

Agro-Pastoral Dairy Chains and Prospects for Expanding Milk Processing in Tanzania: A Case of Misungwi District

Godfrey Lucas Chasama and Heriel Fanuel Massawe

ABSTRACT

A market survey was conducted in Misungwi District to explore interventions towards increased milk processing. A total of 99 producers, 34 transporters and 11 traders of milk from six villages of the district were interviewed using questionnaires. It was found that at least 24,180.7 liters of milk are marketed from farmers every day in Misungwi. Majority (61.2 %) of the milk selling households sold milk to consumers and some others (35.8 %) sold to transporters whereas few (3 %) sold to traders. Prices per liter of milk fetched by producers, transporters and traders were 854, 1,680 and 2,122 TSHs, respectively. Accessibility to electricity, roads, extension, veterinary, inputs and water services was considered at least satisfactory by 95.9 %, 78.8 %, 83.9 %, 86.1 %, 49.5 % and 50.5 % of producers, respectively in the district. Supermarket and shops found in the district were selling packaged milk at a price of 3750 TSHs per liter. All milk transporters used bicycles and considerable part (44%) of them carried milk using un-recommended plastic containers. Milk quality testing is not commonly practiced in milk trading. The major chain bottleneck observed was thus identified to be underdevelopment of milk collection and lack of industrial scale dairy processor. The main intervention that was recommended is capitalizing on progressive farmers by organizing them to form dairy cooperatives. These can be capacitated to perform vibrantly functions of milk collection and processing and also to act as pivotal points for streamlining quality control through quality testing. The cooperative can be backed by existing service providers from both public and private sectors to combat the existing challenges. Major adaptation needed is coping with the dispersed and mobility nature of the milk producers which can be achieved by establishing an extensive but highly accessible milk bulking network.

Keywords: Agro-Pastoral System, Dairy Chains, Interventions, Marketing Functions, Value Addition.

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I. INTRODUCTION

Dairy sub-sector has important role to play in reducing poverty among rural households in the developing world [1]. In the African continent dairy chains harbor potential opportunities for deriving food, income and employment [2]. Full exploitation of such opportunities however has remained challenging, with limited processing of raw milk being the major shortfall [3]. In Tanzania, of the 2.38 billion milk liters produced annually, only around 12 % is processed [4].

Commendable efforts were made by the government in the past to develop dairy processing in the country. During 1960s-1990s major intervention was forming large and medium scale government processing plants which however underperformed and collapsed because of mismanagement with public ownership and ineffective availability of raw material [5]. During the past two decades the focus was turned to smallholder chain actors under market liberalization and enacted regulation of Tanzania Dairy

Board [6]. Minimal development has been impacted because little achievement has been made regarding organizational development of the actors and enforcement of pertinent guidelines. In the past few years the government has imposed high taxes on dairy imports and omitted levies for importing dairy equipment's, and at the same time attracted private investors in order to promote development of local processing for milk [7]. However, the pace of milk processing development seems to be still stagnant.

The condition is worse in the Lake zone, which accounts for a major part of the country's milk production but has no large or medium scale dairy processing industry, and even small processing industries are rarely found. There, milk is produced sparsely and marketed largely informally under agro-pastoral system which is extensive in nature [7]. However, interventions that can address specific constraints to development of dairy processing have been less explored in the zone. This study was undertaken to explore interventions that can stimulate expansion of milk collection and processing in Misungwi District.

II. MATERIALS AND METHODS

The study was conducted in Misungwi district which is in Mwanza Region. It is located between latitude 2.51°S and 2.85°S and between longitude 33.05°N and 33.083°N at elevation above sea level of 1178 meters [8]. The climate is mostly semi-arid and the production system is predominantly agro-pastoral. Human population is estimated at 351,607 comprising 173,997 males and 177,610 females with 324,280 living in rural areas and only 27,327 living in the urban area [8]. Household size for the district averages at 6.5 [9]. Cattle population in farmers' herds is estimated at 159,225 comprising 153,456 zebu cattle and 5,769 dairy crossbred cattle [8].

This study was undertaken in six (6) villages which were sampled purposively to establish the potentiality for milk production in Misungwi district. For producers, sampling frame was prepared across sampled villages and 99 respondents were finally selected randomly. Snowball technique was used to sample 11 milk transporters and 34 milk traders across the study area. The respondents were interviewed using questionnaires designed for specific groups (producers, transporters and traders).

III. DATA ANALYSIS

The data were analyzed using Statistical Package for Social Sciences (SPSS 16.0). Frequency Distribution of Descriptive Statistics was employed to generate frequencies (n) and percentages (%). Means procedure was used to generate means with standard deviations (Mean $\pm$ sd).

IV. RESULTS

A. Quantities of Milk Produced and Sold by Producers

The production of raw milk in Misungwi District is shown in Table I. Herd size and number of cows per household were 21.1 and 9.4, respectively implying an estimate of 43.1 % composition for lactating cows in herds. Average production of milk per cow per day for wet and dry seasons was estimated at 0.99 and 0.52 liters for Zebu and 3.2 and 7.6 for crossbreds, respectively. Percentage of milk delivered for selling was 57.1 for dry season and 62.4 for wet season. Therefore, the quantity of milk produced varies more widely between the seasons than the percentage of milk sold.

B. Potential for Milk Collection from Farmers in the District

Data from Misungwi District profile showed that the district has 153,456 zebu cattle and 5,769 dairy crossbred cattle (Table II). The number of lactating cows in the district were 66,140 and 2,486 for Zebu and crossbred cattle, respectively. From the number of lactating cows and the cow mean performance estimated formerly from the sample, daily milk production in the district was estimated at 42,348 liters for dry season and 84,372.2 liters for wet season. Basing on milk selling rate, it was ultimately established that in the district an average of 24,180.7 and 52,648.3 liters of raw milk is marketed per day from producers during the dry and wet season, respectively. Therefore, there is a potential to collect substantial milk for industrial scale processing from farmers in the district.

TABLE I: HOUSEHOLD CHARACTERISTICS RELATED TO MILK PRODUCTION AND MARKETING IN MISUNGWI

Characteristic	Statistic	Status
Cattle herd size/household (number)	Mean $\pm$ sd	21.1 $\pm$ 3.44
Number of lactating cows/household (number)	Mean $\pm$ sd	9.4 $\pm$ 0.76
Herd composition for lactating cows (%)	%	43.1
Milk production/cow/day during dry season for Zebu cattle (in liters)	Mean $\pm$ sd	0.52 $\pm$ 0.041
Milk production/cow/day during wet season for Zebu cattle (in liters)	Mean $\pm$ sd	0.99 $\pm$ 0.59
Milk production/cow/day during dry season for crossbreds (in liters)	Mean $\pm$ sd	3.2 $\pm$ 0.85
Milk production/cow/day during wet season for crossbreds (in liters)	Mean $\pm$ sd	7.6 $\pm$ 1.12
Part of milk marketed during dry season (%)	%	57.1
Part of milk marketed during dry season (%)	%	62.4

TABLE II: INDICES RELATED TO AVAILABILITY OF RAW MILK ALONG MARKETING CHAIN IN MISUNGWI

Indicator	Status
Zebu cattle herd size for the whole Missungwi District	153,456
Dairy crossbred cattle herd size for the whole District	5,769
Number of lactating zebu cows in Missungwi District	66,140
Number of lactating crossbred cows in Missungwi District	2486
Daily milk production during dry season in Missungwi District (liters)	42,348
Daily milk production during wet season in Missungwi District (liters)	84,372.2
Milk delivered/day for selling during dry season in Missungwi District (liters)	24,180.7
Milk delivered/day for selling during wet season in Missungwi District (liters)	52,648.3

TABLE III: CHARACTERISTICS OF MILK PRODUCERS RELATED TO MARKETING OF MILK IN MISUNGWI

Characteristic	Frequency	%
	Buyer of milk	
consumer	41	61.2
trader	24	35.8
processor	2	3.0
Market outlet	—	—
farm gate	51	76.1
away	16	23.9
	Value addition	
raw	61	91.0
processed	6	9.0
Total	67	100

C. Milk Marketing Channels and Forms

It was observed that 67.1 % of cattle farmers in Misungwi sell milk (Table III). Of the farmers who sell milk, 61.2 % sell directly to consumers. Another significant group of buyers of farmers' milk (35.8 %) is milk transporters who collect milk and transport it for retailing to consumers and traders (glossaries and hotels). Very few producers (3 %) sell milk directly to glossaries and hotels. Majority (76.1 %) of milk selling households sold their milk at farm gate and most (91 %) sell their milk while in raw form. Therefore, value addition strategies of changing milk form and marketing place are less exploited.

D. Existing Middlemen and Their Practices

No milk bulking and collection points were reported in Misungwi. A more active group of middlemen is that of transporters who essentially transfer milk from producers to either consumers or traders. These were found to use bicycles in their transportation function and a considerable part of them (44%) used plastic containers instead of the recommended stainless steel or aluminum containers (Table IV). Quality testing of milk at buying is done by very few (9.01%) transporters. Another existing middleman group is that of traders (hotels and glossaries).

TABLE IV: STATUS OF PRACTICES RELATED TO MILK TRADING AND HANDLING IN MISUNGWI

Characteristic	Number	Percent
Milk handling equipment for collectors		
Stainless steel cans	6	56
Plastic containers	5	44
Total	11	100
Transport means for collectors		
Bicycle	11	100
Others	0	0
Total	11	100
Milk quality testing at milk buying		
Testing	1	9.09
Not-testing	10	90.01
Total	11	100
Source of milk for processors		
Own	1	2.9
Farmer	23	67.6
Collectors	10	29.4
Total	34	100
Milk handling equipment for processors		
Sufuria	4	11.8
Plastic containers	29	85.3
Stainless steel	1	2.9
Total	34	100.0

These obtain milk from either farmer (67.6%), transporters (29.4%) or own farm (2.9) and while operating at a fixed point they prepare a subsidiary product (commonly boiled milk and traditionally fermented milk) for immediate consumption. Majority (85 %) of the traders used non-food grade plastic-made containers to handle their milk. Therefore, the supply chain for milk in Misungwi District operates in a chain illustrated in Fig. 1. Milk bulking and collection functions are severely underdeveloped. Producers' milk is mainly channeled directly to consumer and is delivered unpackaged. Quality control system is essentially not in place and milk handling is generally not well done.

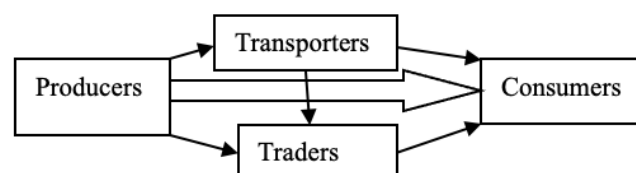


Fig. 1. The marketing chain for milk in Misungwi.

E. Scale of Existing Dairy Business and Price Dynamics

Remarkable seasonal differences were observed in quantity of milk sold per producer household with average of 2.8 liters for dry season and 5.8 liters for wet season (Table V). Producers sold milk at average prices of 860.3 TSHs and 846.9 TSHs during wet and dry seasons, respectively indicating stability regardless of seasonal off-take variation. On average 43.6 liters of milk is transported per day and retailed to consumers and traders at the average price of 1680 TSHs. For traders the dealt volume of milk per day was found to be averaging at 8.8 liters and price they fetch averaged at 2122 TSHs. Milk which is well packaged and certified for quality was found to be sold in shops at an average price of 3750 TSHs per liter.

F. Status of basic services

Table VI summarizes the status regarding accessibility to services in the district under the study. Basing on producers, the accessibility to electricity, roads, extension, veterinary, inputs and water services were considered to be satisfactory by 95.9 %, 78.8 %, 83.9 %, 86.1 %, 49.5 % and 50.5 % of producers, respectively. Therefore, all the studied services that affect milk production and marketing are fairly accessible to producers' localities.

TABLE V: SCALE OF EXISTING DAIRY BUSINESS AND PRICE DYNAMICS IN MISUNGWI

Indicator	Mean±sd
Milk collected and retailed per collector per day	43.6±9.3
Milk processed per trader per day	8.8±1.06
Price per liter of milk at producers delivery during dry season	860.3±16.8
Price per liter of milk at producers delivery during wet season	846.9±85.1
Price per liter of milk at transporters delivery	1680±216.3
Price per liter of milk at traders (glossaries and hotels) delivery	2122±97.8
Price per liter of packaged milk at mini-supermarket and shops	3750±49.9

TABLE VI: RATING OF STATUS OF SERVICES IN MISUNGWI

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Rating	Service											
	Electricity		Roads		Extension		Veterinary		Inputs		Water	
	n	%	n	%	n	%	n	%	n	%	n	%
Satisfactory	95	95.9	78	78.8	83	83.8	85	86.0	49	49.5	50	50.5
Unsatisfactory	4	4.1	21	21.2	16	16.2	14	14.0	50	50.5	49	49.5
Total	99	100	99	100	99	100	99	100	99	100	99	100

V. DISCUSSION

Results of the study on the side of producers showed that all of them were consuming at least a part of milk they produce and majority (67.1 %) also sold milk. This witness the role cattle play in rural household nutrition and income security as was reported by [10]. The seasonal variation in milk off-take observed is a common feature in traditional milk production systems of sub-Saharan Africa and has often been attributed to lack of implementation of dry season feeding strategies for dairy animals [3]. Possibly this occurs because the cattle kept are mostly of the indigenous type with low genetic potential for dairying and hence don't yield economic returns to investment in alternative feeding systems.

It has been established that the quantity of milk delivered out for marketing from producers in Misungwi at any one time is not less than 24,180.7 liters daily. This is a quite large quantity of milk which if collected effectively can make a substantial raw material base for industrial scale milk processing [11]. According to [2], if all the marketed milk can be processed it is possible to generate 480 full time jobs within Misungwi District only. Reflecting about the whole lake zone of Tanzania, the findings indicate unexploited great potential for income generation and employment creation in dairy sub-sector. But obviously the benefits of expansion of dairy processing will not be limited to creation of jobs in the processing industries. Producers of milk will get a more reliable market for their produce to boost their earnings. Diffusion of milk from traditional sector to formal markets with expansion in milk processing is also envisaged to impact increase in dairy exports thereby to promote a healthier foreign currency balance.

While the potential for obtaining milk for industrial scale processing seems to be eminent, the price structure for milk observed suggests that embarking in dedicated dairy processing can be a rewarding venture in Misungwi District. In this regard, marketing is a very important aspect. Presence of close by markets for milk and dairy products is a key motivating factor for milk producers. The promotion of marketing will require collection of milk from several producers, transforming it to an acceptable marketable product and delivering to consumers at the desirable time, quality and at an affordable price. The price difference observed in this study between milk sold at mini-super market and shops, and raw milk sold by farmers (TSHs 2,889.7) is quite large and few consumers can afford.

Large amount of milk produced goes through informal channels or is consumed on farm and little goes to processing, this was also found by Gambi *et al.* [12]. With the observed good status of infrastructure, particularly electricity and roads, investment in milk collection and bulking is expected to be affordable. What remains questionable especially from ineffectiveness of quality

regulation enforcement is assurance of the quality of milk that will be collected for processing. From a critical outlook on the chain status, particularly upon considering the bottleneck of underdeveloped milk collection and bulking functions and the requirement for assurance of quality, adoption of cooperative milk marketing is a highly recommended intervention.

Milk handling equipments, transportation and quality testing observed in this study concur well with other authors [13]–[15]. Commercial-oriented producers, particularly those with crossbred cattle owe to be the focus at the beginning. These can be organized over extensive areas and capacitated technically in organizational management, hygienic milk trading and solicitation of capital for investing in structure and equipment's for handling, collection and storage in rural areas. To cope with the extensive dispersion and sometimes sedentary mobility of producers, the established cooperative dairies need to deploy a satellite collection network system whereby bulking points are located strategically where herds are clustered to capture milk and using simple transport like a motorcycle which can access almost every location, to carry the milk from farmers to bulking points equipped with cooling facilities. From collection points milk handled well in tanks can then be transported to a dairy which acts both as a bulking and processing center. The dairies can be buying milk also from farmers who are not members of the cooperative and by operating in that mode the idea of cooperative milk marketing can progressively be scaled deep in the production system.

Efficiency and sustainability of the dairies as new actors in the dairy chain will depend much on viability of the whole business. To attain that the dairy will need to be producing highly sellable products. This can be possible by focusing on traditional dairy recipes which need simple equipment and can be easily absorbed in local markets and be sold at reasonably affordable price while also making some modest profit. Another issue needing critical attention is control of quality because always highly sellable products are produced from quality raw materials. A strategic point for enforcing quality regulation in the proposed value chain will be the bulking points where milk can be screened by performing platform test and handled well promptly after passing.

One of the strategies which has potential in tackling constraints to the development of livestock chain in sub-Saharan Africa but has been underutilized is collaboration [3]. In this scenario the cooperative can liaise with existing potential service providers like milk equipment suppliers, financial services organizations, livestock training agencies, livestock research institutes and livestock department in local governments to form dairy development platform which can address under collaborative initiatives all the encountered operational challenges. Obvious issues that will

need to be settled include building the capacity of actors on hygienic milk production and marketing, linking the cooperative to potential business capital services providers and linking the cooperative to reliable dairy equipment and materials importers.

However, in efforts to stimulate development in dairy sub-sector all over the country, the government is advocating the formation of dairy cooperatives with the same emphasis as it is attracting private single proprietorship companies to invest in milk processing industries. The anticipated workability of the recommended intervention model doesn't distinguish a dairy cooperative from a private dairy company. Also important is to bear in mind that, the capital load for investing in equipments and materials for milk bulking, collection and processing has also been lessened by the tax exemption policy and competition of the processed dairy product within the country is protected by the banning of the importation of foreign produced dairy products.

VI. CONCLUSIONS

It has been found that milk that is channeled from producers into the market chain in Misungwi if tapped effectively can justify operation of dairy processing industry. The existing marketing practices are generally inefficient and there is a big loss in value for milk. The major bottleneck is underdevelopment of milk collection and lack of industrial scale processor. Quality regulation is also ineffective. However, business opportunities for milk processing are attractive and the availability of services is fairly good. The main intervention recommended is capitalizing on progressive farmers by organizing them to form dairy cooperatives. These can be capacitated to perform vibrantly functions of milk collection and processing and also act as pivotal points for streamlining quality control through quality testing. Major adaptation needed is coping with the dispersed and mobility nature of the milk producers in the production system which can be achieved by establishing an extensive but highly reachable milk collection network. Considering the big unemployment problem the country is facing now, it is important to focus on the formation of dairy cooperatives in the lake zone area.

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CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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