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Abbreviations

FAO: Food and Agricultural Organization;
GDP: Gross Domestic Product; QSAE:
Quality and Standards Authority of
Ethiopia; SSA: Sub Saharan Authority;
AI: Artificial Insemination; MOA: Ministry
of Agriculture; NGO: Nongovernmental
Organization; ESSs: Ethiopian standards;
NAIC: National Artificial Insemination
Center

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Review Article

Review on Dairy Milk Value Chain

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Summary

Ethiopia has a huge potential to be one of the key countries in dairy production for various reasons. Dairying is one of the investment areas farmers can venture into to improve their standards of living. The dairy sector provides income and employment to many, often poor people. There are different interactions forming the supply of all goods and services for the dairy subsector. The interaction of those input and product is called value chain. It is an innovation that enhances or improves an existing product or introduces new products or new product uses. Dairy milk Value chain analysis can play a key role in identifying the distribution of benefits of actors in the chain. Dairy value chain function starts from inputs use to produce milk and value added products. The Major constraints affecting milk production potential of dairy cattle in most parts of Ethiopia are diseases, shortage of feed, inadequate/week veterinary extension service, low performance of the local breeds, inadequate Artificial Insemination (AI) service and labor shortage. Rapidly increasing population size with a growing urbanization is resulting in a growing demand for dairy products in Ethiopia. So, possible intervention strategies along with strong Extension service should be well designed and applied along the entire Dairy value chain.

Introduction

Ethiopia has a huge potential to be one of the key countries in dairy production for various reasons. It includes a large population of milk cows, a huge potential for production of high quality feeds under rain fed and irrigated conditions, existence of a relatively large human population with a long tradition of consumption of milk and milk products and hence a potentially large domestic market [1]. Dairying is one of the investment areas farmers can venture into to improve their standards of living [2]. It is a developmental tool as it widens and sustains three major mechanisms out of poverty; securing the assets, improving smallholder and pastoral productivity, and increasing market participation by the poor. It is estimated that almost 150 million farm households (more than 750 million people), are engaged in milk production worldwide, the majority of who are in developing countries (FAO, 2010). The dairy sector provides income and employment to many, often poor people. It is estimated that 12 to 14 percent of the world population, or 750-900 million people, live on dairy farms or within dairy farming households and the production of one million liters of milk per year on smallholder dairy farms creates approximately 200 on-farm jobs. Dairy production is practiced almost all over Ethiopia (pastoralists, agro pastoralists and crop livestock farmers) involving a vast number of small scale, medium scale and large scale farms [3]. The dairy cow is one of the most important investments a farmer can make to improve their standing (ILRI, 2003) because of their inherent value, the nutritional valuable milk produced, the work they can perform, and the way it can help to diversify farming activities. The importance of the dairy cow is expected to increase as food imports to sub-Saharan Africa (SSA) are projected to more than double by 2030 under a business as usual scenario [4].

As dairying plays significant role in the lives of the poor households [5], promotion of the dairy sector can therefore contribute significantly to poverty alleviation as well as availability of food and income generation. In Ethiopia, dairy value chain entailed about 500,000 smallholder rural farmers who produce about 1,130 million liters of milk of which 370 million liters of raw milk, 280 million liters of butter and cheese and 165 million liters is consumed by the calves [6]. The private sector to the increased demand for dairy is expected to be significant, the small-scale household farms in the highlands hold most of the potential for dairy development [7]. There are different interactions forming the supply of all goods and services for the dairy subsector. The interaction those input and product is called value chain. Dairy Cow milk Value chain analysis can play a key role in identifying the distribution of benefits of actors in the chain. That is, through the analysis of margins and profits within the chain, one can determine who benefits from participation in the chain and which actors could benefit from increased support or organization. This is particularly important in the context of developing countries (and agriculture in particular), given concerns that the poor in particular are vulnerable to the process of globalization. Moreover, this Value chain analysis plays a key role in understanding the need and scope for systemic competitiveness, upgrading and achieving efficiency which allows entry into global markets [8]. Rapidly increasing population size with a growing urbanization is resulting in a growing demand for dairy products in Ethiopia. Dairy development can lead to growth in rural areas by increasing farm income and employment opportunities. Despite its demand, dairy milk production is below its expected threshold. Besides its low production levels, milk collection, processing and marketing are not well developed in the country. A comprehensive chain approach aimed at sustainable development of the dairy sector is lacking. These factors discourage to improve the quality and quantity of milk production. More reliable information are required and regarding the requirements of livestock products, production potential, cost of production and available market value chain analysis on milk will be helpful to understand the current cost return scenario in milk production and creating the opportunities to harness better return to milk production [9]. Therefore the objectives of this paper were:

- To identify actors and their functions along dairy value chain.
- To high light the Opportunities and Constraints of Dairy milk value chain in Ethiopia

Milk Value Chain Concept

Different authors define the concept of value chain differently. Thompson [10] defined the value chain as the full range of activities that are required to bring a product or service from its conception, through the different phases of production; Whereas McCormick [11] defined value chain as a chain of activities required to bring a product from its conception to its final consumption. In his study on linking of the value chain, Michael [12] also defined value chain as the sequence of business activities that turn raw materials into products that are sold to final customers the term value chain as the entire chain of productive activities, from production to consumption. The term value chain has been used to characterize a vertical alliance or strategic network between independent business organizations within a supply chain implying that, a value chain is within a supply chain, emphasizing that; production per se is only one of the value added links. There is a range of activities within each link of the chain. Although often depicted as a vertical chain, intra-chain linkages are most often of a two-way nature [13]. For example,



specialized design agencies not only influence the nature of the production process and marketing, but also are in turn influenced by the constraints in the downstream links in the chain. According to Kamuzora et al. [14], the value perceived by the end consumer of a product is derived in part from each step in the chain. Although not all steps create the same amount of value to deliver the same profit potential, profit is determined by value of a product, and value is what buyers are willing to pay for a product or service and the costs of performing the activities involved in creating it [15].

Dairy Value Chain Actors and their Function

Value chain is an innovation that enhances or improves an existing product or introduces new products or new product uses. The major ones include: actors along the chain and their functions and linkages among themselves, governance mechanisms for the chain and roles of actors (e.g. power relations and principal drivers of the chain functions), impact of upgrading products, services and processes within the chain and distribution of benefits among actors within the chain [16]. The different actors in the dairy value chain are some of the important factors that contribute to the poor development of dairy sector. While the response of the private sector to the increased demand for dairy is expected to be significant, the small-scale household farms in the highlands hold most of the potential for dairy development [17]. The dairy plants play an important role and have right to make decisions. In other word, the dairy plants (processing firms) become the main actor, which receives most of the profit. The farmers who invest lots of capital and time to raise dairy cow only receive a small proportion of the profit. One of the most essential tasks of dairy milk is being prior to choose the best dairy cows. The most important role in the whole value chain of dairy milk and the lack of animal food, infrastructure, technology and the support from government. The famers in the dairy value chain also lack the necessary knowledge and skills of livestock sector (dairy farming). As a result, the dairy breeding sector only meets 25% of domestic demand in the country [18]. Generally, dairy value chain function starts from inputs use to produce milk and value added products. In milk value chain and in agricultural value chains in general, the major value chain actors, value chain supporters, and value chain enablers are the major components of the value chain map and they are clarified as follows:

Inputs supply and services

The main inputs and service required for the dairy sector are feed, water, breed stock, AI and health service, training/ advice and finance [19].

Feed: Most producers are dependent on natural pasture and crop-residues though it is becoming increasingly scarce due to increasing pressure on land. Natural pastures, crop residues (barn, crop coverage etc.), pasture crops and cultivated forage (Alfalfa, Napier, Elephant Grass etc.) are widely used. Concentrate feeds are mainly sourced from agro industrial byproducts (by-products of flour mills, oil processing plants, breweries and sugar factories). Compounded feeds are mainly used by commercial dairy producers [20].

Improved breeds and other veterinary services: The Ministry of Agriculture is the main provider of veterinary services and vaccines, but there are private veterinary centers as well. AI services in Ethiopia has long years of experience having been started in 1938 for the first time. The productivity of local dairy cows is very limited-an average of 1.5 liters per day for a maximum of 6 months annually. Exotic and hybrid species yield a yearly amount of milk in the order of magnitude of 8 to 20 times more than indigenous breeds. Getting good quality cross breeds or local dairy cow from the market is also an issue. The average improved and local cows buying price varies depending on the status/productivity of cow and location. NAIC, established under the MoA in 1976 E.C., is the main provider of AI services at a highly subsidized rate (5 birr/ insemination). It produces and distributes semen and liquid nitrogen based on the requests of regions. The center maintains bulls of 50% and 75% of Friesian and Jersey, crossed with indigenous cattle of Ethiopian Boran, Arsi, Begait, Fogera and Horro. It also keeps pure breed of Friesian and Jersey.

Financial service: Financial service providers work to refine products for dairy sector and implement value chain financing for better financial access to different actors for investment and working capital [21]. The formal financial service provision to dairy production is accessed from different a source that includes Addis Credit and Saving Share Company, Cooperative Union, NGOs revolving fund scheme and private companies. But it is reported that the financial service provision is found to be under expected due to the fact that the low access are financial institutes collateral requirement loan processing time and steps, farmers awareness level, risk averting behavior and interest fearing culture. Insurance for dairy cows and other agricultural practice are still more at pilot in some areas. Financial services for other dairy industry actors mentioned as a critical issue to expand their business and to run day to day operation with enough working capital [22].

Milk producers

Milk is a highly perishable and complex product to handle due to the fact that it is a

perfect medium for microbiological contaminants. However milk has the advantage that it is easily convertible into various dairy products like cheese, yogurt, butter oil and cream. The transformation process at times involves a series of sequential investment activities that are targeted at meeting specific consumer demand .The value addition options also provide a way of dealing with inter-market price differentiation occurring due to spatial factors [23].The first level of creating value is improving production or processing efficiency so that the same labor yields more or a higher-quality product. An important aspect of this is improving the storage and handling of products to reduce losses and improve quality [24]. Milk processing can play a major role in improving milk and dairy product safety, mainly through a variety of heat treatment processes. The low level of integration of the different activities along the value chain, the relationship between dairy farmers and dairy processors changes along with the market demand and seasons for their conflicting interests. Dairy processors tend to price the raw milk according to demand and supply, but not quality based. Such pricing system has transferred the market risks to dairy farmers, which results in low efficiency of dairy farming and lack of incentives for dairy farmers to improve raw milk quality and farm management (FAO, 2015).

Milk collection and transportation

Milk collected at milk collection center is supplied directly to consumers in the urban towns and the surplus is collected by large dairy enterprises such as Lame (Sholla), Sebata Agro Industry (Mama) and Family Milk and transported by bulk tankers to the respective processing plants. These dairy enterprises process and pack the fresh milk collected for distribution to consumers in urban areas through agents and retailers. Homogenized, pasteurized and standardized (2.7-2.8 percent milk fat) milk packaged in half litre capacity plastic packets are distributed [25]. The demand for milk and milk products declines substantially during the fasting period of the Ethiopian Orthodox Church as this population abstains from consuming animal products including milk and milk products. There is a missing link in the dairy value chain as it is difficult to justify the cause of the supply/demand mismatch. Most producers complain of the lack of market outlets for milk, especially during and shortly after the rainy season where milk production increases following the increased availability of animal feed and during fasting periods [26].

Milk processing

Milk processing refers to the act of traditionally converting milk into milk products at home or by catering service providers to derive other milk products. Accordingly, milk is processed into regularly consumed products such as plain hot milk, a mix of coffee and milk (macchiato), fermented whole milk, butter, traditional ghee, buttermilk and cottage cheese. Dairy farmers and catering service providers are the main actors who process milk into these milk derivatives. At household levels, milk processing activities are carried out using traditional processing methods and inputs [27]. Traditional milk processing based on ergo (fermented milk), without any additional culture practices in the country is basically limited to smallholder level and hygienic qualities of products are generally poor [28].The total milk produced (almost 40%) is allocated for butter while only 9% is reserved for cheese. Traditional butter, which ferments slowly at room temperature, can be kept for a year or longer, offering rural consumers a readily storable and durable dairy product. Mostly (about 96.5 %) dairy producers used traditional churning material, which are made from clay pot [29].

Wholesalers

Fermented milk is collected from the local markets by the wholesalers, who bring it directly to Freetown and sell to Freetown wholesalers and retailers. Freetown wholesalers sell to other retailers who do not have access to local market wholesalers. Local retailers who have stocked a large quantity of fermented milk can also take it to Freetown to supply the retailers who sell to consumers along with the usually limited amounts of milk butter [30]. The processed dairy products are distributed to retail shops, supermarkets, schools, hospitals restaurants, cafes and hotels located in major urban centers. The main market destination is market for most of their processed products. Pasteurized milk and other milk products pass mainly through supermarkets and retail shops channel. Restaurants and distributors are the next important outlets for the processed products. For Ayib (local Cheese) and butter customers that come to the processing companies, factory gate or others own shops are the important outlets [31].

Retailers

Raw milk that is sold through retailers or door to door distributors is mainly in areas where there are crowded houses and common living apartments (e.g. condominium houses). Raw milk shops are also opened by individual traders, dairy farms and cooperatives in different village corners and other towns. Most traditional cooking butter and cheese are supplied through the informal market channel, the main one is butter market [32].

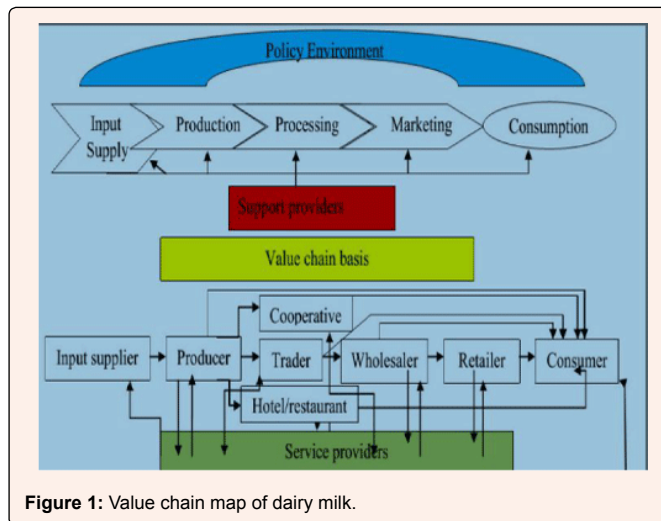


Figure 1: Value chain map of dairy milk.

Consumers

Milk consumers obtain milk from dairy farmer's retailers and wholesaler's (Figure 1). The largest share is obtained from retailers as they are accessible to consumers in different locations where producers and wholesalers cannot be accessed [28].

Opportunities and Constraints of Dairy Milk Value Chain in Ethiopia

Opportunities

The large livestock population, the favorable climate for improved, high yielding animal breeds and the relatively disease-free environment for livestock make Ethiopia to have a significant potential for dairy development. Considering the important prospective for smallholder income generation and employment opportunities from the high value dairy products, the development of the dairy sector can contribute immensely to poverty alleviation and improved nutrition in the country. With the present trend characterized by transition towards a market-oriented economy, the dairy sector appears to be moving towards a takeoff stage. Liberalized markets, involvement of the private sector and promotion of smallholder dairy are the main features of this stage [33]. Moreover, Availability of suitable agro-ecology for dairy cow production, growing of different crops and forages realized the potentiality of the area for milk production. The Availability of huge market potential for fluid milk is also the other opportunity. As the country is the center of tourist and the hotels and restaurant requires huge amount of milk to provide fluid milk for their tourist [34]. According to report of Betela et al. [6]; several opportunities of value chain Ethiopia dairy sectors at different level have been analyzed. For instance: opportunities at the production level include equipment supply and leasing, farm input supplies via organized check-off systems for groups of large farmers, milk testing and recording services, transport services and private extension services. At the farm level, investment potential lies in medium and large dairy farming but also there is potential in food processing and provision of advisory services including breeding technologies. There is opportunities to invest in dairy feed processing and feed technologies.

Constraints

Major constraints affecting milk production potential of dairy cattle in most parts of Ethiopia are shortage of grazing land, diseases, shortage of feed, inadequate/week veterinary extension service, low performance of the local breeds, inadequate Artificial Insemination (AI) service and labor shortage [35].

Lack of milk market: It is revealed that lack of milk market is the top most problem facing the dairy producers and other market agents (dairy cooperative, hotel and café and consumer). The reason is that, low milk productivity, seasonality of the product, religion of the society exist in the district market, lack 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 [36].

Lack of supplementary feed: Feed shortage is one of critical factors affecting milk production and productivity. This problem is caused by the shrinkage of rangeland due to over grazing, bush encroachment and the population increment which ultimately resulted to the shortage of grazing land. The deterioration of the indigenous knowledge for natural

rangeland conservation and lack of knowledge and capacity is also one the ground cause. Inadequate supply of quality feed and low productivity of the indigenous cattle breeds are the major factor limiting dairy productivity [37].

Low breed performance: The pastoralists categorize the milking cow breeds into two namely: mirgisa/waticha and Baku based on the amount of milk they produce. Mirgisa/ waticha are animals which are high yielding milking cow groups and Baku's are the relatively low milk yielding cows. Through different surveys it is indicated that the pastoralist Focus group discussion groups indicated that the Mirgisa/waticha type breeds are getting decreasing at decreasing rate. These animals are highly susceptible to environmental stresses like drought, diseases outbreak etc as compared to low milk producers. The pastoralists and other key informants from pastoral areas pointed out that high milk yielding animals had been the dominant among herd groups 40 years ago; however, currently the herd proportion dominated low milk yielders. This contributes a negative impact on milk production status. The reduction of high milk producing groups within the total herd is mostly caused due to weakness of traditional breeding systems, uncontrolled genetic dilution problems and high animal mortality rates resulted from environmental, recurrent drought and diseases outbreak stresses [33].

Weak Veterinary extension services: Livestock extension is currently the responsibility of the animal health field services and does not form integral part of the extension services offered to crop producers. The present extension system is relatively unstructured with no set schedule of visits or seasonally based extension messages. With regards to training and field work however, emphasis is mainly on animal health aspect. Livestock extension is currently the responsibility of the animal health field services and does not form integral part of the extension services offered to crop producers [38].

Government has deployed agricultural development agents in rural areas to render extension service to the Livestock Production rural communities. Four livestock development packages have been formulated to be adopted by farmers. These packages include technologies that support dairy for milk production. However, the recent national agricultural sample survey has revealed that less than 1% of households have adopted the packages. Hence in general, Poor accessibility of extension services and inadequacy of practical demonstrations are the causes of poor performance of the livestock extension service among small dairy holders [39].

Seasonal fluctuations of diseases: The animal health service organized under the Federal and Regional Governments had contributed to the national economy through reducing the negative impacts produced by epizootic and zoonotic diseases. Lack of inspection and quality control services of livestock products to safeguard the public from diseases, uncoordinated veterinary drugs administration, efficacy and quality problems are major constraints. Prevention and control of diseases through development of veterinary infrastructures and manpower, design and implements appropriate control and prevention strategies, and encouraging of the private veterinary drug dispensing are recommended [40].

Current Scenarios on Dairy Milk Value Chain in Ethiopia

There are 10 million dairy cows in Ethiopia producing approximately 3.2 billion liters on average of 1.54 liters per cow per day over a lactation period of 180 days. The farm-level value of the milk is an estimated Birr 16 billion. The values of other important animal products and services include blood, traction, transport, and manure for organic fertilizers and fuel. Estimated calf consumption and wastage of milk is 32% of the milk produced (FAO, 2009). Households consume approximately 85% of the milk collected, 8% of the milk is processed into products with longer shelf life, and 7% is sold Tesfaye et al. (2010). During peak production in the wet seasons, rural farmers, not part of formal cooperatives, face challenges marketing their milk as most regions experience a surplus. More surplus milk may be processed at the home into local cheese or butter. For most subsistence farmers in all cultures in Ethiopia, the daily decision on how to allocate milk is decided by the head female in the household and is dependent upon season, number of children in the household, presence of sick family members, and daily financial needs. Ethiopia holds large potential for dairy development. In addition, the country enjoys diverse topographic and climatic conditions favorable for dairying. These consist of a high central plateau ranging from 1,800 to 3,000 meters above sea level, a rift valley that divides the country from north to south with altitudes ranging from 1,000 to 1,800 meters above sea level and lowland plain areas of less than 1,000 meters above sea level in altitude [41].

Conclusions and Recommendations

Dairying constitutes an important part of the Ethiopian smallholder crop/livestock mixed farming system. The country is known to have the highest number of cattle in Africa, making it one of the biggest potential producers of milk and milk products in the continent [42-50]. Despite this advantage, the industry is plagued with a number of constraints and the country remains a net importer of milk and milk products. The



poor infrastructure network, inadequate provision of veterinary services and lack of continuous supply of animal feeds throughout the year are among some of the challenges faced by farmers in the field. The rapid rise in dairy consumption coupled with higher demand for improved milk quality will continue creating market opportunities for modern dairy chains in Ethiopia. That places, however, considerable demands for synchronized programs and policies regarding quality upgrading aimed at improving the competitiveness of the whole dairy chain [51-59]. There is a need for the government and its international development partners to invest in the dairy industry and transform the activity into a lucrative business, which will contribute to the GDP of the country through exportation. Based on the above conclusive ideas, the followings are recommended:

- a. Possible intervention strategies should be designed and applied along the entire Dairy value chain.
- b. Extension service should be encouraged to improve Dairy cow production and productivity.
- c. A policy framework should be in place to support cooperatives in improving the milk quality and processing infrastructure.
- d. Research should revisit breeding and development strategy in line with exploiting the production potential of Dairy cows.

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