	----	0.0769	13

Where, ------ not recognized as constraint/ problem at the selected area.
Source: own computation, 2015

Lack of supplementary feed

Even though, producers are self-source for most of the feed but the lack of supplementary feed is the second most limiting constraint. The available feed resources in the study area are crop residues and hay. So that, the smallholder dairy producers are dependent on these feed type but in todays the producers use concentrated feed to some extent. However, the availability and the price of the concentrated feed was a bottle neck for the producers. This is confirmed by the finding of Nardos (2010) that lack of supplementary feed remains a dominant constraint to small and medium enterprises in Mekelle city.

Water scarcity

The research shows that water scarcity is the third most important challenge for smallholders' dairy producers.

Water in dairy production is the most important thing for milk production and lives of the animal. According to the respondent water scarcity recognized as an important constraint because of the producers travel to get water on average 1.5 km from the dairy farm of the households and this leads them to reduce productivity of milk gain from individual cow milk.

Low breed performance

Improved breed cows also require a complementary investment in improved feeds (dairy meal concentrates) to achieve the desired productivity levels. From the research, smallholder dairy producers recognized the low breed performance as fourth most problems. This was explained that low breed performance was limited due to the huge capital requirement. Farmers thus face a decision to remain with local or slightly improved breeds that are generally resistant to diseases and relatively easy to maintain, versus investing in a more costly, risky venture that has implicit regular animal health and improved feeding requirements. Most of the smallholder producers rearing local breed and this lead them to produce low milk product. This is in line with the finding of Woldemichael (2008) and Nardos (2010) that low breed performance remains a dominant constraint to small and medium enterprises in Mekelle city.

Shortage of grazing land

Smallholder dairy producers are ranked shortage of grazing land as their fifth topmost constraint. The reason for Shortage of grazing land is recognized as topmost problem in the study area, most of the land available in the study area is used for crop production purpose, urbanization and infrastructures such as school, health center and farmer training center. This is in line with the finding of Nardos (2010) that low breed performance remains a dominant constraint to small and medium enterprises in Mekelle city.

Opportunities for developing cow milk value chain in the study area

In the study area, there are huge opportunities for improving the productivity dairy cow and marketing of fluid milk. The existing opportunities for developing the milk value chain in the study area are:

- Availability of suitable agro-ecology for dairy cow production, growing of different crops and forages. This realized the potentiality of the area for milk production.

- The Availability of huge market potential for fluid milk is other opportunity. As Aksum is the center of tourist and the hotels and restaurant requires huge amount of milk to provide fluid milk for their tourist. The town also endowed with market opportunity including university and college staff and students, restaurants and hotels in Akum.

- Relatively well developed infrastructures (asphalted road access to major towns) and communication facilities and telephone access in the district and kebeles.

- Relatively there are emerging small towns in most of the kebeles and urbanization is growing schools are opened staffs and student require milk and other product.

Conclusion

The study was aimed at analyzing value chain of cow milk the case of Laelay Maichew district Centeral Zone of Tigray. The specific objectives of the study include identifying the key constraints and opportunities of dairy production and marketing in the study area.

In line with the above, the study also points out different challenges in dairy production and marketing system and these are ranked as the major problems and constraints. The top five constraints are lack of market, lack of supplementary feed, water scarcity, low breed performance and Shortage of grazing land respectively. Therefore, due to those reasons milk productivity of the smallholders become low production and this also leads to producers not to participate in milk marketing.

To development the dairy sub-sector it requires to provide some insights and this study has made a careful assessment on the Laelay maichew smallholder dairy sector opportunities and major constraints. From the findings of the study it emerges that the district's dairy sector requires minimum initial capital to be engaged in and has a good opportunity of being a development practice for the rural poor if some of the constraints of the sector are solved.

Some of the drawbacks of the sector in the district include the milk value chain actors in the study area and the channels of milk marketing are few as compared to other agricultural outputs. Most smallholder dairy producers sell their milk directly to consumers at the rural neighbor and Aksum town implying that there is lack of organized marketing channel. Lack of knowledge and skill on dairy production, lack of other market agents (milk collector), lack of availability of processers, and lack of institutional linkages, lack of two way flow of

information, little or no product promotion and lack of appropriate extension service especially on fluid milk marketing were identified as the major constraints that the sector is facing in the district.

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