

**VALUE CHAIN ANALYSIS OF SMALL SCALE CHEESE PROCESSING IN
ARUMERU DISTRICT – TANZANIA**

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**A Thesis Submitted to the Graduate School in Partial Fulfilment for the Requirements
of the Collaborative Masters of Science Degree in Agriculture and Applied Economics
of Egerton University.**

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DECLARATION AND APPROVAL

DECLARATION

I declare that this research proposal is my original work and it has not been presented in any other university for the award of degree, diploma or certificate.

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DEDICATION

I dedicate this thesis in the memory of my late Father **BALTAZARY S. MASHELLE** who unluckily missed to see my success, to my mother **PULKERIA D. KILENGA** and to all my brothers and sisters for nursing me with affections and love and their dedicated partnership in the success of my life

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ABSTRACT

Milk production and marketing contributes to the livelihoods of many smallholder dairy farmers in sub Saharan Africa. Milk marketing in Tanzania is done through both the formal and the informal channel with large volume being channelled through the informal channel. Milk being a perishable product with fluctuation in production during wet and dry season there is a need of transforming it into long life products like cheese. Despite these value adding activities being done by small scale processors; there is little information on the performance of the cheese value chain at small scale level in Arumeru District. A sample of 150 smallholder dairy farmers from three villages in Arumeru District where milk is being processed at small scale level were randomly selected and interviewed in order to understand the performance of cheese value chain. In addition to dairy farmers; four small scale cheese processors, six secondary cheese consumers and ten milk vendors were also interviewed and data was collected using structured and semi structured questionnaire to elucidate the volume of milk supplied through the formal channel. Descriptive methods were used to summarize the socio economic characteristics of the cheese value chain actors and the dairy farming systems. Value chain mapping was done to know the relationship of the chain actors and the costs and marketing margins along the cheese market channels. Heckman two steps selection model was used to determine the factors affecting the decision of the dairy farmers to participate in the formal dairy market channel and the volume of milk supplied. The results identified four major chain actors who were involved in different value adding activities for the milk. There were no middle men between cheese processors and the secondary cheese consumers. Cheese processors who sell to supermarkets were receiving higher marketing margins as compared to the cheese channelled through the tourists' hotels. The Heckman results reveals that dairy market entry decision was affected by the breed of the cow, number of milking cows, volume of milk produced, distance to the market and the price of raw milk. Generally the cheese value chain in the study area seem to be uncompetitive; constrained by lack of infrastructures, business license and lack of enough raw milk supply to meet the increasing demand of cheese in Arusha region. The study highlighted policy implications that can help in improving the dairy industry through promoting and enhancing the formal milk marketing channel which will improve the livelihood of the actors in the cheese value chain.

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LIST OF ACRONYMS AND ABBREVIATIONS

CARMATEC	Centre for Agricultural Mechanisation and Rural Technology
EAC	East African Community
GMM	Gross Marketing Margin
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
LME	Liquid Milk Equivalent
LMU	Livestock Multiplication Units
MCC	Milk Collection Centres
MoAFC	Ministry of Agriculture and Food Cooperatives
MLFD	Ministry of Livestock and Fisheries Development
MWLD	Ministry of Water and Livestock Development
NBS	National Bureau of Statistics
RLDC	Rural Livelihood Development Company
SDDP	Smallholder Dairy Development Program
SIDO	Small Industries Development Organization
TAMPA	Tanzania Milk Producers Association
TAMPRODA	Tanzania Milk Processors Association
TSH	Tanzanian Shilling
TDB	Tanzania Dairy Board
TDL	Tanzania Dairy Limited
TGMM	Total Gross Marketing Margin
UHT	Ultra Heat Treatment
USD	United States Dollar
VC	Value Chain
VCA	Value Chain Analysis

1US\$ = 1570.50 TSH on April 2012

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Milk production and marketing contributes to the livelihoods of many smallholder farmers in Sub Saharan Africa. Market oriented smallholder dairying has higher returns than many traditional agricultural activities and thus offers important income opportunities for resource-poor producer households and for rural and urban poor through their participation in processing and marketing (Omore *et al*, 2004). The increasing demand for dairy products associated with the growth in human population, raising income and urbanization offers an opportunity for smallholder dairy farmers and other intermediaries in the milk value chains to realize higher incomes through value addition. Many agricultural research and development (R&D) institutions have realized that small-scale farmers' key concern is not only agricultural productivity but also better market access (Bernet *et al*, 2005).

Agricultural producers need to be better linked to consumers by finding new markets for processed and value- added products. Most smallholder farmers, and particularly poor rural famers, do not participate in formal value chains. Rather, smallholders tend to be limited to informal markets for unprocessed or unrefined commodities such as raw milk, sunflower and grain (Larsen *et al.*, 2009). Enhanced focus on entrepreneurship and developments of innovative agro-food value chains are powerful means to address the challenges and improve the producer's role and redistribute income.

The Tanzanian livestock population ranks third in Africa after Ethiopia and Sudan (MMA, 2008). Cattle population totals 21,400,889 million, (NBS, 2011) of which most are traditional cows (Zebu). Around 1,148,000 households in Tanzania keep cattle, 97% of the cows are traditional Zebu that have a very low milk production. Only 3% are of improved dairy breed which have a higher milk production (MLFD, 2011). About 70% of the annually produced milk comes from the traditional sector (indigenous cows), whereas the commercial sector (dairy cows) produces about 30%. Proportionately, milk production by individual animals within the traditional sector is very low. This is due to low genetic potential (for milk production) of the indigenous cattle which produce between 1 – 3 litres per cow per day compared to improved

dairy cattle known to produce more than 7 - 15 litres of milk per cow per day depending on the level of management (Njombe and Msanga, 2009). Most of the farmers in Tanzania who keep livestock adopted zero grazing (RLDC, undated). They are found mostly in highlands where because of population pressure, there is no space for free grazing. With zero grazing farmers keep a limited number of cross breeds with high potential for milk production if well maintained.

The total annual milk production in Tanzania is around 2.5 billion litres (NBS, 2012). It is estimated that 41 million litres of milk is annually processed in the country into pasteurised milk, UHT, cultured, ghee, butter, cheese and cream and sold in the domestic market (Njombe *et al*, 2011). The number of milk processors has dramatically changed over the past years. In 1990s many factories of the government run Tanzania Dairy Limited closed because they were unable to operate efficiently. The total number of processors, including micro-processors now number more than 45 (TDB, 2011). Currently the major processing regions are Mara, Tanga, Arusha and Iringa. The northern zone which comprise of Arusha, Kilimanjaro and Manyara has a total of 252,554 number of improved dairy cattle that were introduced in the region since 1970s (MoAFC, 2008). Due to lack of land the farmers often apply the zero grazing system, and keeping a limited number of cows. People in this region who engage in dairy farming often live in small communities that are scattered on the slopes of the Mount Meru and Mount Kilimanjaro. The variations in topography complicate the transportation of milk to milk collection centres.

Arusha has one medium sized processor (International Dairy Product limited) who handles about 4,000 thousand litres daily and several microprocessors that serve their localities and the neighbourhood around Moshi Municipality and Arusha city. This research gives and overview analysis of local cheese value chain, and investigated how these smallholders are able to add value to small-scale production, and through this analysis identified strategies that can improve value chain participation for small scale producers.

1.2 Statement of the Problem

In the Arusha region, there is one medium sized processor and several microprocessors with a capacity of processing milk into various products. The dominating product by many companies is fresh milk and fermented milk or (*mtindi/mala*). Cheese processing in Arumeru District dated back in 1989 and has been done by the small-scale processors. Milk being a perishable product with fluctuations in production during wet and dry season there is thus a need

to preserve milk in different products. Cheese is the only milk product that can be kept for a very long period of time for up to five years depending on the variety. Cheese therefore provides an ideal means of storing milk in a concentrated form and can be eaten raw, used to make pizza, different snacks and cheese spreads. There is little information on the cheese value chain performance at small scale processors and the role each actor plays. Hence there is need to identify the key players in the chain, their roles and costs and price issues so as to understand the challenges and economic performance of key cheese chain actors in the area.

1.3 Objectives

1.3.1 Broad Objective

The main objective of the study is to conduct an analysis of the cheese value chain in Arumeru District that supplies most of the cheese sold in hotels and supermarkets in Arusha Municipality.

1.3.2 Specific Objectives

- i. To map the cheese value chain actors in the study area.
- ii. To determine marketing margin along the cheese value chain.
- iii. To determine factors affecting market participation and extent of participation by the smallholder dairy farmer in the cheese value chain in the study area.

1.4 Research Questions

1. Who are the actors involved in the value chain of cheese processing?
2. What are the costs incurred and price paid by different chain actors along the cheese value chain?
3. What factors affect market participation and volume of milk supply to cheese processors by the smallholder dairy farmers?

1.5 Justification of the Study

Cheese production and marketing is an important revenue-generating activity for the people of Arumeru District. There is limited knowledge about cheese market chain performance in the area. This study intends to generate vital information for the key players in cheese production and the challenges the players face.

Information generated by the study will contribute to the policy making process in line with the achievement of MKUKUTA (*Mkakati wa Kupunguza Umaskini na Kukuza Uchumi Tanzania*), (Tanzania Poverty Reduction and economic growth Strategy), Analysis of the markets for cheese will help to determine the economic value and importance of dairy industry. Moreover, the study will fill the knowledge gap in the value chain analysis in dairy subsector, and also serve as a benchmark for further related studies on value chain analysis for milk and related products in the country. Further more this study seeks to inform the policy makers about the economics and challenges facing the cheese value chain and ultimately identify opportunities to increase farmers' and processors' income and expansion of the dairy industry.

1.6 Scope and Limitation of the study

The study concentrated on the selected chain actors in the cheese value chain in three villages namely; Mulala, Ndatu and Songoro in Arumeru District. These actors were actively involved in the supply chain of cheese starting with the supply of raw milk, cheese processing and marketing. Only the formal channel of raw milk was analyzed as this channel supply milk to cheese processors. Due to limited time and financial constraint the study could not cover the detailed chain analysis of other dairy products processed by the cheese processors and the informal channel of raw milk. The information and data presented is from the small scale dairy farmers, cheese processors and the secondary cheese consumers (supermarkets and hotels).

1.7 Definition of terms

Dairy marketing chain: The dairy market chain is the movement of commodities right from the dairy farmers' home to the consumer. The dairy products, starting with milk, go through a chain, and generally at each stage, the value improves and the price increases. The market chain is interlinked right from milk production, farm-gate selling, processing, and marketing up to consumption.

Supply chain analysis: Some analysts make useful distinctions between supply chains and value chains. A supply chain is expressed as a set of linkages between actors where there are no binding market relationships while the concept of a value chain refers to a particular type of

supply chain where actors actively seek to support each other to improve efficiency and competitiveness of the market (Barham, 2007).

Value added: Is a measure for the value created in the economy. It is equivalent to the total value generated by the operators in the chain (chain revenue = final sales price * volume sold). The value added per unit of product is the difference between the price obtained by a VC operator and the price that the operator has paid for the inputs delivered by operators of the preceding stage of the value chain and the intermediate goods bought in from suppliers of inputs and services who are not regarded as part of the value chain.

Value chain: Various studies have come up with different definitions of value chains. (Kaplinsky and Morris, 2001) describes value chain as the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

Smallholder dairy farmer are farmers with 2-10 dairy cattle in an intensive or semi extensive system for income generation.

Formal milk marketing is the channel through which farmers deliver milk directly to the milk processing plant or to a milk collection centre (MCC) or traders who buy the milk from farmer and sell to MCC.

Secondary Cheese consumers: for this study the cheese consumers were the supermarkets and hotels here referred to as secondary cheese consumers.

Informal milk marketing is direct delivery of raw milk by the farmer to consumers or through vendors /hawkers before reaching the consumer

Value chain mapping According to the definition of the value chain; value chain mapping consists of a functional map of VC actors. Mapping can but does not necessarily include the macro level of a value chain.

Value chain actor: This term summarizes all individuals, enterprises and public agencies related to a value chain, in particular the VC operators, providers of operational services and the providers of support services. In a wider sense, certain government agencies at the macro level can also be seen as VC actors if they perform crucial functions in the business environment of the value chain in question.

CHAPTER TWO

LITERATURE REVIEW

2.1. Over View of Dairy Industry in Tanzania

Tanzania is endowed with abundant natural resources, which include land, forage and a large livestock resource base. Out of the total 94 million hectares of land resource, 60 million hectares are rangelands utilized for grazing 21 million cattle, 13.1 million goats and 3.6 million sheep. Other livestock kept in the country include 1.2 million pigs, 30 million indigenous poultry and other species (MLFD, 2011). The livestock industry can be categorized into two major production systems namely extensive and intensive. The intensive system, though limited in size, has been receiving more emphasis in investment and improvement because of its contribution to the market oriented economy. Dairying is one of the fast growing enterprises in the livestock industry. Common dairy species in the country include cattle, dairy goats, water buffaloes and camels. Milk marketed comes mainly from small-scale livestock farmers who supply on average about 70% and large-scale farmers supply about 30% (MLFD, 2006). Dairy cattle and their crosses have increased from 200,000 in 1995 to about 6000,000 in 2008 (NBS, 2012). Common dairy cattle breeds in Tanzania include *Friesian*, *Jersey*, *Ayrshire*, *Sahiwal*, *Mpwapwa* and their crosses. Sources of heifers for dairying include Livestock Multiplication Units (LMUs), public institutions, small and large-scale private farms.

From mid 1970's, the Government of Tanzania and development partners has put up efforts in the development of the dairy sub sector which resulted in an increase in improved dairy cattle, more milk collection points and processing through state owned Tanzania Dairies Limited. TDL at his height processed 400,000 litres per day (RLDC, 2009). The liberalization of the dairy industry in the mid 1990s resulted in expansion of private investments in milk collection and processing and privatization of government owned assets. In the recent years Tanzania has seen some efforts to revamp the dairy sector. This has included a Smallholder Dairy Development Program (SDDP) which facilitated formation of Tanzania Milk Producers Association (TAMPRODA). Other developments have included formation of Tanzania Dairy Board (TDB) and Tanzania Milk Processors Association (TAMPA).

2.2. Milk Production and Marketing

A total of 2.5 billion litres of milk is produced in Tanzania annually from both indigenous cattle and the improved breeds (NBS, 2012). Improvements in milk supply in Tanzania have largely been due to increases in cattle numbers rather than increases in productivity (Kurwijilla, 2001). According to a study done by RLDC in 2009 on milk production and collection for Central Tanzania has shown that 72% of the total produced milk is consumed on farm and not marketed at all meaning that only 28% is marketed. Unlike the neighbouring country Kenya where on-farm consumption (non-marketed milk) accounts for about 40% of milk and the remaining 60% is marketed through various channels (Mariuki, 2001). The formal market channel represents only 9.5% of the marketed quantity. In the informal milk marketing is mainly practiced by vendors/hawkers who collect raw milk from their own cattle and other household to sell directly to retailers (kiosks, restaurants) consumers. The positive downside of the informal market is that it provides employment and income to more than 100,000 milk hawkers who are involved in the chain and making their living by transporting approximately 80 to 100 litres of raw milk each per day to final consumers, mostly on bicycles (RLDC, 2009). The processors who buy milk either direct from farmers or through the milk vendors distribute and sell their produce through their own distribution networks using trucks, tricycles and bicycles, the major outlets being touristic hotels, supermarkets and retailer shops.

Despite the Government Livestock Policy (dairy) prohibiting sales of raw milk, the reality is that the major part of milk marketing is through the traditional informal markets which offer cheaper price due to low transaction costs (Kurwijila, 2001). However, there are health risks since the milk is not checked for quality and even the cows may have diseases. This is due to ignorance on the side of the vendors on such risks. The presence of antibiotic residues in milk is of public and economic concern, because of the risk of impaired health in persons who consume milk from treated cows and the interference of manufacturing of dairy products by the antibiotics present in milk (Kivaria *et al*, 2006). To provide better safeguards to the consumer, consumers should be informed about the hazards associated with current raw milk selling practice (Kivaria *et al*, 2006). There is a need for introducing a payment scheme to smallholder farmers according to the quality of their milk.

The informal market creates competition with the formal market. The informal market is neither regulated nor taxed. The sector assessment conducted by RLDC in 2009 on the dairy marketing estimate that 295 million litres of milk (38 – 45%) is traded directly to consumers. The average milk production is low due to the low milk production genetic potential of the Tanzania shorthorn Zebu estimated to produce around 0.5 litre/lactating cow/day in the dry season and 1.2 litres/lactating cow/day in the wet season (RLDC, 2009). Milk production fluctuates greatly with seasonality; the wet season production roughly doubles that of the dry season caused by shortages of pasture and water which in turn involves long distant trekking.

The fluctuations in production are major constraint for milk producers' and milk processors as it reverses sharply the demand and supply curves. This pattern puts a strain on both sides as producers are looking for continuous sales of milk and processors are not supplied with enough milk during dry seasons. Milk being a highly perishable product; marketing of surplus milk is indispensable and can only be tackled by processing raw milk into long life dairy products such as UHT milk, cheese, butter and ghee. In Tanzania, there is a total loss of 16.4% in the entire marketing chain during dry season and 25% or more during rainy season (RLDC, 2009). Most dairy farmers are concerned with problems of assured buyer of milk and timely payment for the product marketed (Jabar, 2010). A survey among farmers involved in supply arrangements with Milk Vita and Aarang in Bangladesh showed that more than 94% of the sample dairy farmers under Milk Vita as well as Aarang considered the availability of assured market for milk as the main motivation behind their decision to participate in the formal market (Jabar, 2010). The second most important reason was timely payment for output delivered.

Compared to other countries in the EAC region, Tanzanians consume relatively little milk. With only 42 litres of milk per annum (MLFD, 2011), average milk consumption per capita in Tanzania is lower than that in Uganda (50 litres per capita) and Kenya (100 litres per capita). The World Health Organization (WHO) recommends a per capita consumption of 200 litres per year (MMA, 2008).

2.3. Milk Processing

The milk processing industry in Tanzania has progressively shrunk by more than 80% over the last 15 years and has low competitive edge on the domestic market (narrow and expensive range of products). Since the privatization of TDL in 1990-1997 milk collection, processing and marketing has been left to the private sector. Currently the estimated quantity of milk processed is estimated at 30 million litres per year (9.5%) of the marketed milk (RLDC, 2009). Currently there are 45 medium sized processing plants operating in the country with production higher than 1,000 litres daily. Out of them there are five clear leaders in processing and marketing namely; ASAS, Iringa in the South, Tanga Fresh and Tandairies for the Dar Es Salaam/Coast region, International Dairies in Arusha (Serengeti Brand), and Musoma and Mara Dairies in Lake Zone. Musoma Dairy is the only plant in the country producing UHT milk. These processing plants produce fresh milk, cultured milk, yoghurt, cheese, ghee and butter. Milk processing in Tanzania is not well developed; the total operable installed capacity attends to hardly 7.1% against about 25% in Kenya (RLDC, 2009). In terms of capacity utilization still Tanzania lags behind other EAC countries.

The inadequate infrastructures (lack of collection/cooling and storage facilities) have been compelling the producers to rely principally on direct sales to neighbours and informal market agents consisting of hawkers, and retail outlets (restaurants, milk bars, dairy kiosks and shops). The Tanzanian dairy sub sector has a great potential, given the existing production and the clear indications of unsatisfied demand. If adequately linked to the markets, the dairy sector can make a considerable contribution to poverty alleviation for the cattle keeping rural households and the small scale rural dairy processors in the country.

2.4. Milk/Dairy Products

There is a wide array of dairy products. However the product range is relatively narrow which include fermented milk (*mtindi/mala*), pasteurized fresh milk, and UHT milk and to small extent, yoghurt, cheese, butter and ghee (RLDC, 2009).

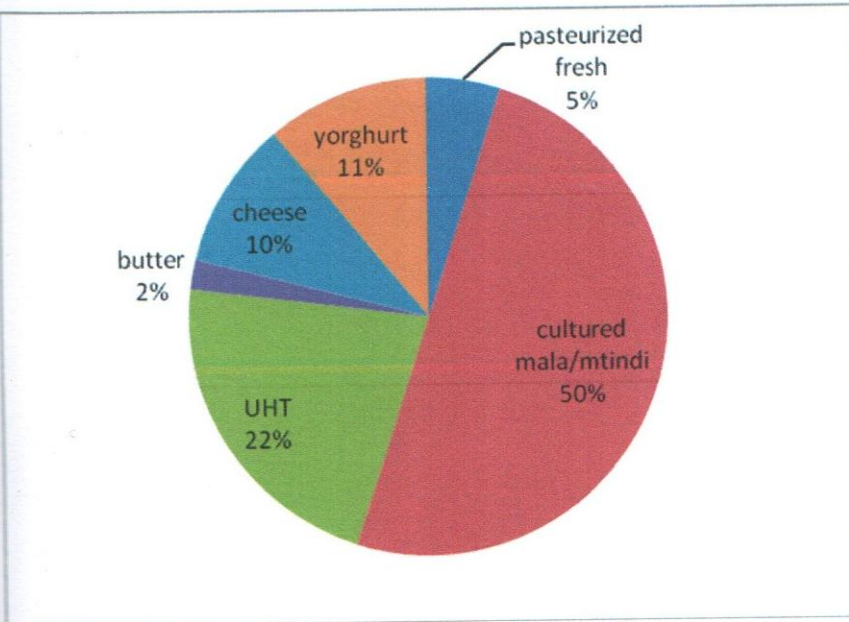


Figure 1: Main Dairy Products Produced in Tanzania. Source; RLDC, 2009.

According to the Tanzania Revenue Authority (2009) annual import bill for dairy products stood at 25.92 million LME worth USD 4.22 million between 2004 and 2009. In 2009 imports accounted for 1.79% of the national supply, but up the value chain it account for 48% of the processed dairy products end market. The trend shows that imports have been growing at an annual rate of 9.41% per annum, far ahead of the local production (estimated at 6.7% between 2007 and 2008).

2.5. Cheese Processing and Marketing

Throughout the world and particularly in countries with a developing dairy industry the milk of several mammals is processed by traditional methods into a variety of products for immediate consumption or for later use during times of reduced milk production. In many countries there exist several traditional milk products whose processing techniques and technologies are handed down from generation to generation through demonstration and experience. However, most of these products have a comparatively short shelf life and loss of valuable milk nutrients often occurs particularly during periods of high milk production. The need, therefore, to manufacture products with a long shelf life is evident and a number of cheese varieties exist which provide the ideal vehicle for the preservation of the milk nutrients (O'Connor, 1993).

Cheese is made in almost every country of the world and there exist more than 2000 varieties. Cheese may be classified into different groups, i.e. ripened and unripened cheese, cheese with low or high fat content and cheese with soft or hard consistency. Unprocessed milk held at high ambient temperatures has a shelf life from 2–3 hours up to 24 hours. Cheese, however, has a shelf life from 4–5 days up to five years depending on the variety (O'Connor, 1993). Cheese therefore provides an ideal vehicle for preserving the valuable nutrients in milk and making them available throughout the year. Cheese is an excellent source of protein, fat and minerals such as calcium, iron and phosphorus, vitamins and essential amino acids and therefore is an important food in the diet of both young and old people. Cheese products use 45 per cent of milk consumed in manufactured dairy products or approximately 36 per cent of total milk usage, making it the largest product category for the dairy industry (Dairy Australia, 2008). Compared with the quantities produced in Europe and North America the amount of cheese produced in Africa is quite small (O'Connor, 1993). Most of the cheese produced in Africa is made on a small scale and generally at farm level. Even though produced in small quantities cheese is a very valuable food and source of nutrients and cash for many people in Africa.

According to Ryoba (2006), Tanzanians are not traditionally cheese eaters. They rather prefer to drink fermented milk. Although this poses a problem, cheese makers in Arusha and Moshi on the slopes of Mount Kilimanjaro and Mt. Meru have found a limited yet lucrative market in the region's budding tourism industry.

The small scale cheese makers mainly produce Gouda and Mozzarella an industry that the American multinational co-operative Land O' Lakes helped them to secure (Ryoba, 2006). In Tanzania cheese processing and consumption focused on cheeses for which a ready market demand exists such as in the hospitality and tourist trade areas. The types of cheese which are highly produced to meet the demand are; Gouda, Feta, Mozzarella and Ricotta cheese (Ryoba, 2006).

2.6. Theoretical framework of VCA

Analysis of the firm's value chain is instructive from a number of theoretical aspects. There is no single one for mapping of the theories to the value chain analysis. Rather there is a good deal of overlap between the key theories and the functions. The theories are transaction costs economic theory, strategic assets theory and the production economics theory. The transaction costs economics theory helps one to assess the efficiency of firm's activities using value chain analysis by optimizing the level of vertical integration, identifying need for complimentary assets and the reasons for cost and risk alliance formation (Williamson, 1989). This is helpful in identifying which of firms' strategic assets it possesses and which it needs to access by alliances or to acquire outright (Amit and Schoemaker, 1993).

On the other hand, transaction cost economics would be concerned with opportunism and asset specificity in predicting whether such assets would be accessed through alliances or integrated. The reasons for firms to participate in alliances or a network are to acquire access to complementary assets and/or form a governance structure that reduces the costs or risks of innovative activity. Value chain analysis would suggest that the efficiency of activities in the value chain would deliver competitive advantage through lower cost structure and therefore higher profit potential.

The value chain displays how total value is created by the firm and consists of value activities and a margin. Every value activity employs purchased inputs, human resources, some form of technology and makes use of information (Porter, 1985). Porter divides value activities between primary activities and support activities. Primary activities focus on the creation and sale of the product to buyers whereas support activities include technology development procurement and human resources. These may be tailored to particular segments of the value chain or support the entire value chain. The value created by the chain is measured by the total product revenue.

In the production process the firm is faced with choices as well as constraints. These constraints are a result of the individual characteristics of the different production factors as well as the interaction between the factors of production within a framework of different states of nature. When choices or decisions have to be made in terms of production these constraints have

to be taken into consideration since they have direct and indirect impact on the production process. Production technology, profit maximization and cost minimization aspects will positively contribute to the sustainability of the firm in business.

An operating firm/farm faces choices of what to produce, the amount to produce and the method of production to be employed. However the underlying principle on which all of these choices are based is the principle of profit maximization. Thus the firm has to choose a production plan that is likely to maximize profit. Given the choices in terms of profit maximization and constraints that the firm faces in the production process, the firm attempts to produce a specific level of output but at the same time attempts to minimize costs. In order to minimize costs, the firm needs to find the point of production where the specific combination of inputs results in a specific level of output but at the same time where costs are at minimum. This entails the combination of the cost function as well as the production function of the firm; this is where the technical rate of substitution is equal to the factor price ratio.

$$-\frac{MP_1(X_1^*, X_2^*)}{MP_2(X_1^*, X_2^*)} = TRS(X_1^*, X_2^*) = -\frac{w_1}{w_2} \quad (2.1)$$

Where: MP is the marginal physical product

X_1^* and X_2^* are factors of production

TRS is the Technical rate of Substitution

w_1 and w_2 are the costs of factor of production

VCA not only allows the understanding of the constraints and opportunities that producers face within the VC, but also to consider what needs to be done in order for producers to better integrate into the local market. The chains can be simple when producers directly sell to the consumers but long and complex when the other actors play a role in buying, processing, transporting and selling to the end user, the consumer. The complex chain, however, offers a multitude of choice to farmers. They may choose to supply a specific market segment, and produce the product that is tailored to that segment.

Dairy producers for example may decide not to sell the raw milk directly to consumers and rather sell it to processors. Farmers need to understand the players in the chain and the requirements of the different branches so they can supply the product which that branch requires (UNIDO, 2010). That will increase their bargaining power in the chain, and improve the price they get for their product. This in turn increases farmers' comparative advantage by increasing the volume of supply, quality of the product and consistency of supply, which is often possible when farmers act as a group (UNIDO, 2010)

2.7. Value Chain study Approaches

An approach used in VCA depends on the research question (Kaplinsky and Morris, 2001). Accordingly, four aspects of value chain analysis have been applied in agriculture:

Value chain mapping: a VCA systematically maps the actors participating in the production, distribution, processing, marketing and consumption of a particular product (or products). This mapping assesses the characteristics of actors, profit and cost structures, and flows of goods throughout the chain, employment characteristics, and the destination and volumes of domestic and foreign sales.

Identifying the distribution of benefits of actors in the chain: 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.

Examining the role of upgrading within the chain: Upgrading can involve improvements in quality and product design that enable producers to gain higher-value or through diversification in the product lines served. An analysis of the upgrading process includes an assessment of the profitability of actors within the chain as well as information on constraints that are currently present. Governance issues play a key role in defining how such upgrading occurs. In addition, the structure of regulations, entry barriers, trade restrictions, and standards can further shape and influence the environment in which upgrading can take place. Possible forms of upgrading include: process upgrading, product upgrading and function upgrading.

Role of governance in the value-chain: Governance in a VC refers to the structure of relationships and coordination mechanisms that exist between actors in the VC. Governance is

important from a policy perspective by identifying the institutional arrangements that may need to be targeted to improve capabilities in the VC, remedy distributional distortions, and increase value-added in the sector.

2.8. Value Chain Analysis in Dairy Sector

VC approach is used by many organizations across the globe. Following the pioneering contributions of Porter and Millar, 1985 who focused on how individual firms can create value and build up their competitive advantage and Gereffi *et al.*, 2005 who focused primarily on the economic governance patterns in “global” value chains, different institutions and individuals applied VC approach in the agriculture sector. The application of VCA in agriculture is growing due to market failure and non competitive setting of small scale agricultural production (UNIDO, (2010).

The focus has for many years been increasing the participation of smallholder farmers in high value global value chains. A particular emphasis has been exports, often of organic and fair trade products, with support from either the private sector or public sector, through NGO’s and other international development agencies. However, in high-value agrifood value chains smallholder farmers have limited control (Lie, 2011). Furthermore, power is often concentrated among one or a few chain participants that coordinate market activity.

As the modern agrifood sector is based on consumer assurance, high standards for food quality and safety, low prices, and reliability of supply, lead actors in retail or export often coordinate the value chain (Lie, 2011). The market is also constantly changing, requiring rural farms and firms to respond by for example switching market channels, change how they are organized, or invest in equipment. Such value chains may thus be less appropriate for many smallholder actors, who may lack the ability to handle dynamic markets and the increasing amount of regulations.

According to a study done by Lie, (2011) to assess the potential for local dairy value chains as an approach for smallholder farmers to improve their livelihood; the study findings reveal that producing yoghurt, considerable value is added to the goat milk and the value accrues to the farmers since the chain is controlled by the farmers themselves. Also some farmers were able to increase their dairy goats herd size since they were assured of a market for the milk and

increased income from the sale of the milk to the cooperative for yoghurt processing. However the cooperative was faced with some constraints like poor infrastructures, limited access to information and extension services. Also the study proves that local dairy value chain has positive implications for the smallholder farmers directly, and indirectly, participating in the value chain (Lie, 2011).

The disadvantage of small farmers in high-value supply chains is partially due to high transaction costs. Specific investments in this could include the creation of farm associations and collection points where processors and retailers can source from many small suppliers at low transaction costs (Swinnen et al, 2010). Furthermore; investing in quality control centers has additional advantages of enhancing the bargaining power of suppliers and ensuring correct payments for quality in the chain.

A quantitative assessment of key elements in the value chain should be performed as part of the value chain analysis, at least for the node of the target group and for the next node downstream. This information will be used to assess the attractiveness of alternative upgrading strategies, to evaluate the competitiveness of the target group in the end market, and to generate qualitative and quantitative indicators for monitoring and evaluating changes in the value chain (Riisgaard *et al*, 2008). The specific elements included in the quantitative value chain assessment will depend on the specific characteristics of the value chain, but should include, for each node in chain: volume produced, number of producers/processors/traders involved, prices, cost of production, processing, trade (by major item), revenues and margins earned.

2.9. Conceptual framework

The VCA conceptual framework used in this study is that of Porters' (1985). To understand and determine the economics of cheese value chain it is important to assess the entire chain. This was done by undertaking analysis of the chain of a product from production to consumption, which includes raw milk suppliers (individual dairy farmers), the MCC, processors, marketing intermediaries and finally the consumers. The actors and organizations involved in the value chain are taken into account, concerning their contribution to the cheese value chain and the relationships among these different actors in the chain. The amount of costs and capital that has been involved in the different stages of the value chain will determine the market margin for every actor in the chain. The dependent and interdependent variables were

assessed closely to know their influence to the final outcome which includes increased profit margin along the market chain and the improved income for the small scale dairy farmers and the cheese processors.

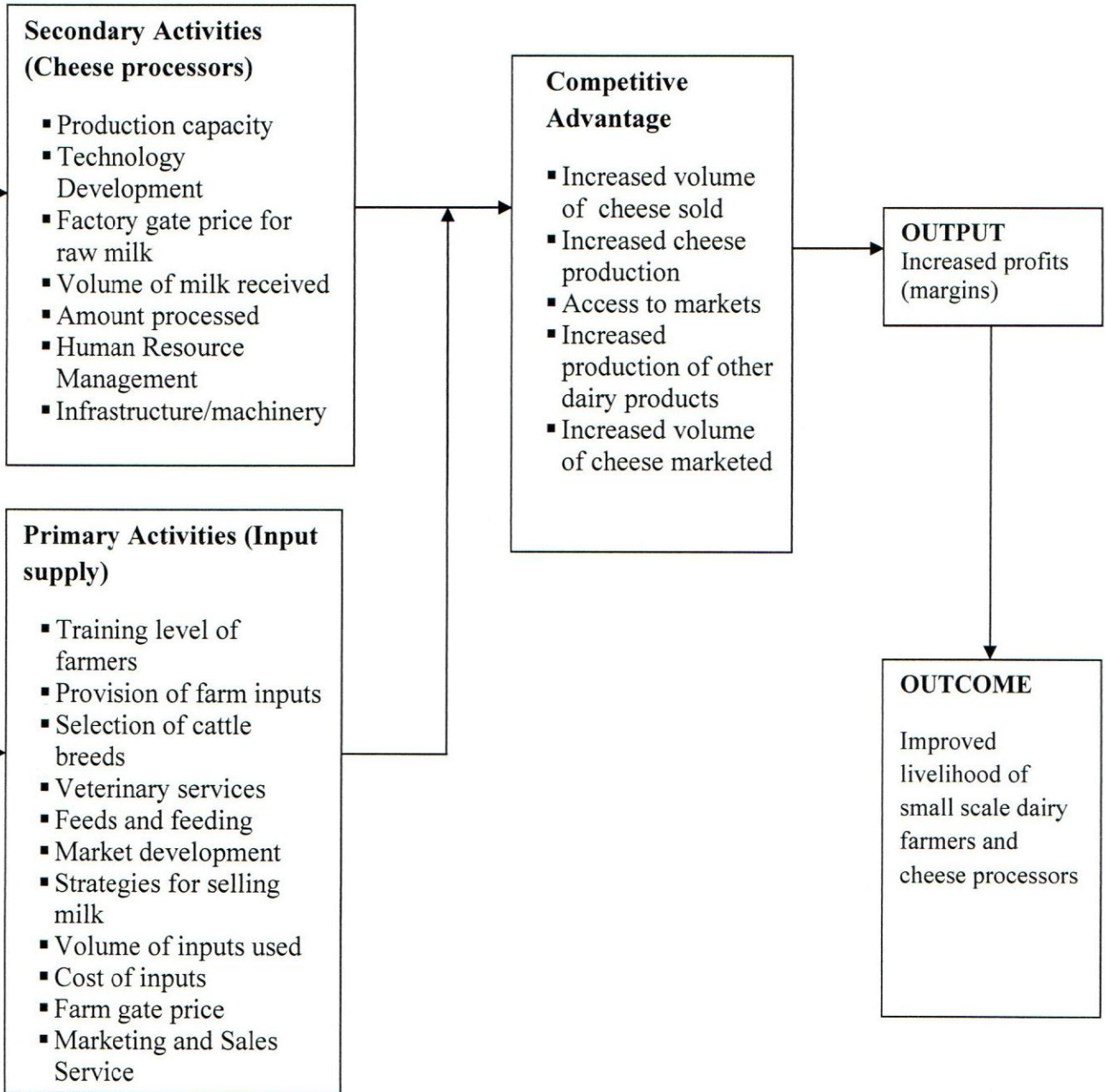


Figure 2: Conceptual Framework Adapted from Porter's VCA

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study area

Arumeru is one of eight districts in Arusha Region in North - Eastern Tanzania, situated between 37°E and 3°S with an area of 2966 km². The district borders Monduli to the North and West, Hai to the East and Simanjiro to the South. It has six Divisions, Enaboishu, King'ori, Mbuguni, Moshono, Mukulat and Poli, with 30 Wards and 143 villages (Nyaki et al. 1991). Population density averages 110/km². The Maasai people occupy the North, the Meru occupy the central part and a mixture of Chagga, Maasai, Iraques and Meru tribes occupy the South. The District experiences a bimodal rainfall pattern, with the prolonged rains starting from end of February to June, and the short rains from the end of October to December. The average annual rainfall in the district ranges between 600 mm in the low lands and 1000-1500 mm. The major farming activities include livestock farming, maize, ground nuts, pigeon pee and coffee growing. The remainder of the district is the lowlands which are in the semi-arid climate zone. This zone is essentially a rangeland with major socio-economic activities being agriculture and dairy farming.

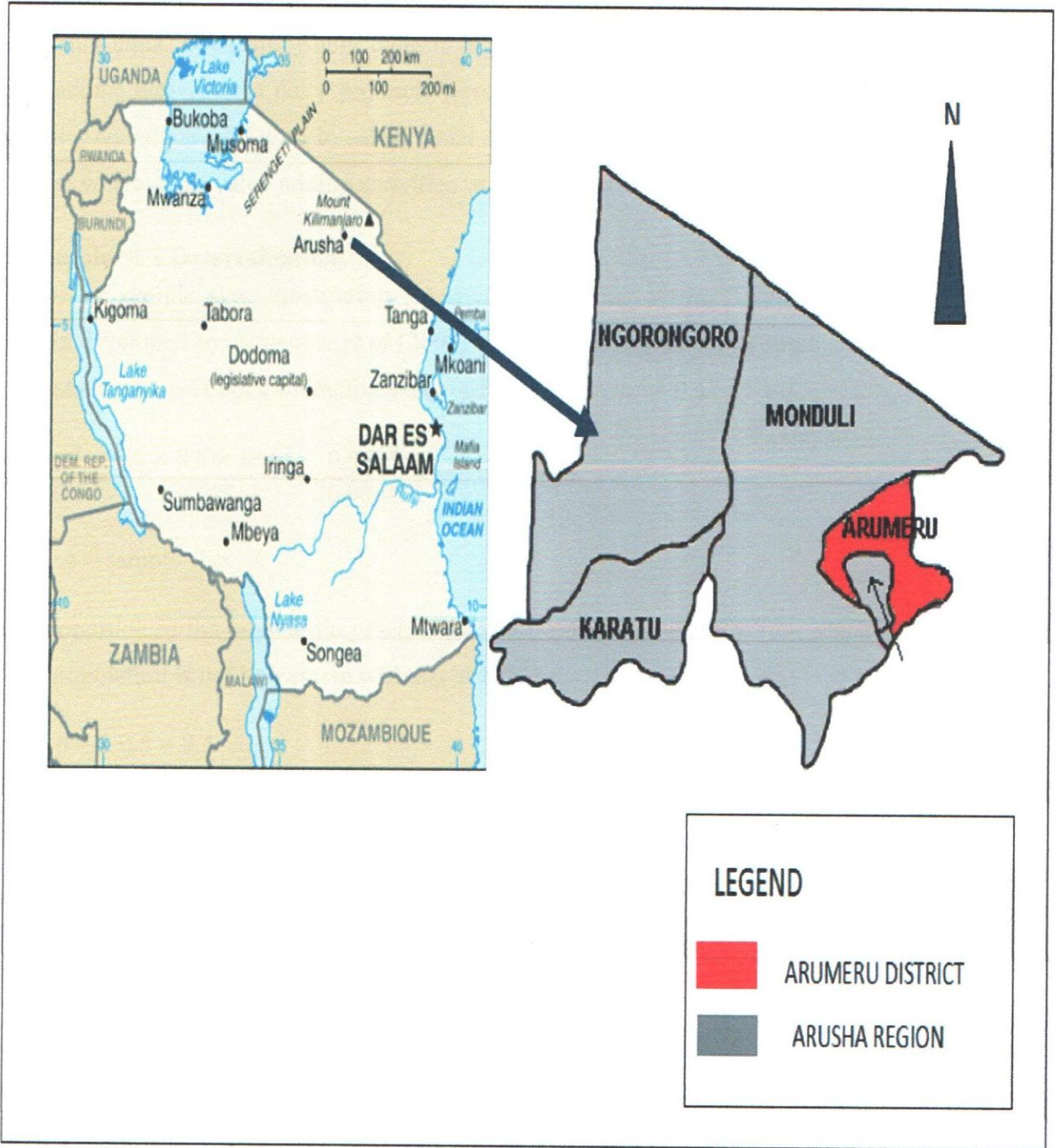


Figure 3: Map Showing the Study Area

3.2. Sampling Procedure

Arusha region was purposively selected due to its well established small scale cheese processing units. Divisions where there is high concentration of small scale dairy farmers and value adding activities to dairy products were also purposively selected. Lastly simple random sampling technique was used to select small scale dairy farmers from the three villages in Poli division where dairy value adding activities were performed.

3.3 Sample Size Determination

The sample size constituting the small scale dairy farmers was determined using the formula developed by Anderson *et al* (2007). Since the total number of small scale dairy farmers in the study area was not known, the value of P was taken to be 0.5 and q 0.5.

$$n = \frac{pqz^2}{E^2} = \frac{0.5 \times 0.5 \times 1.96^2}{0.08^2} = \frac{0.9604}{0.0064} = 150.06 \approx 150$$

Where n = sample size

p = proportion of the population practising dairy farming in the study area, since the proportion of the population is not known we will take p=0.5.

$$q = 1-p = 1-0.5 = 0.5$$

z = confidence level ($\alpha = 0.05$) and Z= 1.96

E = acceptable/allowable error for the study and is assumed to be 5% that means 95% confidence level.

In Poli Division there were four dairy small scale cheese processors who process milk into cheese and other milk products, since they were small in number the study considered all of them. Data was collected from the cheese processors downstream to the secondary consumers and upstream to the raw milk suppliers (smallholder dairy farmers). There was no market intermediary between the cheese processors and the secondary consumers. A total of ten market intermediaries for raw milk sampled purposively were used in this study. Six secondary cheese consumers that are supplied with cheese from the small scale cheese processors were sampled to know the trend of cheese supply, volume supplied and the quality of the product. This was done

to help in identifying the challenges and opportunities that face the cheese industry and the possible strategies to improve the industry.

3.4. Data Collection, Type and Data sources

Data on milk production, processing and marketing of cheese, volume of cheese marketed, and system of storage, transport facilities and supporting institutions were collected from sample respondents using semi structured questionnaire. In addition to primary data; secondary data on number of licensed and unlicensed traders, marketing agents and their role was collected from secondary sources. Sources of primary data was small scale dairy farmers supplying milk to the processors, small scale cheese processors, marketing intermediaries and the cheese consumers. Secondary data sources included Arumeru District Office of Agriculture and Livestock Development, (DALDO) and different publications and documents which have data relevant to the study.

3.5. Descriptive Analysis

Data was analyzed using data analysis computer software; SPSS and the STATA packages. Descriptive statistics was used to get the percentages, means, and standard deviations in the process of comparing socio-economic and institutional characteristics of the dairy household and the cheese processors and traders in the study areas.

3.6. Empirical Analysis

3.6.1. Value Chain Analysis and Econometric Analysis

Objective one of this study was achieved by mapping the activities in the cheese value chain and characterizing the actors participating in the chain. The goal of mapping the value chain is to give a visual presentation of the actors in the chains and connections between them. Also chain mapping helps one to make an overview of the flow (and value) of commodities and services from supplier to consumer, and to show the activities performed in each actor. The mapping of the value chain was guided by the following; knowing how value chain is structured and the organizational approach and to know how much value is added throughout the chain and how is it distributed within the chain actors. This was further analysed to obtain the market margin and the producers' share of the final product value.

Objective two was achieved by use of marketing margin analysis. A marketing margin is the percentage of the final weighted averages selling price taken by each stage of the marketing chain. The total marketing margin is the difference between what the consumer pays and what the producer/farmer receives for his product. In other words it is the difference between retail price and farm price. Computing the total gross marketing margin (TGMM) is always related to the final price paid by the end buyer and is expressed as percentage.

$$TGMM = \frac{\text{Consumer price} - \text{Farmer's price}}{\text{Consumer price}} \times 100 \quad (2a)$$

Where TGMM is Total Gross Marketing Margin.

It is useful to introduce here the idea of “producer participation”, “farmer’s portion” or “producer’s gross margin” (GMM) which is the portion of the price paid by the end consumer that belongs to the farmer as a producer. The producer’s margin or share in the consumer price (GMMp) is calculated as:

$$GMMp = \frac{\text{Price paid by the consumer} - \text{Marketing gross margin}}{\text{Price paid by the consumer}} \times 100 \quad (2b)$$

Where GMMp is the producer’s share price

To achieve objective three of this study which entails to know the formal market participation by smallholder dairy farmers and the volume of market supply was modelled using Heckman two step models. This model allows the milk supplier to decide whether or not to participate in a particular market, and if so, to choose the volume of market supply. In this study, Heckman two steps model was used over double hurdle model and ordinary Tobit model. When two decisions are involved such as participation and volume of supply, Heckman two step estimation procedures is appropriate. The participation equation attempts to capture factors affecting participation decision. This equation is used to construct a selectivity term known as the 'inverse Mills ratio' which is an ideal tool for controlling bias due to sample selection.

Thus for this study, Heckman’s two step model was used to identify factors that affect farmers decision to sell their milk to formal market and amount of milk supplied to the formal market. In the first step of Heckman’s model, the probability of participation was modelled by Maximum Likelihood Probit, from which Inverse Mill’s ratio was estimated. In the second step,

the estimated Inverse Mill's ratio was included as right hand side variable in the milk market supply equation. The Heckman two step model, which is explained by Probit model for the first step for participation decision and OLS, was used in the second step to establish the extent of participation.

3.6.2. The Equation for Market Participation (Probit Model)

$$Y_i = \beta_i x_i + \varepsilon_i \quad \varepsilon_i \sim N(0, 1) \quad (3a)$$

where; Y_i - market participation decision identified as dummy variable, if

decision is participating $Y_i = 1$ other wise $Y_i = 0$.

β_i - coefficient of i^{th} explanatory variable

x_i - vector of explanatory variable determining market participation

ε_i - error term and it is normalized to 1 because only market participation is observed and Y_i is not observed; it is also assumed to be bivariate, and normally distributed with correlation coefficient, ρ)

3.6.3. The Equation for the Amount of Market Supply:

The parameters were estimated by ordinary least squares (OLS) over the given observations including values for Y_i by including an estimate of the inverse Mill's Ratio, denoted by λ_j .

$$Y_j = \beta_j x_j + \mu \lambda_j + \varepsilon_j \quad \varepsilon_j \sim N(0, \delta^2) \quad (3b)$$

where Y_j - is the amount of milk supplied to formal market and it is observed only if market participation decision is yes, that is $Y_j = 1$.

β_j - coefficient of the j^{th} explanatory variable

x_j - explanatory variables determine amount of market supply

μ - indicate the impact of participation on the quantity supply

ε_j - error term, this is assumed to be bivariate, and normally distributed with correlation coefficient, ρ)

$$\lambda_j = \frac{f(X\beta)}{1-f(X\beta)} \quad (3c)$$

$f(X\beta)$ is density function and $1-F(X\beta)$ is distribution function.

Before fitting the explanatory variables a test for multicollinearity for both the continuous and discrete variables was analysed. Multicollinearity is a situation where it becomes difficult to identify the separate effect of independent variables on the dependent variable because of the existence of strong relationship among them. Therefore, in order to check multicollinearity problem for the continuous variables variance inflation factor (VIF) was used. When R^2 increase towards 1 that means there is colinearity of explanatory variables. As a rule of thumb if VIF greater than 10, that means R^2 greater than 0.8 the variables are highly collinear (Gujarati, 2003).

$VIF(X_j) = (1 - R_j^2)^{-1}$ Where: R_j^2 is a multiple correlation coefficients between explanatory variables.

Contingency coefficient was used to check multicollinearity between discrete variables. The value ranges between zeros to one. Zero indicates that there is no any association between the variables and closer to 1 that means greater than 0.75 indicates higher degree of association between variables.

$$CC = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

Where; CC is Contingency Coefficient

N is the total number of observation

χ^2 is the Chi-square of the discrete variables.

Table 1: Variables used in the Heckman Two Step Selection Model

Variable	Description	Unit of measurement	Expected sign
Dependent variables			
		Dummy	
MMP	milk market participation	(1=participate,0=otherwise)	
MMV	marketed milk volume	litres	
Independent Variable			
AGE	age of household	years	(+)
SMP	size of milk output	litres	(+)
FSHH	family size of household	adult equivalent	(+)
ELHH	education level of household	years	(+)
EXHH	experience in dairy production	years	(+)
DNMM	distance from dairy market	km	(-)
CB	cross breed herd size	number	(+)
LB	local breed herd size	number	(+)
ACEV	access to veterinary services	dummy (1=yes,0=no)	(+)
INFDS	income from non dairy sources	TSH	(+)
SEX	sex of the household head	dummy (1=male,0=female)	(+)
ACCR	access to credit	dummy (1=yes,0=no)	(+)
PMM	price of marketed milk	TSH	(+)
	access to milk market		
ACMINF	information	dummy (1=yes,0=no)	(+)

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the findings of the research from the study area. The descriptive analysis was used to describe the general characteristics of smallholder dairy farmers and cheese processors who engage in different activities of the value chain. This also provides road map for mapping the various chain actors and identifying the market channels through which the product move from the producers to the secondary consumers. The market margin analysis was used to determine the costs and benefit distribution among different actors in cheese value chain. Lastly; econometric analysis was used to identify factors that affect dairy farmers' decision to participate in formal market channel of raw milk and the volume supplied to the market.

4.1 Socio-economic Characteristics of the Chain Actors

The respondents involved in this study were 150 smallholder dairy farmers, four small scale cheese processors, 10 milk vendors and six secondary cheese consumers. Data were collected from the small scale cheese processors downstream to the cheese consumers and upstream to the raw milk suppliers (small scale dairy farmers).

4.1.1 Socio-economic Characteristics of Smallholder Dairy Farmers

Sample respondents were from Poli Division involving three different villages namely; Mulala, Songoro and Ndatu. A total of 70 smallholder dairy farmers from Mulala, 40 from Songoro and 40 from Ndatu were interviewed. The variations in the number of respondents in the villages were attributed to the presence or absence of milk collection centres which were used as a base for sourcing milk for cheese processing. In Mulala village there were two milk collection centres which were established with the assistance from Land O' Lakes an NGO operating in that village. Ndatu and Songoro villages had no milk collection centres. Dairy farmers in these villages either sell their milk directly to the cheese processors or to milk vendors. The cheese processor present in Mulala village obtains raw milk only from milk collection centres. Table 2 shows the socio economic characteristics of the respondent smallholder dairy farmers.

Table 2: Socio-economic Characteristics of Respondent Smallholder Dairy Farmers

Characteristics	Frequency	Percent
Sex of respondent		
Female	66	44
Male	84	56
Total	150	100
Age of respondent		
25-35 years	41	27.3
36-45 years	43	28.7
46-60 years	46	30.7
61-80 years	20	13.3
Total	150	100.0
Education level of respondent		
Primary school	88	58.7
Secondary school	42	28.0
Certificate	16	10.7
Diploma	4	2.6
Total	150	100.0

Source; survey data 2012

Female made up 44% of smallholder farmers respondents; the rest (56%) were male. The larger proportion of the males in the dairy sector is due to the tradition that men are owners of the household assets including livestock. The proportion of the respondents who falls in the age group of 46-60 years was 30.7%; whereas those in between 61-80 years were 13.3%. The large percent of smallholder dairy farmers had received primary education (58.7%), 28% secondary education while those with certificate and diploma education made 10.7% and 2.6% respectively. None of the interviewed dairy farmer had received university education.

The mean household size was found to be five members per household in the study area. Dairy farmers keep different breeds of livestock; cross breeds and local breeds (zebu). About 9.3% of the respondents were keeping traditional cattle, while 90.7% were keeping the crossbred dairy cattle. All the interviewed farmers in the study area have permanent crops farm where they usually produce coffee and plantains. Apart from dairy husbandry farmers do also participate in other income generating activities. Of the interviewed farmers, 40% were doing off-farm small business around the study area and in Arusha town about 20km away, 20% are farming carrot and sweet potatoes while 18.7% are employed either in private or government sector. Those engaging in dairy farming only make 17.3%, 1.3% was retired public servants who were pensionable and 2.7% were retired workers without pension.

The average farm size was 2.5 acres with 44.7% of farmers having less than 2.5 acres; between 2.5 and 3 acres were 42.7% and the rest 12.6% was above 3 acres. Among the sampled dairy farmers 36% have been practicing dairy farming for about 16 to 30 years; 33.3% had experience between 10 and 15 years while 24.7% had 3 to 9 years of experience and 6% have been doing dairy farming for more than 30 years. Table 3 below shows the mean age, farm size, and experience in dairy farming of the interviewed respondents

Table 3: Selected Demographic Characteristics of Smallholder Dairy Farmers

Characteristics	Variable	Percent
Household size	less than 4 members	12.0
	4 to 5 members	60.0
	more than 5 members	28.0
Type of cattle kept	improved dairy cattle	90.7
	traditional cattle	9.3
Other occupations	salaried employment	18.7
	retired with pension	1.3
	retired without pension	2.7
	businessman/woman	40.0
	carrot and sweet potato farming	20.0
	no other occupation	17.3

N=150. Source survey data 2012

4.2 Dairy Production Systems

Out of 150 interviewed farmers; 136 (90.7%) were keeping improved cattle and 14 (9.3%) were keeping traditional cattle. The average herd size for the improved dairy system was 4 animals of different categories per household. The dominant system of dairy production in the study areas was smallholder dairy production system where the animals were either confined in doors the practice commonly referred to as zero grazing or are grazed along the road side. There were also some farmers who did semi-grazing with some few practicing total grazing. Of the interviewed 55.3% were practicing zero grazing farmers, 37.4% were practicing semi-zero grazing and 7.3% were grazing the animals.

4.2.1 Feeding Methods of Dairy Cattle

The feeds for the animals were sourced from the farm. The main feed is banana leaves and stems with additional grasses either planted in the farm or from the road side. Also the crop residues from maize and sweet potatoes were used. During dry season farmers do purchase hay from the Tengeru Livestock Training Institute (LITI-Tengeru). About 94% of the farmers were supplementing their animals with concentrates. Only 6% of the interviewed farmers were not supplementing their animals with concentrate. Table 5 shows the different types of concentrates used by the dairy farmers to feed their animals.

Table 4: Types of Concentrates given to Dairy Cows

Type of concentrate	Frequency	Percent
Purchased compounded dairy meal	113.00	75.33
Home compounded	26.00	17.33
Maize bran only	2.00	1.33
None	9.00	6.00
Total	150	100

Source; survey data 2012

Dairy feeding in the study area was not limited to concentrates; pastures and other sources of feeds were used as well. Dairy farmers in the study area were managing pastures in various ways. About 46% were using both planted and purchased fodder, 32% were using planted fodder and 5.3% source feeds from public lands (Table 5). The remaining 16.7% were either

feeding their dairy cattle using road side fodder or purchase the fodder throughout the year. Table six present the results for various feeding method of dairy cattle and the sources of feeds.

Table 5: Feeding and Feed Sources for Dairy Cattle

Characteristics	Variable	Frequency	Percent
Feeding method of dairy herd	pasture grazing	11	7.3
	zero grazing	83	55.3
	part zero part grazing	56	37.4
	Total	150	100
Feed sources	planted fodder	48	32.0
	road side fodder	12	8.0
	public land fodder	8	5.3
	planted and purchased fodder	69	46.0
	purchased fodder only	1	0.7
	other sources	12	8.0
	Total	150	100.0
Feed types	guatemala grass	39	26
	grass legume mixture	84	56
	other sources	27	18
	Total	150	100
Concentrates type	home made	26	17.3
	purchased dairy meal	113	75.3
	maize bran only	2	1.3
	no concentrates given	9	6.0
Total		150	100

Source; survey data 2012

4.2.2 Breeding Methods

Both artificial and natural mating was used to breed the dairy cows. About 53.3% of the respondents used natural mating while 46.7% used artificial insemination. Natural mating was preferred over artificial insemination as it was cheaper and reliable. The bull is either owned by the farmer (28.7%) or hired from the neighbor (24.6%). For hired bull the cost of breeding the animal range from 2000Tsh to 6000Tsh per service while for artificial insemination costs ranges from 8000Tsh to 12500Tsh per service.

4.2.3 Milk Production and Milking Practices

During the survey out of 150 smallholder dairy farmers 138 (92%) were milking their cows while 12 (8%) farmers were not milking. Those who were not milking had either pregnant cows or had sold their milking cows to meet household requirement especially paying school fees for the children. About 39.3% of the farmers were milking one cow; those milking two cows made up 36%, while the rest 24.7% were milking more than three cows. On average the milk production per cow per day was 10 litres for the crossbreeds and 2.5 litres for the traditional Zebu; with seasonal fluctuation in wet and dry season.

4.3 Milk Marketing Channels

The marketed milk volume was the amount left after subtracting the volume consumed at home and the milk given to calves. Milk left home was either used for calf feeding or for home consumption and this was represented by 7.9% of the total milk produced. Traditionally farmers were processing fermented milk (*mala*) at home for drinking with *ugali* or *kitalolo* a tradition food made from banana and some vegetables mixed with fermented milk.

Different market channels for raw milk were identified in the study area. Milk was marketed formally through the cold chain Milk Collection Centres (MCC) or via the cheese processors and informally through the milk vendors. With the formal channel, dairy farmers deliver milk to the MCC and from there the cheese processors collect the cooled and quality milk for processing cheese. Upon delivering milk to the collection centres quality or platform tests are carried out to confirm the quality of milk. The common platform tests carried out was organoleptic and the lactometer reading to check for any adulteration. The average distance to the market where farmers sell their milk were less than one kilometre (86.6%) for the farmers who sell to the MCC/cheese processors and more than one kilometre for those selling to vendors

(13.4%). In the informal channel the vendors' source the milk from the farmers' premises and no platform test was carried out. Milk collected by vendors was then transported to Arusha Municipality about 30Km away and sold to hotels and individual households. The formal channel (MCC and cheese processors) absorbed 54.7% of the marketed milk and the remaining 45.3% was sold through the informal channels. A study done by RLDC (2009) reported that over the country only 9.5% of the produced milk is marketed through the formal channel. However the study had different findings as more milk was sold through the formal channel. This is an important finding which shows that with high concentration of cross breeds dairy cattle more farmers are inclined to sell to formal channel.

Also the MCC and the small scale cheese processors have taken efforts to create awareness to farmers on the importance of selling milk through the formal channel. The formal channel was found to be more reliable market channel as during the high milk production season the vendors were not able to absorb the increased production due to limited capital and high competition in the market. During the Muslim festivals farmers who relied on vendors faced a lot of problems because the potential consumers closed down their hotels and restaurants. Detailed market channel of Raw Milk in Poli Division in Arumeru District

1. Small scale dairy farmer —> MCC —> Cheese processors 32.7% (709 litres)
2. Small scale dairy farmer —> Cheese processors 22% (488 litres)
3. Small scale dairy farmer —> Milk vendor —> consumers 34.7% (753 litres)
4. Small scale dairy farmer —> Consumers (neighborhood/milk kiosk) 2.7% (59 litres)
5. Small scale dairy farmer —> Home consumption and calf feeding 7.9% (432 litres)

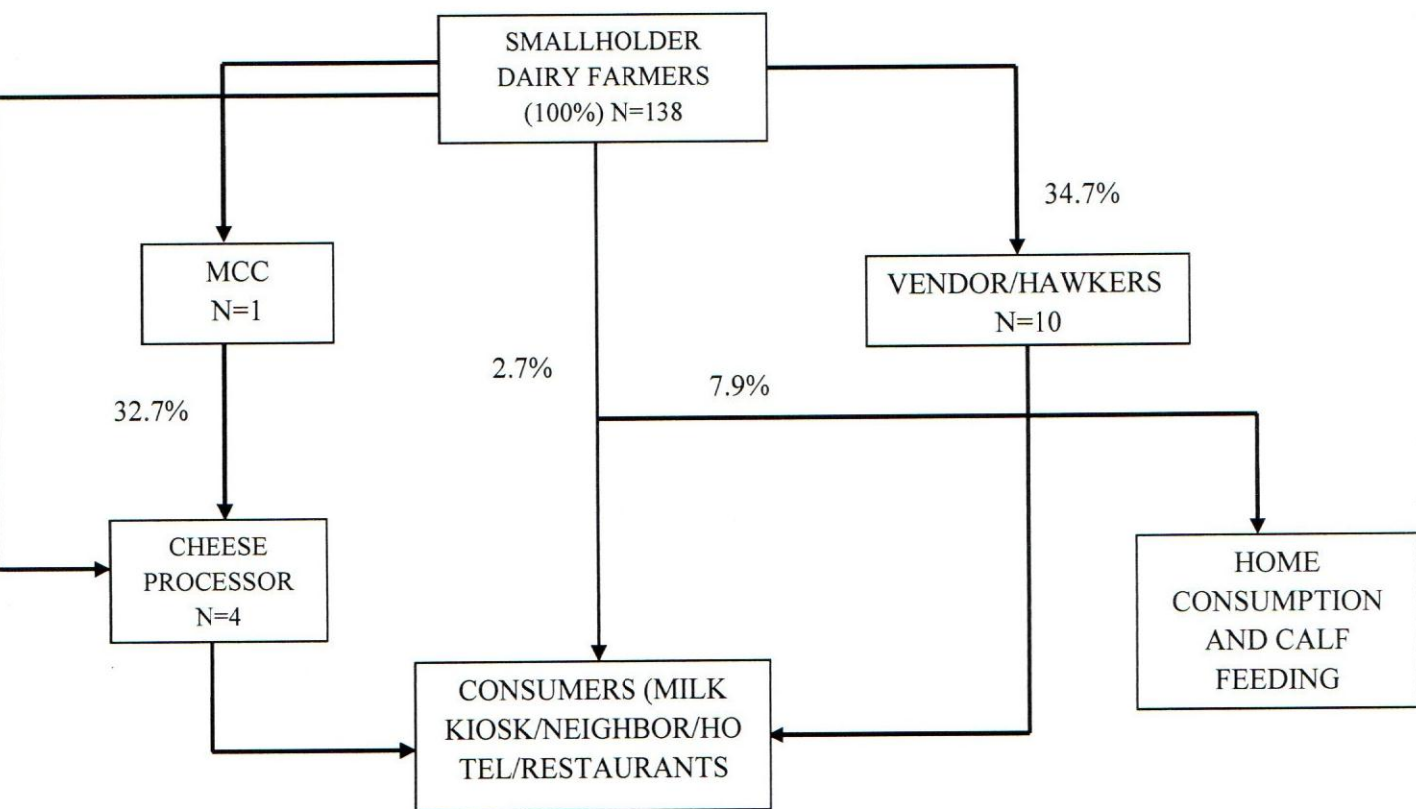


Figure 4: Detailed Market Channel of raw Milk

4.4 Raw Milk Pricing

There is variation in price of milk between the wet and dry season, with lower price during the wet season. However despite of the seasonal variation in price; different prices were offered by different market agencies. Farmers who were selling milk through the MCC were receiving the lowest price (560Tsh) compared to those selling through the vendors (700Tsh) or direct to cheese processors (600Tsh). Generally the price per one litre of milk was between 560Tsh and 800Tsh. Table 6 shows the price offered by different marketing agents. Among the market agents vendors' were offering the highest price. Vendors sell one litre of milk to the final consumers at a price between 800Tsh and 1200Tsh. The payment scheme by vendors is cash on sale while for cheese processors and the MCC is on monthly basis. However, even before the date of payments farmers were allowed to take some inputs for their animals on credit. The input offered was feeds (concentrates) with agreement to recover from the milk proceeds. Farmers were also given informal training by the cheese processors on the production of good quality milk especially in the area of milk handling and hygiene.

Table 6: Farm Gate Price for Raw Milk by different Marketing Agents

Marketing agent	Price offered (Tsh)	
	Wet season	Dry season
Vendors	700	800
Cheese processors	600	700
MCC	560	560

Source; survey data 2012

4.5 Milk Market Information

Different market information was given by different marketing agencies. The preference of cheese processors and the MCC was information on the quality aspect of milk while that of vendors was on the price of milk. However other types of information were also given. Table 7 shows the different types of information as sourced from different channels.

Table 7: Sources of Raw Milk Market Information for Farmers

Source of market information	% Using source of market information on			
	price	volume to supply	quality	price, volume to supply and quality
Processors	1.6	8.9	16.3	0.0
MCC	38.2	0.0	0.0	0.0
Extension worker	0.0	0.0	0.0	0.8
Vendors	21.1	2.4	0.0	0.0
Both processors, vendors and MCC	7.3	3.3	0.0	0.0

Source survey results; 2012

4.6 Cheese Processing

Cheese processing in Poli Division in Arumeru district dates back to 1989 when the first small scale cheese processing plant was established. The idea of cheese processing was a means of trying to reduce milk losses which occur in high volumes during the rainy season. Poor road infrastructure was limiting the transportation of raw milk from the highlands of Arumeru to the main road leading to Arusha municipality. Given these difficulties, the idea of transforming milk into preserved dairy products was introduced to the farmers. Cheese is among the dairy products that can be easily adapted by small scale rural based processing conditions; it does not require intensive training and can be easily stored. Also all equipment needed for cheese processing was locally available with the exception of rennet which was procured from outside the country. The mild cool climatic condition of this area allow for storage of cheese even without a refrigerator. Alongside cheese making, biogas plants were introduced by CARMATEC with financial assistance from GTZ to assist farmers in getting cleaner and safe energy that could help reduce deforestation around Mount Meru.

Since then the number of small scale processors around Poli division has increased to four. Women are the key players in the small scale cheese processing chain, as they were targeted by the NGO's to enable them increase their income. "Mountain Green" was the first small scale cheese processing plant established in 1989, followed by "Gitumi Women Group" in 2001, "Manna Women Group" in 2006 and lastly "Uvingu Women Dairy Group" in 2010. The startup capital for these processors was sourced from different channels; GTZ provided grants for the Mountain Green, whereas SIDO provided credit to the Uvingu Women Dairy group. The rest obtained capital from family, friends and own savings. Depending on capacity and capital, the small scale cheese processors process a different array of products. Mountain Green is the key leading processor with capacity of processing four different products namely; cheese, ghee, butter, yoghurt and fermented milk. Although the major objective for these processors is cheese processing, the production of other products is usually done during the period of low cheese demand which falls between April to June. During this period of the year the number of tourists is dramatically reduced and since they are the major consumers of cheese, this result into reduced demand for cheese. However Mozzarella cheese consumption is not much affected by the

tourists' season; this is because the product is mainly for Pizza making and local populations are also fond of Pizza. Table 8 shows the types of products as per processor.

Table 8: Different Dairy Products Processed by the Small Scale Dairy Processors

Product	Processors			
	A Mountain Green	B Uvingu Women Dairy Group	C Gitumi Women Group	D Manna Women Group
Cheese	√	√	√	√
Yoghurt	√	-	-	-
Ghee	√	-	√	-
Cream	√	-	-	√
Butter	√	-	-	√
Fermented milk	√	-	-	-

Source; survey data 2012 – Not processed, √ = processed

4.6.1 Cheese Marketing

Marketing of cheese is done by the processors without middle men between the processors and the secondary consumers. Cheese processors source information from the market about the demand of certain type of cheese by visiting the potential consumers and place orders. The Supermarkets were the most reliable market for the cheese processors. However small scale cheese processors faced competition from the imported cheese mainly from Kenya (KCC), Switzerland, South Africa, Holland, Switzerland and Austria. During the time of survey none of the processors were able to export their products this was partly due to lack of registration by the Tanzania Bureau of Standards, low quality packaging materials and due to low production capacity. Only one processor had official certification by TBS, the rest were still in the process of being certified.

4.6.2 Cheese Consumption

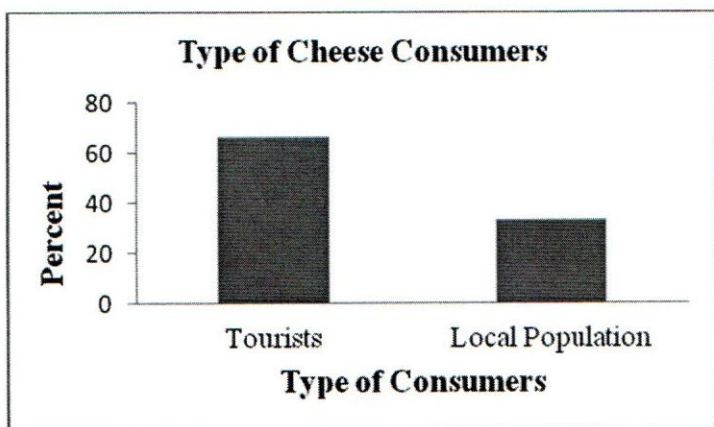
For this study, five different market places as listed by the processors were visited and information about the consumer preference on locally produced cheese as compared to imported cheese was obtained. The market places visited were; Sakina Supermarket, Rotterdam Supermarket, Pepe Pizza Restaurant, Ndotu Lodge and Mountain Village resort. Only one of these is located around Arumeru District and the rest were located in Arusha Municipality 20km away from Arumeru District. Sales Managers were interviewed, and information solicited included cheese consumption, the number of customers and the type of cheese they bought. The respondents indicates that Cheddar was the most preferred cheese type (60%), followed by Mozzarella (30%), and other cheese types represented by 10%.

Tourists' were the major customers for cheese (66.7%); the consumption by local population was only 33.3%. Both local and imported cheeses were sold in these places. In the tourists resorts/hotels and the restaurant's the major type of cheese purchased was Mozzarella for Pizza making. The hotels/restaurants had a contract with the local processors for the quantity of cheese to supply. The whole price for one kilogram of cheese ranges from 10,000Tsh to 16,000Tsh depending on the type of cheese and brand as indicated in table 9. Other cheese products like crackers and cheese spreads were imported from outside the country.

Table 9: Whole sale Cheese Prices per Kg

cheese type	Price (Tsh)
Mozarella	10000
Gouda	12000
Feta	10000
Cheddar	16000

Source; survey data 2012



Source; survey results 2012

Figure 5: Cheese Consumption as Reported by Cheese Outlets

4.7 Value Chain Analysis

Value chain analysis is essential for understanding of markets, their relationships, the participation of different actors, and the critical constraints that limit the growth of dairy industry and consequently the competitiveness of small scale cheese processors. The value chain analysis of small scale cheese processing in Arumeru district provides a systematic flow of product (cheese) from the producers to the secondary consumers. The cheese value chain involves three major value adding activities; production, marketing and secondary consumption.

4.5.1 Mapping of Actors and Product flow in the Cheese Value Chain

The key actors in cheese value chain were the raw milk suppliers (small scale dairy farmers), transporters of raw milk, processors, transporters of cheese and the secondary consumers. This study did not take into account the individual consumers of cheese as it was difficult to collect the data pertaining to individual consumption. Raw milk takes different market channels before reaching the cheese processors. The major channel is through the MCC accounting for 32.7% of the processed milk. Also farmers have an option of selling the milk direct to the processors accounting of (22%) of the milk sold through the formal channel. Milk sold through the vendors was neither preferred by the cheese processors nor by the MCC. Milk vendors were blamed for adulteration thereby reducing the quality of milk to undergo processing. The major form of adulteration identified was through addition of water or wheat flour and water. Milk given to calves, consumed at home, and the volume sold through the informal channel was not considered for this value chain.

The processors can sell the cheese direct to hotels where they use it for making Pizza, or to tourists' resorts and supermarkets where they sell the product to the final consumers. The market channel through which the cheese move are shown in figure 5 below;

1. Cheese processors —————> consumers (tourists' resorts)
2. Cheese processors —————> consumers (supermarkets)
3. Cheese processors —————> consumers (pizza restaurants)
4. Cheese processors —————> consumers (local shops)

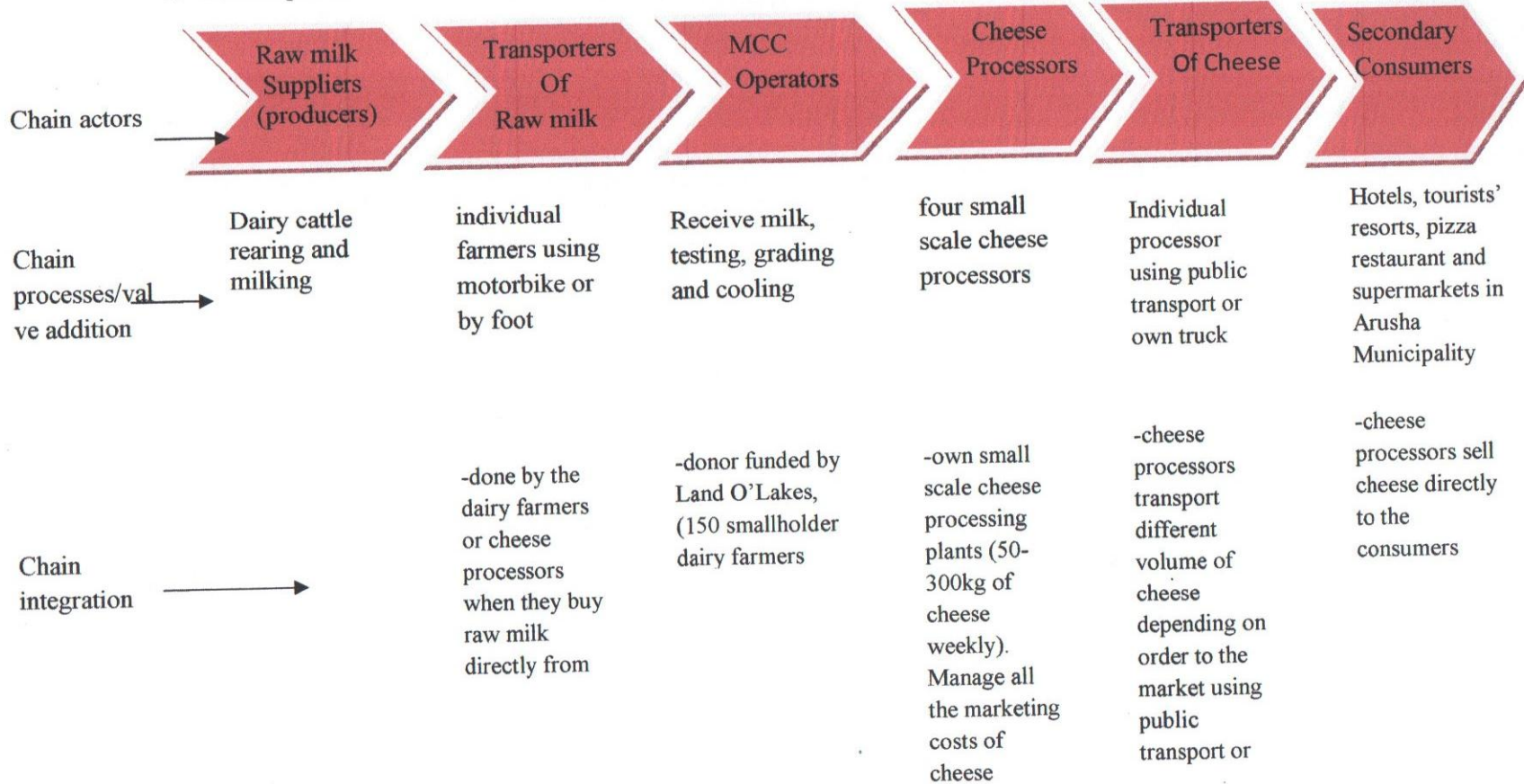


Figure 6: Mapping the Cheese Chain

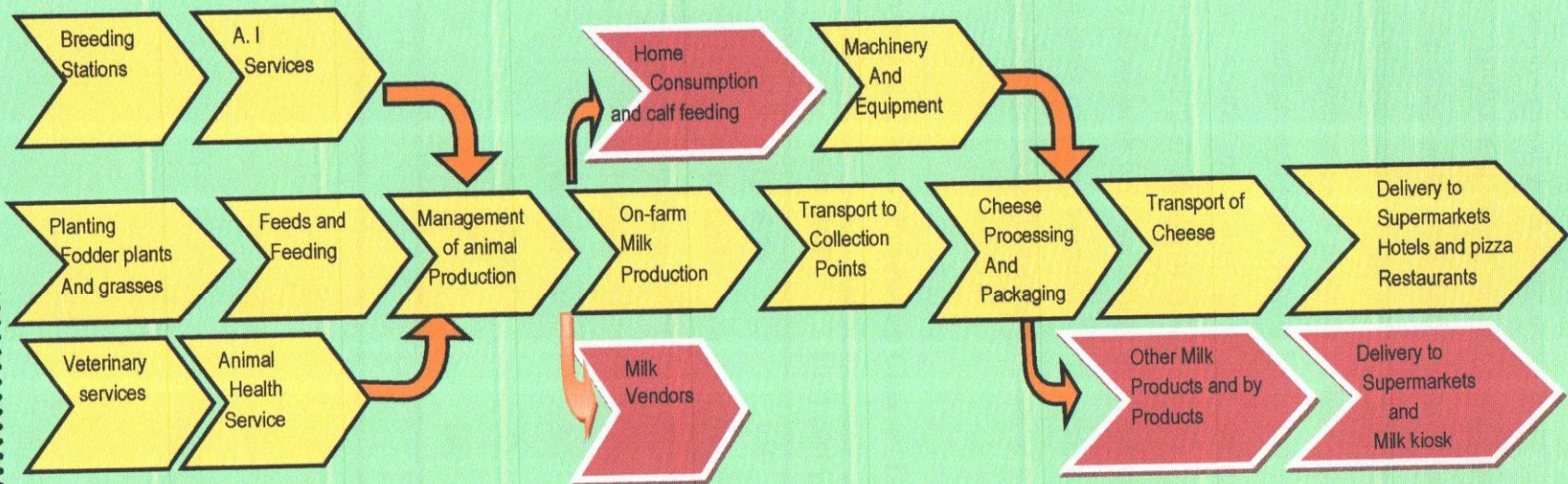


Figure 7: Cheese Value Chain Analysis

4.7.2 Production and Marketing Costs of Cheese

Different costs are incurred by different chain actors in bringing the product to the final consumers. To produce 1kg of cheese one need to use between 10-12 litres of milk depending on the type of cheese to be processed. Milk is the major input for cheese processing, plus the starter cultures (rennet), salt, labour and other related costs. Transport cost of the cheese to the consumers is part of the processors costs as there were no market intermediaries in between processors and the market destination. Three out of four processors use public transport and load the cheese into cool boxes with only one processor using a box body truck (unrefrigerated). None of the processors use a refrigerated truck, reason being costs of maintenance and the volume of cheese produced. The volume of cheese produced varies from one another. The leading processors produced between 200-300 kg of cheese weekly; the rest were producing between 50-100 kg per week. The processors were including only the paid labour as part of their production costs and exclude the costs of group members in the production chain. Raw milk accounts for about 84% of all the production costs. The average costs of producing 1kg of cheese are outlined in table 10.

Table 10: Detailed Average Costs of Producing Cheese (Tsh/Kg)

Item	Quantity	Unit cost (Tsh)	Total cost (Tsh)
Raw milk	10 litres	650	6500
Rennet	0.10ml	100	100
Salt	0.02gm	700	700
Packaging materials	1.00pcs	200	200
Starter culture	0.02ml	50	50
Labour	man-day	43	43
Other costs		100	100
Total			7693

Source; survey data 2012

Table 11: Average Marketing Costs of Cheese (Tsh/Kg)

Item	Unit cost (Tsh)	Total cost (Tsh)
Transport (trip)	17.14	17.14
Packaging materials	100.00	100.00
Storage	71.43	71.43
Other costs (losses)	100.00	100.00
Total	288.57	288.57

Source; survey data 2012

4.8 Market Margin Analysis

Marketing costs and margins of a particular commodity reflect the efficiency of a system to a great extent. The analysis of marketing costs and margins of dairy plants would help in reducing the unwarranted costs in marketing of dairy products. The economic efficiency and success of a dairy plant largely depends on the effective management of operations like milk procurement, processing and distribution of dairy products. An efficient marketing system is one, which minimizes the cost of marketing services to ensure the largest share of producer in the consumer shilling. On the other hand, the consumers should be provided with quality dairy products at a reasonable price.

In this section, marketing margins are presented per destination markets (supermarkets, tourist resorts/hotels and pizza restaurants). Price averages of the main destination markets have been considered to give insights to the magnitude and direction of changes in profits and margins. The difference between the price per kg of cheese at the processors' gate and the price per kg when sold to the final consumer (the retail price) is termed as the total gross marketing margin or alternatively, the total price spread (Smith 1992). Market prices reflect two elements; marketing and transaction cost on one hand and normal profit on the other.

Based on the data on selling and buying prices and applying the gross marketing margin calculation formulae presented in chapter three, the marketing margins for the three destination markets in the supply chain are shown in Table 12. The processors' share of the consumer's price was found to be the highest along the supermarket channel followed by the Pizza restaurants and lastly the tourists' resorts/hotels represented by 92%, 83% and 80% respectively.

Table 12: Market Margin Analysis for different Cheese Market Channels

Particulars	Market channels		
	Supermarket	Tourists' hotels	Pizza restaurants
Retail price per Kg Tsh (consumers price)	13,000.00	20,000	12,000.00
Processor price per Kg Tsh (farm gate price)	12,000.00	16,000	10,000.00
Processor' retail price spread	1,000.00	4,000	2,000.00
Processors' share (GMM) (%)	92.00	80	83.00
TGMM (%)	7.69	20	16.67

Source; survey data 2012

The processors' share of the final price in the supermarket chain is 92% higher than the other distribution channels. The higher processors' share of the final price in the supermarket (92%) and Pizza restaurants (83%) market channel is due to the presence of many actors in these channels. The supermarkets again sell the cheese to tourists' hotels or the pizza restaurant which is different for the tourists' hotels channel as they sell the product direct to the final consumers. Information asymmetry along the marketing channel leads to risks and uncertainties in transaction thereby increasing the margin (Williamson, 1989). Information asymmetry occurs when buyers are more informed about the demand of the product but sellers/cheese processors are least informed about the supply chain. Moreover costs of production vary with different processors' hence the variation in price and margins in the different markets where they sell their products. Existence of collective marketing structures (commonly cooperatives) with sufficient market power creates buying competition in local markets, forcing up prices (Mitchel *et al*, 2009). In price-taking environments such as these, private buyers must make their offer at least as attractive as that of the cooperative in order to compete to purchase farmers production.

Also the decline in the producer share of the retail price can be due to rise in the margin of retail prices over fob prices (Gilbert, 2006). The principal explanation of the rise in the margin of retail prices over fob prices is the rise in labor costs unmatched by productivity. However, that reduction can be offset by effects of market liberalization and reduced export taxation.

4.9 Market Participation by the Dairy Farmers

The aim of this section is to look at factors that affect market supply of raw milk to the formal market (cheese processors or MCC). Some households may not prefer to participate in a particular market in favour of another, while others may be excluded by market conditions. Based on the data collected, out of 150 small scale dairy farmers 49 of them are non-participants while the rest 101 are market participants. Those considered as market participants were those who sell milk through the formal channel (cheese processors and MCC), the informal channel was regarded as non participant.

Heckman two step selection models were used to identify the factors that determine the milk market participation and the level of participation. The first step of the procedure involves establishing the probability of participation in the market by estimating a probit model. For the second step the level or volume of sales was estimated by Ordinary Least Square (OLS) model. Before running the Heckman selection models, normality of the data, and multicollinearity tests were carried out. The continuous explanatory variables were checked for multicollinearity using Variance Inflation Factor (VIF); while Contingency Coefficients (CC) was used to detect the degree of association among the discrete explanatory variables. According to the results in Appendix 1, problems of normality, and multicollinearity were not observed.

4.8.1 Determinants of Market Participation by the Smallholder Dairy Farmers

The participation of small scale dairy farmers in milk marketing was found to be significantly influenced by sex of the respondent, distance to the market, number of cross breeds, number of milking cows, volume of milk produced and the price of milk. Table 13 shows the probit regression results for the first step of market participation; the decision for the farmers to participate in the formal milk marketing.

The sex of the household head is statistically significant at both 1% 5% and 10% with a negative coefficient. Sex was a dummy variable taking the value of 1 if the household head was male and 0 otherwise. It was expected that the sex of the household head to be significant with positive coefficient. The marginal effect reveals that the probability of male household to participate in formal marketing was 31% lower than female house hold. However the results deviate from the expected sign. In mixed farming system, both men and women take part in livestock management. Generally, women contribute more labour input in area of feeding,

cleaning of barns and milking; but when comes to sale of milk and other dairy products men are the decision makers on whether to process and sell or to sell raw milk. Obstacles such as lack of capital, and access to institutional credit and extension service, may affect women's participation and efficiency in ruminant livestock production (Tanga et al., 2000). The results agree with the study conducted by Gizachew (2005) on dairy value chain analysis for milk which indicated negative relation between sale volume of milk and male-headed household. Also study conducted by Rehima (2006) confirmed the same result.

Distance to the market reduces transaction costs like transport, spoilage losses, better access to market information and storage. This improves return to labour and capital; increases farm gate price and the incentives to participate in economic transaction. The closer the market gives high probability for the farmers to sell to that market. The results in table 13 shows the distance to the market was statistically significant at 1%, 5% and 10% with positive coefficient as it was hypothesized. The marginal effect reveals that as the market become closer by one unit the participation in formal market would increase by 0.3%. A study conducted by Holloway et al (2002) on expanding market participation among smallholder livestock producers in the Ethiopia high lands revealed that distance to milk market was negatively related to milk market participation decision of dairy households. However in this study the coefficient is positive meaning that the small scale dairy farmers preferred to sell to the vendors as they come to collect milk from their premises hence no any cost associated with taking the product to the market. If MCC and cheese processors could think of a means of collecting milk from the farmers from this scenario we hope for more milk to be sold through the formal channel and not vendors.

Number of crossbreed cows the farmer kept, number of milking cows and the volume of milk produced were statistically significant at 5% and 10%. The volume of milk produced had a positive coefficient implying that farmers will make decision to participate in the market with regard to the milk output. Marginal effect results showed that the decision to participate in the formal market will increase by 5% for any additional litre of milk produced. The entry to milk market and marketed milk volume are assumed to be positively influenced by the number of milking cows owned. Volume of milk produced in turn varies directly with the number of lactating dairy cows. As the number of lactating cows increases, production also increases and the percentage share of consumption declines and sales increases (Holloway et al., 2002).

The study conducted by Holloway et al. (2002) in the Ethiopian high lands on expanding market participation among smallholder livestock producers indicated positive and significant relation between milking cow numbers and market participation and marketable milk volume. Further, study conducted by Gizachew (2005) confirmed positive and significant relation between market participation decision by dairy household and marketable milk volume. Since farmers are constrained by flow of liquidity, their decision to participate in a given market will be driven by cash. MCC which absorbs most of the farmers is the least paying marketing agent.

Price was statistically significant at 1%, 5% and 10% but with a negative coefficient. Farmers were having three options on where to sell milk; either selling through the MCC, cheese processors or to milk vendors. However these different three markets were offering different prices. MCC was offering the least price while milk vendors were giving the highest price. Selling to MCC or cheese processors was regarded as reliable market as there were no fluctuation in price and volume purchased in wet and dry seasons. The marginal effect results showed that selling to formal market (MCC) which was offering the least price could reduce the farmers' cash by 0.3% for each litre of milk sold through this channel. However there were other benefits to farmers in this channel as access to credit for buying feed and paying for other related costs even before the date of payment.

Table 13: Probit Model Coefficient Estimates and Marginal Effect

Variable	Marginal Effect	Standard Error	z	P> z 	Coefficients
House hold size	0.12264	0.08765	1.40	0.162	0.46722
Sex of respondent	-0.31964	0.09404	-3.40	0.001***	-1.36120
Age of respondent	-0.00005	0.00764	-0.01	0.995	-0.00019
Education level	0.00880	0.07027	0.13	0.900	0.03354
Distance to the market	0.00321	0.00078	4.10	0.000***	0.01222
Experience in dairy	0.00187	0.00940	0.20	0.842	0.00712
Other occupations	0.03123	0.02531	1.23	0.217	0.11899
Number of milking cows	0.46690	0.14871	-3.14	0.002**	-1.77880
Volume of milk produced	0.05002	0.01297	3.86	0.000***	0.19058
Number of crossbreeds	0.15690	0.06001	-2.61	0.009**	-0.59775
Price per 1 litre of milk	-0.00383	0.00108	-3.53	0.000***	-0.01457
Constant		3.55499	2.96	0.003	10.52313
Number of obs	106.00				
LR chi2(11)	62.43				
Prob > chi2	0.00				
Pseudo R2	0.48				

*significant at 10%, **5% and ***significant at 1%.

4.9.2 Determinants of Marketed Milk Volume

The second step is an OLS regression of the milk sales volume on the reduced regressors and the inverse Mills ratio (IMR) derived from the first-stage probit regression, which controls for the probability of market participation so that the remaining regressors are explaining sales volumes conditional on a given probability of market participation. Table 14 shows the OLS results for the extent of market participation. Sex, education level, experience in dairy farming and volume of milk produced were significantly influencing the volume of market supply.

Volume of milk out put affects both the decision to participate in marketing and the volume to be supplied to the market and it was significant at 1%, 5% and 10% with a positive coefficient. A reduction in one litre of milk produced will decrease the volume of market supply by 88 litres. With more milk produced dairy farmers are likely to sell in the formal market than through the informal market channel.

Experience in dairy farming though not significant in the first step but for the second step is significant at 5% and 10 % with a positive coefficient. This implies that an increase in one year of experience in dairy farming will increase the volume of market supply by 6 litres. Those with much experience in dairy farming are likely to be selling to the MCC/cheese processors than those who are just entering the market. Reason being that with much experience, one is able to study the nature of different markets and the risk associated with those markets. Vendors are regarded as the risky marketing agents because sometimes when milk spoilage occurs because of other factors rather than those associated with the farmer; they brought milk back and demanded the reimbursement.

Education level was positively influencing the amount of market supply at 10% significant level. This reveals that an additional year of schooling will increase the volume of market supply by 38 litres. Education enhances farm productivity directly by improving the quality of labour, by increasing the ability to adjust to disequilibria, and through its effect upon the propensity to successfully adopt innovations (Weir, 1999).

Table 14: OLS Results (second step)

Milk sold	Coefficient.	Std. Err.	t	P> t
Household size	-0.151318	0.290462	-0.52	0.603
Sex of respondent	-0.819869	0.363297	-2.26	0.026**
Age of respondent	-0.003223	0.023860	-0.14	0.893
Education level	0.383274	0.229077	1.67	0.097*
Distance to the market	0.000610	0.002155	0.28	0.778
Experience in dairy	0.066091	0.030206	2.19	0.031**
Number of milking cows	0.127744	0.400442	0.32	0.750
Volume of milk produced	0.908463	0.022956	39.57	0.000***
Price of 1 litre of milk	-0.003179	0.003238	-0.98	0.328
Constant	-0.338021	2.180985	-0.15	0.877
Number of observation	120.000			
Prob > F	0.000			
R-squared	0.986			
Adj R-squared	0.985			
Root MSE	1.849			

*10% significant, **5% significant and ***1% significant

4.10 Constraints and Opportunities in the Cheese Value Chain

During the survey the raw milk suppliers and processors listed the following challenges which results into inefficient cheese processing in the study area. The findings are presented in table 15.

Table 15: Constraints and Opportunities in the Cheese Value Chain

Major Opportunities	Constraints standing in the way of realizing the opportunity	Potential for growth
1. Unsatisfied supply of local cheese	low production capacity for cheese processors lack of legal certification by some processors limited variety of locally processed cheese lack of infrastructures (electricity) by some processors unavailability and high costs of cultures	Financial support to increase capacity utilization Legal certification Improvement of infrastructure
2. The growing demand for local Cheese in Arusha	low quality of locally processed cheese financial constraints for the processors seasonal fluctuation in supply of raw milk competition from imported cheese lack of training and technical support to cheese processors poor quality packaging materials	Formal training to cheese processors Strategies for year round milk production Availability of quality packaging materials
3. Efforts by the Government to increase milk production	informal milk marketing small number of milk cooling centres lack of technical training to farmers for hygienic milking practices small number of small scale cheese processors seasonal fluctuation of feed supply for dairy cattle low price for raw milk in the formal channel	More milk collection centres Price setting for raw milk Strategies for year round feed supply

4.11 Areas of Strategic Intervention in the Cheese Value Chain

The critical interventions in improving the cheese value chain need to focus at boosting the raw milk supply to higher levels and create a sustainable flow of milk for processing. Rising milk supply is required in terms of; Constant year-round supply, higher daily supply volumes from small scale farmers who supply the cheese processors, rising average quality and reduction of losses due to spoilage, improving the management of herds in terms of feeds and feeding, breeding by encouraging the use of A.I services at affordable rates and improving the overall chain cheese in terms of equipments, training packaging and marketing of cheese. Figure 8 shows the areas of strategic intervention in the cheese value chain with the description of the areas below.

Area 1: Improving the dairy cow management practices will increase the volume of milk yield. This can be achieved through improved feeds and feeding and training of farmers on the best practices for dairy cattle keeping. A study by ILRI, (1995) has highlighted feeding and nutrition as the major constraint in dairy production globally.

Area 2: To achieve high milk yield the genetic potential of the animal is an important factor. Therefore encouraging the use of A.I services to improve the genetic potential of the local breeds will ultimately increase milk yields.

Area 3: Reducing the volume of milk traded through the informal sector. To increase cheese production more milk need to be traded through the formal sector; this can be achieved by increasing the number of milk collection centres, forming farmers' cooperative groups to enhance milk collection and training farmers on the importance of selling milk in the formal sector. Price paid per litre of milk need to be considered when planning for introducing more milk collection centres and also premium pays for the best quality milk could encourage farmers to adhere to the hygienic standards which will result into low losses due to spoilage.

Area 4: Targeting the small scale cheese processors' by provision of financial assistance for purchasing quality equipments for cheese processing. This will improve the quality and quantity of cheese processed to be able to compete with the imported cheese.

Area 5: The intervention in the whole process of cheese marketing. Cheese processors are lacking technical skills in production of different types of cheese and business management skills. There is need for training to the processors to meet the demand of different types of cheese in the market.

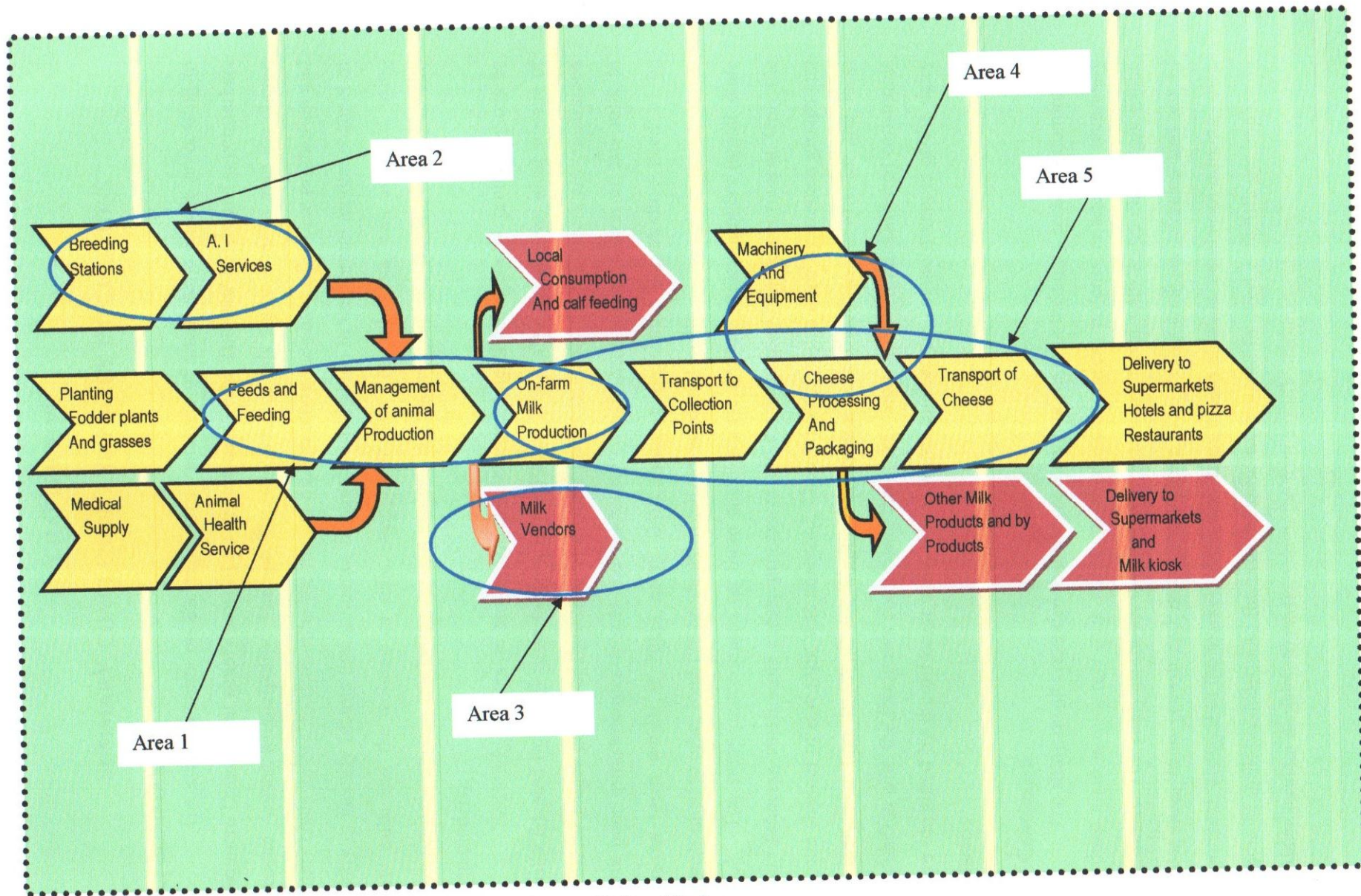


Figure 8: Areas of Strategic Intervention in the Cheese Value Chain

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 SUMMARY

The study focuses on the value chain analysis of small scale cheese processing in Arumeru District that supply most of the cheese sold in the Tourists' hotels and supermarkets around Arusha Municipality. The specific objectives of this study were to map the cheese value chain actors, to determine the market margin along the chain of cheese production and lastly to identify factors that influence farmers' participation in the formal market channel of raw milk and the volume of milk supplied to this channel. Data was analyzed using descriptive statistics, marketing margin analysis and the econometric models (Heckman two step models).

The study focuses on small scale cheese processing because cheese processing can be easily adapted by small scale farmers in rural areas and it also provides an ideal storage of milk for longer period of time than other milk products. Rural dairy farmers are constrained with poor infrastructures (roads and electricity) which limit transportation of raw milk to Arusha town which is 20km away. Milk being a perishable commodity; need to be transformed to other long life products which can be stored easily.

The study concentrated on three chain actors; the raw milk suppliers (small scale dairy farmers), small scale cheese processors and the secondary cheese consumers. Only the formal channel of raw milk was analyzed. Cheese processing is done by women groups and at individual families. The consumption of cheese was found to be low for the local population with the foreigners comprising the higher consumption level. Different constraints were identified by the different chain actors which hinders the competitiveness of the dairy industry.

5.2 Conclusion

The study results revealed that the cheese value chain in the study area was dominated by three main actors; raw milk suppliers, small scale cheese processors and the secondary consumers. The analysis shows that different actors are faced with some challenges which hinder them from growth and being competitive. The Probit analysis revealed that sex of respondent, distance to the market; number of cross breeds animals, number of milking cows, volume of milk produced and the price of milk were found to exert a significant impact on the dairy farmers decision to participate in the formal milk marketing channel.

Volume of milk produced was affecting both the participation decision and the marketed volume. Experience in dairy farming has an impact on the extent of participation since those with experience of more than 10 years were selling through the formal channel and those with less experience preferred the informal channel.

Furthermore the study identified that 1197 (54.7%) litres of milk per day were marketed through the formal marketing channel by the sampled farmers whilst 753 (34.7%) litres was traded through the informal channel. There were two milk collection centres in the study villages but only one with a capacity of 1200 litres per day was operating during the survey. The small scale cheese processors were able to process between 50-300kg of different cheese variety depending on the production capacity. None of the processors was exporting the cheese outside the country. Lack of legal business license and limited financial capital were some of the constraints that limit the growth of small scale cheese processors. Small scale dairy farmers were constrained with lack of quality feed especially during the dry season and availability of improved breeding stock to upgrade their animals. The cheese market channel that supplies the tourist hotels was receiving the highest price than the supermarket and the Pizza restaurants market channels. Cheese consumption by the local population was relatively low (33.3%) as compared to the consumption by non nationals (66.7%).

5.3 Policy Implications

Based on the results of this study, the following policy implications are recommended to be considered in the future intervention strategies which are aimed at the promotion of dairy production, processing and marketing in the study area in particular and in the country in general.

The results have shown that policy relevant variables were having greatest impact on milk market participation decision by the smallholder dairy farmers and the volume supplied to the formal market. The number of cross breeds, distance to the market, volume of milk produced, number of milking cows and milk price were affecting farmers' decision to participate in the formal milk marketing. To realize more milk production and processing and consumption of various dairy products in the country these variables needs immediate action.

Establishment of more milk collection centres and encouraging farmers to form dairy cooperatives will improve the formal marketing channel of raw milk. Price of raw milk was negatively affecting farmers' participation in the formal chain. Since farmers have liquidity

constraint they rather prefer selling to the cash on sale market (informal channel) which also offers the highest price. Therefore there is a need for the government to regulate price of raw milk and if possible to set a price that will attract farmers to sell in the formal market.

The distance to the nearest formal milk market was positively related to milk market participation decision. This positive valued relation of the variable indicates that the closer the milk market, the lesser would be the transportation charges, reduced loss due to spoilage, and reduced other marketing costs. Thus, the Government through the Ministry of Livestock and Fisheries Development should consider better means of coping with access problems to milk and other dairy products market through increasing dairy market outlets by forming market oriented dairy producer led-cooperative, and increasing and improving infrastructure facilities in order to reduce transaction cost associated with distance from milk market outlets.

The processing sector is constrained with lack of sufficient financial capital, machinery, cheese cultures, quality packaging materials and business trade license. These constraints have constrained the growth of this important sector in the dairy industry. The Government has to decentralize the procedures of obtaining business license to reduce the bureaucratic procedures which takes long to obtain the legal license. Also the Government should find a means to enable the processors to promote a dairy credit cooperative for easy access to credit by the processors and the dairy farmers.

If the aforementioned constraints will be tackled the outcome will be increased milk production and more milk channelled through the formal channel thus more milk products produced locally ultimately there will be reduction in imported dairy products which drain foreign exchange. On the other hand, increased dairy production need to be in line with increased consumption of the same. Therefore there is a need for promoting the consumption of dairy products especially cheese which is relatively less consumed by the local population as compared to other products.

Since the study gives the overview of the value chain analysis of small scale cheese processing, there is a need to conduct further studies for an in depth analysis of each node in the chain to identify the most weak node for improvement.

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APPENDICES

APPENDIX 1

Multicollinearity test results for continuous and discrete variables

Table 16, Test for multicollinearity for continuous variables

Variable	VIF
Size of the household (total family members)	1.11
Age of respondent (years)	2.182
Education level of household head (years)	1.232
Distance to market (Km)	1.89
Experience in dairy farming (years)	2.253
Volume of milk produced per day (litres)	8.182
Number of milking cows	7.916
Price of milk received in dry season (Tsh)	3.416

Table 17, Test for multicollinearity for discrete variables

Variables	SEX	AMINF	AVES
Sex of respondent (SEX)	1		
Access to market information (AMINF)	0.03	1	
Access to veterinary services (AVES)	0.11	0.3	1

Appendix 2

QUESTIONNAIRE FOR SMALLHOLDER DAIRY FARMERS IN ARUMERU DISTRICT, ARUSHA REGION

Introduction

This survey has the objective of assessing the cheese value chain with special focus on small scale cheese processing industry in Arumeru District concentrating on the extent, prospects and challenges/constraint. Respondents have been randomly selected to participate in this survey and your **VOLUNTARY** participation in this survey is highly appreciated. Information you will provide will be completely **CONFIDENTIAL** and will be analyzed together with those of other actors in Arumeru District for academic purposes only. The findings from this study will be used to understand the challenges faced by dairy stakeholders in these areas and we hope to come up with recommendations that will help in improving farmers' conditions. I thank you in advance for your co-operation and understanding.

NAME OF ENUMERATOR:	FILLED IN BY: _____
Date: (dd/mm/yy) [_ / _ / _]	1) _____
Value chain actor category: [_]	District: [_]
	Ward: [_]
	Village: [_]

CODES

District	Village
1= Arumeru	1 =
	2. =
	3. =
Value chain actor category	
1=dairy farmer	

SECTION A: BACKGROUND INFORMATION

1. Respondent's Name _____
2. **HH Size:** Adult ___ 5-15 yrs ___ Under 5 Yrs ___ [insert actual numbers]
3. **Background**

Sex of respondent	Age of respondent (yy)	Type of agric/livestock kept	Size of farm (acres)	Position in Household	Education level	Distance to market (km)	Experience in Dairy farming started (yy: mm)	Source of initial financing	Other occupations
[_]	___ yrs	[_]	_____	[_]	[_]	_____	_____	[_]	[_]

CODES

Sex of Respondent	Type of Agricultural /Livestock activities	Position in Household	Source of initial financing	Other occupation
1. =Female	1 = Traditional cattle	1. = Household head	1 = Self-financing	1. = None
2. = Male	2 = Improved dairy cattle	2. = Spouse	2 = Family /friend loan	2. = herding/stockman
	3. = Local chicken	3. = Employee	3 = Credit (specify creditor)_____	3. = Salaried employment
	4. = Broiler chicken	4. = Others (Specify)	4 = Credit in kind (HIT, GIT)	4. = Retired with pension
	5. = Local Goats	Education level:	5 =(Others specify)	5. = Retired without pension
	6. = Dairy Goats	1. = Primary school		6. = Businessman/woman
	7. = Permanent crops	2. = Secondary school		7. = Others (specify)
	8. = Annual crops	3. = Certificate		
	9. =Other specify)	4. = Diploma		
		5. = University degree		

SECTION B: PRODUCER INFORMATION ON DAIRY/ PODUCTION

B.1 DAIRY HERD STRUCTURE

	Traditional cattle	Improved dairy cattle	Total
Adult Bulls			
Adult steers (castrated)			
Adult Cows milking			
Adult cows dry			
Heifers 2-3 year pregnant			
Heifers 2-3 years not pregnant			
Heifers 1-2 year			
Heifers less than one year old			
Bull calves > 1 year			
Bull calves less than 1 year			

B.2 Breeding methods and reproduction

Method used in breeding cows/heifers	If Natural mating, whose bull is used	If Bull used, How much charged (Tshs)	If AI is used, who provides the service	How much is charged for insemination (Tshs)
[__]	[__]	_____	[__]	_____

CODES

Breeding method	Owner of Bull	AI Provider
1. = Mating with Bull	1=own bull	= private inseminators
2. = Artificial insemination	2= Neighbors bull	=group employed inseminator
	3= Group own bull	=government inseminator
		=other (specify)

B.3 Feeding practices

Method used in feeding cows/heifers	If Grazing , area under pasture (Ha)	If zero grazing, source of fodder	If using planted fodder, Area planted	If planted fodder, type	What is the type of Concentrates given	Av. Amount of compounded concentrates given per cow per day (Kg)	Price of concentrate per kg (Tshs)/Ingredient
[__]	_____	[__]	_____	[__]	[__]	_____	_____

CODES

Feeding method	Source of fodder	Type of fodder planted	Concentrates given
1. = Pasture grazing	1.= Planted fodder	1. = Napier grass only	1.= Home compounded
2. = Cut and Carry zero grazing	2. = Public land fodder	2. = Guatemala grass	2.= Purchased compounded feed
3= Part grazing part cut and carry	3. = Road side fodder	4.= Fodder trees (e.g Leuceana, glycidia)	3.= Maize bran only
4= Other specify	4.= Purchased fodder	4. Other specify	4.= none
_____	5.=other (specify)	_____	5.=Other ingredients (specify)

B4: Information on livestock and livestock products sales

B4.1 . Livestock sales in the last 2 years

Cattle	Traditional cattle (count)	Improved dairy cattle (count)	Total	Average price received (Tshs)	Reasons for selling (code)
Adult Bulls					[__]
Adult steers (castrated)					[__]
Adult Cows milking					[__]
Adult cows dry					[__]
Heifers 2-3 year pregnant					[__]
Heifers 2-3 years not pregnant					[__]
Heifers 1-2 year					[__]

Heifers less than one year old					[__]
Bull calves > 1 year					[__]
Bull calves less than 1 year					[__]

CODES

Reasons for selling

- | | |
|------------------------------|---|
| 1=Too old | 4= to meet household cash needs |
| 2= Not producing enough milk | 5= excess of number can accommodate (Lack of space) |
| 3= was sick | 6= Inadequate feeds |
| | 7= Others (specify) _____ |

B4.2: Milk production in last 12 months

Number milking cows (count)	Method of feeding calves	Volume of milk produced/day	Volume of milk given to calves/day	Volume of milk consumed at home
_____	[__]	_____	_____	_____

CODES

Method of feeding calves	1. Partial suckling	2. Bucket feeding	3. Others (specify)

B4.3. Milk marketing in last 12 months

Do you sell milk? 1. Yes 0. No.

Volume of milk sold per day	Where milk is sold	Distance to where milk is sold	Mode of transport used	Time taken to reach selling point (hrs)	Vessel used to transport milk	Price received in dry and wet season
_____	[__]	_____	[__]	_____	[__]	Dry: _____ Wet: _____

CODES

Where milk is sold	Mode of Transport used	Vessel used to transport milk
1. = milk cooling centre/processing plant	1. = on foot	1.= Plastic jerry can (3-5 litres)
2. = neighbours	2. =using bicycle	2. =Plastic jerry can (10 – 20 litres)
3. = transported to market	3.= using own car	3. = Plastic bucket (10-20 litres)
4. = direct to hotel restaurant	4. =using public transport (daladala)	4. = Alumminium can (3-5 litres)
5 = milk vendors/hawkers	5. =using public transport (bus)	5. = Alumminium can (30-50 litres)
		6. = Other (specify) _____

If milk is transported on **public transport**, give transport costs: **Personal fare** (Tshs) _____

Product load fare (Tshs/vessel) _____ **Vessel type** [____]

B4.4: Market information

Do you access market information?	Who provide you with market information?	What type of information is given?
□	□	□

CODES

AMINF	Who provide MKTINF	type of information
1 = yes	1 = Processors	1 = price
2 = no	2 = extension workers	2 = volume to supply
	3 = Hawkers/vendors	3 = quality
	4 = others (specify)	4 = other (specify)

B4.5: Costs of producing milk in the last six months

Cost Item	No. of units/day/cow	Cost (Tsh)/day/cow
Fodder		
Concentrates		
Mineral supplement		
Labourer(s)		
AI services		
Transport of feeds		
Breeding (bull service)		
Equipment		
Veterinary drugs		
Veterinary service		
water		
Other costs		

5.0 What are the challenges you face in dairy farming and your suggestions?

Challenge	Suggestion

ASANTE SANA KWA USHIRIKIANO

QUESTIONNAIRE FOR PROCESSOR LEVEL VALUE CHAIN ACTORS

Introduction

This survey has the objective of assessing the cheese value chain with special focus on small scale cheese processing industry in Arumeru District concentrating on the extent, prospects and challenges/constraint. Respondents have been randomly selected to participate in this survey and your **VOLUNTARY** participation in this survey is highly appreciated. Information you will provide will be completely **CONFIDENTIAL** and will be analyzed together with those of others in Arumeru District for academic purposes only. The findings from this study will be used to understand the challenges faced by dairy stakeholders in these areas and we hope to come up with recommendations that will help in improving farmers' conditions. I thank you in advance for your co-operation and understanding.

NAME OF ENUMERATOR:	FILLED IN BY: _____		
Date: (dd/mm/yy) [_ / _ / _]	1) _____		
Value chain actor category:			
[_]	District: [_]	Ward: [_]	Village: [_]

CODES

VALUE CHAIN ACTOR CATEGORY

1= Milk processor District : 1=Arumeru

SECTION A: BACKGROUND INFORMATION

5. Respondent's Name _____ Sex _____ M/F 1a. Business Name (Where applicable) _____

6. Age: _____

7. Background

Type of ownership	Respondents position	Years since established	Type of suppliers	Source of initial financing	Av. Number of suppliers during wet season	Av. Number of suppliers during dry season	Volume of milk received during wet season	Volume of milk received during dry season	Price offered per litre during wet season	Price offered during dry season
[__]	[__]	_____ yrs	[__]		_____	_____	_____	_____	_____	_____

CODES

Type of ownership	Type of suppliers	Source of initial financing	Respondents position
10. =Sole proprietors	2. = Smallholder farmers	1 = Self-financing	1= Owner
11. =Family business	2. = Traditional cattle keepers	2 = Family /friend loan	2= manager
12. =Partnership	3. = Commercial farmers	3 = Credit (specify creditor) _____	3=Employee
13. =Co-operative society		4 = Grant	
14. =Company Limited by shares		5 =(Others specify) _____	
15. =Other (specify			

SECTION B: INFORMATION ON MILK PROCUREMENT (NB. Complete each row for each source type)

8. Raw Milk procurement

Source type	Organization of procurement	Time of purchase/collection (HH)		Unit of measure for purchase	Purchase price per unit (Tshs)	Amount purchased		Mode of payment	Commodities bartered against milk (if payment is in kind)
		AM	PM			AM	PM		
1 [_]	[_]								
2 [_]	[_]								
3 [_]	[_]								
4 [_]	[_]								
e [_]	[_]								

CODES

Source type	Organisation of collection	Unit of measure	Mode of payment
1 = Individual farmer (zebu)	1=Farmer/herdsman deliver to a collection point (and buyer collects)	1 = Litre	1= Cash; now
2 = Individual farmer (dairy)	2=Vendor(s) deliver to a collection point (and buyer collects)	2 = kg	2= Cash; next day
3 =Co-operative Society	3=Farmer/herdsman deliver to processing premises	3 = Others (Specify) _____	3= Credit; monthly
4 = Wholesaler	4=Vendors(s) deliver to processing premises		4= Credit; two weeks
5 = private Processor	5= Processor collects at farm gate		5= Credit; weekly
6 = Self help group	6= Processor collects at collection centre (of other trader)		6= Others (specify)
7 = Vendors /Hawkers	7= Co-op delivers to processing premises		_____
8 = Own farm	8=Others(specify)_____		
9 = Others (specify) _____			

4. Raw Milk Procurement (Cont'd)

Source type (cont'd as in previous Table)	Quality control measures before receiving raw milk/ product	Lowest value accepted	Penalty for delivering unwhole-some milk/ product	Type of handling vessels & wrapping	Size of handling vessels (litres)	Maximum number bulked from each source	Method of source identification	Length of time buying from source	Contractual arrangements with suppliers		Main type of road milk is transported on
									Nature	Specification	
1 []	[]		[]	[] []	_____	_____	[]	_____	[]	[] [] []	[]
2 []	[]		[]	[] []	_____	_____	[]	_____	[]	[] [] []	[]
3 []	[]		[]	[] []	_____	_____	[]	_____	[]	[] [] []	[]
4 []	[]		[]	[] []	_____	_____	[]	_____	[]	[] [] []	[]
5 []	[]		[]	[] []	_____	_____	[]	_____	[]	[] [] []	[]

CODES

Source Type 1 = Individual farmer (zebu) 2 = Individual farmer (dairy) 3 = Co-operative Society 4 = Wholesaler 5 = private Processor 6 = Self help group 7 = Vendors/vendors 8 = Own farm 9 = Others (specify) _____	Quality control measures before receiving milk 1. = None 2. = Lactometer 3. = Smell/flavour 4. = Visual check 5. = Freezing point 6. = Alcohol test 7. = Temperature 8. = Clot on Boiling 9. = Butterfat test 10. = Resazurin test 11. = Others (Specify) _____	Penalty for delivering unwholesome milk 1. = None 2. = Buyer rejects 3. = Shared costs 4. = Buyer bears full cost 5. = Warning 6. Other (Specify) _____ Method of source identification 1 = None 2 = Can labelling 3 = Colour of cans 4 = Other (specify) _____	Type of vessels/materials 1. Plastic buckets 2. Plastic gallon 3. Jerry cans (plastic) 4. Glass bottles 5. Aluminium cans/bowls 6. Plastic cans 7. Polythene wrapping/bags 8. Other (Specify) _____	Nature of Contract 0. = None 1. = Informal: verbal 2. = Informal: written 3. = Formal (Lawyer assisted) Specification of contract agreement 1. = None 2. = Quantities of daily supply 3. = Mode of payment 4. = Date of payment 5. = Time of supply 6. = Purchase of all milk supplied 7. = Price of milk supplied 8. = Other (Specify) _____	Main type of road 1 = Tarmac 2 = Murrum 3 = Earth/dirt 4 = Narrow path 5 = Other (Specify) _____
--	--	--	--	--	---

4. Milk procurement (Cont'd)

Source type (continued as in previous table)	Distance from buying to selling point (km)	Who transported milk from collection point	Main mode of Transport from collection point	Total time taken from first buying point to selling point [Days] [Hrs] [Min]	Services /goods provided to suppliers in the last ONE MONTH	Values of input services/goods provided (TShs)	Agreed mode of repayment for services/ goods provided
1[_]	___	[_]	[_]	[_] [_] [_]	[_] [_] [_]	_____	[_]
2[_]	___	[_]	[_]	[_] [_] [_]	[_] [_] [_]	_____	[_]
3 [_]	___	[_]	[_]	[_] [_] [_]	[_] [_] [_]	_____	[_]
4[_]	___	[_]	[_]	[_] [_] [_]	[_] [_] [_]	_____	[_]
5 [_]	___	[_]	[_]	[_] [_] [_]	[_] [_] [_]	_____	[_]

If milk is transported on **public transport**, give transport costs: **Personal** fare (Tshs) _____ **Milk load** fare (Tshs/vessel) _____ **Vessel type** [_____]

CODES

Who transported from collection point	Mode of transport from collection point	Input Services provided	Agreed mode of repayment for services provided	Vessel Type
1. = Self transport	1. = on foot	0. = None	1 = Deducted from proceeds of milk supplied	1 Bus/daladala
2. = Supplier transports	2. = bicycle	1. = Vet clinical services	2 = cash repayment	2 Pick-up
3. = Transport agent	3. =Motor bike	2. = Veterinary drugs	4 = grants	3 Boat
4. =Public transport	4. = public vehicles (open)	3. = A. I services	5 =Payment	4 Ferry
5. = Others (Specify) _____	5. = public vehicles (closed)	4. = Transport services	6 =others	
	6. = own vehicle (open)	5. = Financial advances		
	7. = own vehicle (closed)	6. = Financial credit		
	8. = hired transport (open)	7. = Others _____		
	9. = hired transport (closed)			
	10. = others specify) _____			

SECTION C: PROCESSING UNIT INFORMATION

C1: Technologies used in milk processing

Type of products made [_√_] Tick	Method of heating	Method of cooling raw milk	Method of preserving finished milk products	Method of packaging
1. = Pasteurised milk	[_]	[_]	[_]	[_]
2. = Fermented milk	[_]	[_]	[_]	[_]
3.= Cream	[_]	[_]	[_]	[_]
4. = Butter	[_]	[_]	[_]	[_]
5.= Ghee	[_]	[_]	[_]	[_]
6. = Cheese	[_]	[_]	[_]	[_]
7= Other (specify)_____	[_]	[_]	[_]	[_]

CODES

Method of heating	Method of cooling raw milk	Method of preserving finished milk products	Method of packaging	
1=Charcoal stove 2= Firewood stove 3= Electrical batch pasteuriser 5= Biogas 6 Other (specify)	1. = Running water bath 2. =Ice water bath 3. =Deep freezer 4. =Refrigerator 5. =Cooling tank 6. Other (specify)	1. = Deep freezer 2. =Refrigerator 3. =Cold room 4. Other (specify)	1= manual packaging in sachets 2= semi-automatic packaging in sachets 3= Fully automatic packaging in sachets 4= manual packaging in plastic bottles	5= Semi-automatic packaging in plastic bottles 6= Automatic packing in bottles 7= Manual packaging in cups 8= Semiautomatic packaging in cups 9= Fully automatic packaging in cups 10=Others (specify_____)

C2 Product quality control systems used

Platform tests carried out	Chemical laboratory tests	Cleaning methods used	Waste water disposal system	Quality assurance system in use	Level of quality certification	Is current level of certification adequate for business
[__]	[__]	[__]	[__]	[__]	[__]	YES [__] / NO [__]

CODES

Platform tests	Chemical laboratory tests	Cleaning methods	Waste water disposal	Quality assurance system	Quality certification
1. = Organoleptic 2. = Clot on boiling 3. = 10 minutes resazurin test 4. = Alcohol test 5. = Lactometer test 6= Other (specify)	1. =Butterfat test 2. = Freezing point depression test 3. = Total solids by oven drying 4. pH meter 5. Titratable acidity 6 = Other (specify)	1. = cold water only 2. =cold water + soap 3. =hot water only 4. =hotwater + detergent 5. =manual cleaning 6. =Circulation (CIP) cleaning) 7.= Other (specify)	1. = open drainage 2. =cesspit 3.= municipal sewage 4. =wastetreatment 5. =other (specify))	1. = GMP 2. =HACCP 3. =Other specify	1.= LGA certified 2. =TFDA certified 3. = TBS certified 4. = ISO Certified 5. = Other (specify) _____

D: Types of cheese produced (put tick)

1 = ricotta	<input type="checkbox"/>
2 = mozzarella	<input type="checkbox"/>
3 = gouda	<input type="checkbox"/>
4 = feta	<input type="checkbox"/>
5 = others (specify)	

E: Cheese marketing

Type of products sold	Where is cheese sold	Price of Products	Distance to where cheese is sold	Mode of delivery	Time taken to reach selling point	Type of packaging used	Information provided on label
1. = Ricotta cheese	[__]	[__]	[__]	[__]	[__]	[__]	[__]
2. = Mozarella cheese	[__]	[__]	[__]	[__]	[__]	[__]	[__]
3. = Gouda cheese	[__]	[__]	[__]	[__]	[__]	[__]	[__]
4. = Feta Cheese	[__]	[__]	[__]	[__]	[__]	[__]	[__]

CODES

Where is cheese sold	Distance to where cheese is sold	Mode of Transport used	Time taken to reach selling point	Vessel used to transport cheese	Type of Packaging	Labelling information
1. = Factory door	1. = 1-3 km	1. = on foot	1. = ½ - 1 hr	1. = Plastic jerry can (3-5 litres)	1= Plastic sachet	1= Product type
2. = Supermarket	2. =3 -5 km	2. =using bicycle	2. =1-2 hr	2. =Plastic jerry can (10 – 20 litres)	2= Plastic bottle	2= Brand name
3. = Shops and Kiosks	3. =5-10 km	3.= using own open car	3. =2-3 hr	3. = Plastic bucket (10-20 litres)	3= Plastic cup	3= Product composition
4. = direct to hotel restaurant	4. =10-20 km	4. =using box body truck (unrefrigerated)	4. =3-5 hr	4. = Aluminium can (3-5 litres)	4= Plastic gallon	4= date of manufacture
	5. =20-50 km	5. =refrigerated truck	5. =5- 6 hr	5. = Aluminium can (30-50 litres)	6= aluminium foil	5= Expiry date
	6. =more than 50 km	6.= other (specify)	6. =more than 6hrs	6. = Other (specify)	7= Wax paper	6= Volume
					8=metal tin	7= Storage conditions
					9=paper carton	8= Nutritional information
					10 = Other (specify)	9= Address of manufacturer
						10 Other (specify)

If cheese is transported on **public transport**, give transport costs: **Personal fare** (Tshs) _____ **Product load fare** (Tshs/vessel) _____ **Vessel type** [____]

E: Costs of producing 1kg of cheese

Item	Unit	Number units	Unit Cost (Tsh)	Total cost (Tsh)
Labour	Man-days			
Raw milk	litres			
salt	gm			
Starter culture	litres			
rennet	gm			
energy	kw			
water	litres			
Storage	M2			
coating	kg			
Packaging materials	pcs			
Transport	trip			
Chemicals and detergents				
Tax				
Fees				
Other (specify)				

G: What are the challenges you face in production and marketing of cheese? (put tick where applicable). Give out your suggestions to improve cheese production and marketing

Challenge		Suggestions
Low price offered for processed cheese	[]	
High tax	[]	
Quality of raw milk from farmers	[]	
Electric outrages	[]	
Poor roads	[]	
Competition with the imported cheese	[]	
Others (specify)		

THANK YOU FOR YOUR COOPERATION

QUESTIONNAIRE FOR MARKET INTERMEDIARIES LEVEL, CHEESE VALUE CHAIN ACTORS

Introduction

This survey has the objective of assessing the cheese value chain with special focus on small scale cheese processing industry in Arumeru District concentrating on the extent, prospects and challenges/constraint. Respondents have been randomly selected to participate in this survey and your **VOLUNTARY** participation in this survey is highly appreciated. Information you will provide will be completely **CONFIDENTIAL** and will be analyzed together with those of others in Arumeru District for academic purposes only. The findings from this study will be used to understand the challenges faced by dairy stakeholders in these areas and we hope to come up with recommendations that will help in improving farmers' conditions. I thank you in advance for your co-operation and understanding.

NAME OF ENUMERATOR:	FILLED IN BY: _____
Date: (dd/mm/yy) [__ / __ / __]	1) _____
Market chain actor category: [_]	District: [_]
	Ward: [_]
	Village: [_]

CODES

VALUE CHAIN ACTOR CATEGORY

1= Market intermediary/hawkers 2= cheese trader 3= bulking agent; District 1= Arumeru

SECTION A: BACKGROUND INFORMATION

1. Respondent's Name _____

Sex of respondent	Age of respondent (yy)	Education level	Distance to market (km)	Experience in Dairy marketing started (yy: mm)	Source of initial financing	Other occupations
[_]	_____ yrs	[_]	_____	_____	[_]	[_]

CODES

Sex of Respondent 1=Male 0=Female	Education level: 1. = Primary school 2. = Secondary school 3. = Certificate 4. = Diploma 5. = University degree	Source of initial financing 1 = Self-financing 2 = Family /friend loan 3 = Credit (specify creditor)_____ 4 = Credit in kind (HIT, GIT) 5 =(Others specify)	Other occupation 1= None 2= herding/stockman 3= Salaried employment 4= Retired with pension 5= Retired without pension 6= Businessman/woman 7= Others (specify)
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B1: Market information

Do you access market information?	Who provide you with market information?	What type of information is given?
[]	[]	[]

CODES

AMINF 1 = yes 0 = no	Who provide MKTINF 1 = Processors 2 = extension workers 3 = others (specify)	type of information 1 = price 2 = volume to supply 3 = quality 4 = other (specify)
-----------------------------------	--	---

B2: Products sold

What products do you sell?	How much do you sell per day or month?
[]	Raw Milk: _____ Cheese: _____

CODES

Type of product sold 1 = raw milk 2 = cheese 3= others (specify)
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B3: Market information continue

How much do you pay for? (Tsh)	How do you transport milk/cheese from farmers/processors to the market?	What factors determine the price at which you buy milk/cheese?	Where do you sell milk/cheese?	For How much do you sell (Tsh)
Raw milk:	[]	[]	[]	Milk: _____
Cheese:	[]	[]	[]	Cheese: _____

CODES

<p>Where milk is sold</p> <p>1. = milk cooling centre/processing plant 2. = transported to market 3. = direct to hotel restaurant 4 = other (specify)</p> <p>Factors that determine the purchasing price</p> <p>1 = distance from the farmer 2 = quality of milk 3 = demand and supply in the market 4 = other (specify)</p>	<p>Mode of Transport used</p> <p>1. = on foot 2. =using bicycle 3.= using own car 4. =using public transport (daladala) 5. =using public transport (bus)</p> <p>Where cheese is sold</p> <p>1 = households 2 = tourist hotels 3 = supermarkets 4 = other (specify)</p>	<p>Vessel used to transport milk</p> <p>1. = Plastic jerry can (3-5 litres) 2. =Plastic jerry can (10 – 20 litres) 3. = Plastic bucket (10-20 litres) 4. = Aluminium can (3-5 litres) 5. = Aluminium can (30-50 litres) 6. = Other (specify) _____</p> <p>Factors that determine the purchasing of cheese</p> <p>1 = quality 2 = price offered 3 = consumer preference 4 = seasonal demand and supply 5 = others (specify)</p>
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C: Marketing costs

Item	Cost (Tsh)
Transport	
Packaging	
Labour	
Spoilage	
Storage facilities	
Market information	
Commission	
Others (specify)	

D: What are the challenges you face in marketing of milk/cheese? Provide possible suggestions to improve the dairy industry

Challenge	Suggestions

ASANTE SANA KWA USHIRIKIANO

QUESTIONNAIRE FOR CONSUMERS LEVEL, CHEESE VALUE CHAIN ACTORS

Introduction

This survey has the objective of assessing the cheese value chain with special focus on small scale cheese processing industry in Arumeru District concentrating on the extent, prospects and challenges/constraint. Respondents have been randomly selected to participate in this survey and your **VOLUNTARY** participation in this survey is highly appreciated. Information you will provide will be completely **CONFIDENTIAL** and will be analyzed together with those of other actors in Arumeru District for academic purposes only. The findings from this study will be used to understand the challenges faced by dairy stakeholders in these areas and we hope to come up with recommendations that will help in improving farmers' conditions. I thank you in advance for your co-operation and understanding.

NAME OF ENUMERATOR:	FILLED IN BY: _____
Date: (dd/mm/yy) [__ / __ / __]	1) _____
Market chain actor category: [_]	District: [_] Ward: [_] Village: [_]

CODES

VALUE CHAIN ACTOR CATEGORY

1= individual consumer in the neighbourhood 2= individual consumer in town 3= Hotel 4= restaurant

SECTION A: BACKGROUND INFORMATION

1 Respondent's Name _____ Sex _____ M/F 1a. Business Name _____

2 Age: _____

3 Background

Respondents position	Years since established	Type of cheese suppliers	Volume of cheese received during wet season	Volume of cheese received during dry season	Price offered per kg during wet season	Price offered per kg during dry season
[_]	_____ yrs	[_]	_____	_____	_____	_____

CODES

Type of suppliers	Respondents position
1 = dairy processors	1= Owner
2 = contracted marketing agent	2= manager
3 = Imported cheese	3=Employee
4 = others (specify)	

B: Who are the major consumers of cheese?

Local population	Tourists	Type of cheese preferred	Brand of cheese
[]	[]	[]	[]

CODES

	type of cheese preferred	brand of cheese
1 = population	1 = mozzarella	1 = local cheese
2 = tourists	2 = gouda	2 = imported cheese
	3 = feta	
	4 = ricotta	
	5 = others (specify)	

C: What are the challenges/constraints you face in getting cheese from the local processors? Give out your suggestions to improve the cheese market chain

Challenge	Suggestions
Quality	
Delayed delivery	
Quantity	
Price	
Taste	
Packaging	
Others (specify)	

THANK YOU FOR YOUR COOPERATION