TECHNICAL REPORT

ANALYSIS OF DAIRY VALUE CHAIN IN NORTHERN GHANA

Under the auspices of the Danida funded collaborative research project '***Preserving African food microorganisms for green growth***' (DFC No. 13-04KU)

Content

1.0 INTRODUCTION

Fermented foods produced from local raw materials hold a key position in the West African diet. Preserving these traditional local foods is key to ensuring food security, alleviating poverty, developing local businesses and for implementation of green growth strategies. To be able to turn the traditional West African food sector into a driver of sustainable growth, a danida collaborative funded project 'Preserving African Food Microorganisms for Green Growth' is working with research institutions in Denmark, Ghana, Burkina Faso and Benin to improve production methods through use of starter cultures, upgrade the food value chains and implement new business models.

The project has as one of its major objectives to identify food value chains with potential for green growth. Therefore, this value chain analysis was conducted to identify key actors and processes in the production of milk and milk products in northern Ghana with the objective of identifying areas with strong potential for green growth and sustainable development, to increase SME competitiveness, reduce costs, and improve market share and profitability.

Dairy chains link the actors and activities involved in delivering milk and milk products to the final consumer; with each activity the product increases in value. A dairy chain can involve production, transport, processing, packaging and storage. Activities require inputs such as financing and raw materials which are employed to add value and to transport dairy products to consumers. Every actor of the chain is expected to give the product maximum added value at the minimum possible cost.

This report therefore provides an overview of the dairy value chain, highlights key constraints, and opportunities for growth in the dairy value chain with particular focus on processing and marketing cattle dairy products. While the green growth project focuses primarily on "post-harvest" technologies, this value chair report discusses other factors affecting the entire dairy chain such as milk production and market dynamics to provide a context for the issues discussed. The report concludes with an outline of constraints in the dairy value chain and opportunities and potentials technological innovations.

2.0 METHODOLOGY OF THE STUDY

The dairy value chain was mapped and analysed using a mainly qualitative research tools. The tools employed included:

i. ***Participant observation***: Researchers of the green growth project undertaking the value chain studies were engaged in direct observation of various activities and processes in the dairy value chain. This led to a greater understanding of the characteristics of the situation being researched.

ii. ***Semi-structured interviews and focus group discussions***: Guided conversations with various stakeholders and dairy value chain actors in which topics were predetermined and during which new questions and insights arose as a result of the discussion and visualised analyses.

iii. ***Questionnaire***: Questionnaires focused on what value chain actors are doing, and also to give more insight into why actors are doing what they do and how they formulate their decisions.

Analysis presented in this report is largely based on the qualitative assessment methods; the opinions of experts and dairy value chain actors, secondary information obtained through literature and primary information obtained during focused group discussions and the interviews.

2.1 limitations of the report

Specific data related to dairy product flows, contribution to Ghana's GDP and/or National economic growth is fragmented or unavailable.

3.0 ANALYSIS OF THE DAIRY VALUE CHAIN

3.1 Overview

A summarised map of the dairy value chain is presented in **Fig 1**. The value chain describes a series of sequential activities where at each step in the process, the product passing through this chain of activities is expected to gain some value. Generally, the chain of activities gives the products more added value than the sum of the added values of all activities.

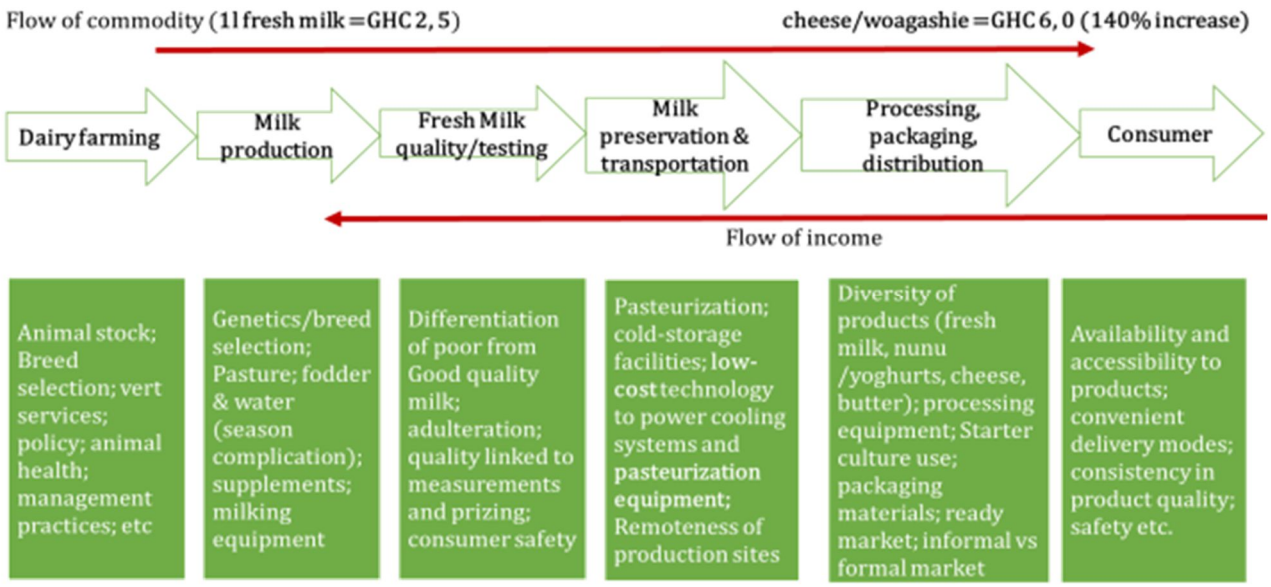

Figure 1. Overview of dairy value chain.

3.2 Milk production

Ghana has about 1.25 million cattle (Otchere and Okanata, 2002). However, the current cattle population may be significantly higher than the aforementioned figure due to the recent influx of nomadic Fulani into Ghana from neighbouring West African countries. The West African Shorthorn (WASH) is the most populous breed of the cattle population. Ghanaian WASH cattle have not been consciously and generally selected for high milk production. In the early 1930s, the Veterinary Services Department of the then Gold Coast (now Ghana) imported White Fulani (WF; zebu) bulls from northern Nigeria to cross with the indigenous WASH to improve on its body size and level of milk production. The stabilised WF × WASH genotype is called the Sanga; it has features intermediate between the taurine WASH and the WF (zebu).

Like many developing countries, milk producing cattle in northern Ghana are raised in subsistence and smallholder systems. These animals are multi-purpose and grow and produce under difficult conditions, such as low inputs, minimum management and harsh environments. They are well adapted to local conditions, but have low genetic potential for milk production. In northern Ghana, cattle herd sizes are generally small, usually between 10 and 200 per herd. Production systems as pertains in northern Ghana is typically '**rural smallholder dairying**' where dairying is often part of a mixed farming system in which manure is used for crop production. Dairy animals are fed on grass, crop residues and cultivated fodder. Supplementary feeding is practised only when feasible. A second production system that is practiced is the '**Pastoral/agropastoral dairying**' which is land-based and milk is often the most important subsistence item. Dairy production is generally associated with cropping, but nomadic pastoralists practise little or no cropping and roam the land in search of grazing grounds and water.

These production operations are based on low inputs, so milk production per dairy animal is quite low. It has been reported that the mean daily partial milk yields per dairy cow is 0.9 and 0.7 kg for the wet and dry season, respectively, (Karbo et al., 1998; Okantah 1992). These low milk production capacities were confirmed during our surveys. Cumulatively these data indicate that indigenous cattle kept by small-holders are generally low milk producers. It should, however, be pointed out that the milk yield figures reported above do not represent the genetic potential of the animals used in the studies because: (a) the amounts did not include milk consumed by calves; (b) the cattle had not been selected for high milk yield; and (c) the environment had not been improved enough to really enable the animals to demonstrate their full genetic potential for high milk yield.

Productivity and returns from dairying can be improved through selective breeding and control of reproduction. Reproductive performance of dairy animals is affected by such factors as the environment, animal nutrition, producers' socio-economic conditions, dairy animals' adaptability and genetic characteristics, and type of production system. Unfortunately, dairy producers in northern Ghana have no scientific knowledge of genetics and breeding. However, they have valuable traditional knowledge regarding breeds and their management. They have breeding objectives and strategies even though these are not formalized or written down.

Dairy production in Ghana is subject to many risks from disease, resulting from several factors such as limited knowledge of disease prevention, management and control; high prevalence of pathogens; and the cost, availability or suitability of animal health services. Low productivity of cattle often results from high levels of endemic diseases (e.g., trypanosomosis, tick-borne diseases, helminthiases) and malnutrition. Control of these diseases has historically been the remit of veterinary services (Ministry of Agriculture, Ghana), which have been contracting as a result of budget cuts and are often difficult to access for resource-poor farmers. Increasing responsibility thus falls on the farmer, animal health assistants and other extension workers. Small-scale dairy producers in northern Ghana generally make few investments in animal health, especially in disease prevention.

While the focus of this project is on "post-harvest" technologies, lack of feed and fodder can have a dramatic impact on milk production. It was estimated that milk production can drop by about 70-80% from the wet to the dry season due to lack of adequate water and other related reasons. Dairy farmers generally use locally available feed resources, such as natural pastures, crop residues, cut-and-carry grass, forage crops and local feedstuffs (including agro-industrial by-products). Communal grazing of livestock is a common practice. Grazing fields often lack conservation practices and are of poor nutritional quality. Grazing without supplementary feeding is also widely practised.

3.3 Marketing, distribution and pricing of milk and milk products

The dairy market sector can be classified into two systems: the '**traditional system**' including small-scale, subsistence and household production with informal market systems and the '**commercial system**' which represents large-scale industrialized production with integrated markets, predominant in developed countries (Staal, Pratt, & Jabbar, 2008). The traditional informal market systems dominates in northern Ghana in particular and Ghana as a whole. The informal markets are without licensing or regulation. As a consequence, the difference between farm-gate and consumer prices of fresh milk is generally smaller as compared to what pertains in a well-established formal market.

Milk production in Ghana is generally low and as such there is low per capita milk consumption. Local annual milk production is conservatively estimated at 36.5

thousand tonnes. Most of it is from smallholder agro-pastoral producers. Thus, there is a big shortfall between domestic milk production and consumption. The deficit is made up through imports of milk and milk products. There are two multinational dairy enterprises in Accra, namely Fan Milk Limited and Nestle, Ghana Limited. These lead actors in the dairy value chain use imported milk powder and butter oil for reconstitution. These enterprises have shown keen interest and willingness to purchase local fresh milk for processing in the past but have not been successful due to serious shortfall in supply. The total production of reconstituted milk and ice cream by Fan Milk and Nestle was 2.08 and 0.998 million litres respectively in the mid-1980s, but by 1996 the production of these products had increased to 27.6 and 3.582 million litres respectiely. From the level of imports of milk and milk products into Ghana, there are clearly good prospects for processing fresh milk produced locally by smallholders.

In northern Ghana, most milk is produced by small-scale producers who are widely dispersed in rural areas, while the majority of markets are in urban/peri-urban areas. The logistical challenge of linking producers to markets is compounded by the highly perishable nature of milk, which calls for streamlined collection and transport. When the price of milk is low, or transport is not viable, any surplus milk that is not suckled by the offspring or consumed by the producer may be wasted unless it is converted to a fermented/sour milk. Generally, milk is transported in plastic containers by the producers themselves or by milk collectors (informal traders and intermediaries). Milk collectors usually collect milk from several producers and then transport them by bicycle, animal, vehicle or foot to local/urban markets, family shops, stands, or small-scale processing sites.

Milk takes various routes from producers (farm-gate) to the end consumer (Fig 2.). Abstracting from wide fluctuations by season and particularities of individual locations (causing prices to be higher or lower than the average), the average current farm gate price is GH₵ 2.5 per litre. The price of raw milk fluctuates with the season, and this affects the price of traditionally processed milk products as well. During the wet season, when milk is abundant, a litre of raw milk can be purchased for GH₵ 2.0 while during the dry season, the price increases to approximately GH₵ 4.0 a litre. Thus, a typical characteristic of the milk and milk products markets is that, the season of the year is the dictates the prices. Generally, demand for milk far surpasses supply in dry

season. The variation in price of milk between the wet and dry season is good indicator to show the gap between demand and supply.

From our observation and focus group discussions, almost all processors do not have any formal training in business and marketing skill. They usually do not have business plans for their operation and most of them do not register accounts. Lack of business and marketing skills limit processors ability to exploits opportunities of high price for their products.

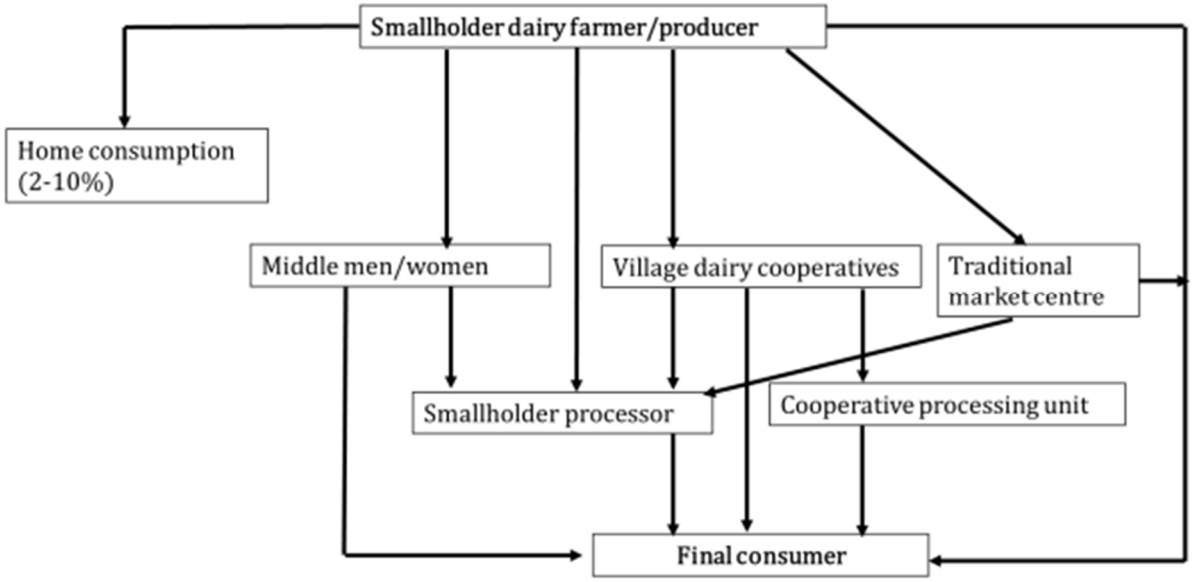

Figure 2. Marketing and distribution channels of milk and milk products

3.4 Milk preservation, processing and quality

Milk is highly perishable because it is an excellent medium for the growth of microorganisms – particularly bacterial pathogens – that can cause spoilage and diseases in consumers. Milk processing allows the preservation of milk for days, weeks or months and helps to reduce food-borne illness. Milk is almost sterile when secreted from a healthy udder. The natural inhibitors in milk (e.g., lactoferrin and lactoperoxidase) prevent significant rises in bacterial numbers for the first three to four hours after milking, at ambient temperatures. Cooling to 4 °C within this period can maintain the original quality of the milk and is the method of choice for ensuring good-quality milk for processing and consumption. However, cooling facilities are expensive for small-scale milk producers and processors in Ghana. Additionally, refrigeration is

not feasible in some remote parts Ghana where milk is produced due to the high initial investment and running costs and technical problems, including the lack or unreliability of electricity supply. Consequently, the milk produced is often sold for less than its full value due to lack of access to markets, poor road infrastructure and inability to transport long distances due to spoilage concern. Since fresh milk is frequently unpasteurized, it is commonly boiled before consumption for sterilization and safety reasons. It is thus a common practice for milk to be boiled between 2 and 3 times to prevent spoilage before consumption, a situation which could drastically reduce taste and nutritional value (Polak et al., 2008). Boiling also utilizes costly and scare energy resources such as fire-wood.

In Ghana, milk is traditionally processed further to convert it into high-value, concentrated and easily transportable dairy products with long shelf-lives. The common milk products include nunu/nyarmie (spontaneously fermented yoghurt-like product), butter, cheese and ghee (Fig 3.). Processing of dairy products gives small-scale dairy producers higher cash incomes than selling raw milk and offers better opportunities to reach urban markets. Milk processing can also help to deal with seasonal fluctuations in milk supply. The transformation of raw milk into processed milk and products can benefit entire communities by generating off-farm jobs in milk collection, transportation, processing and marketing.

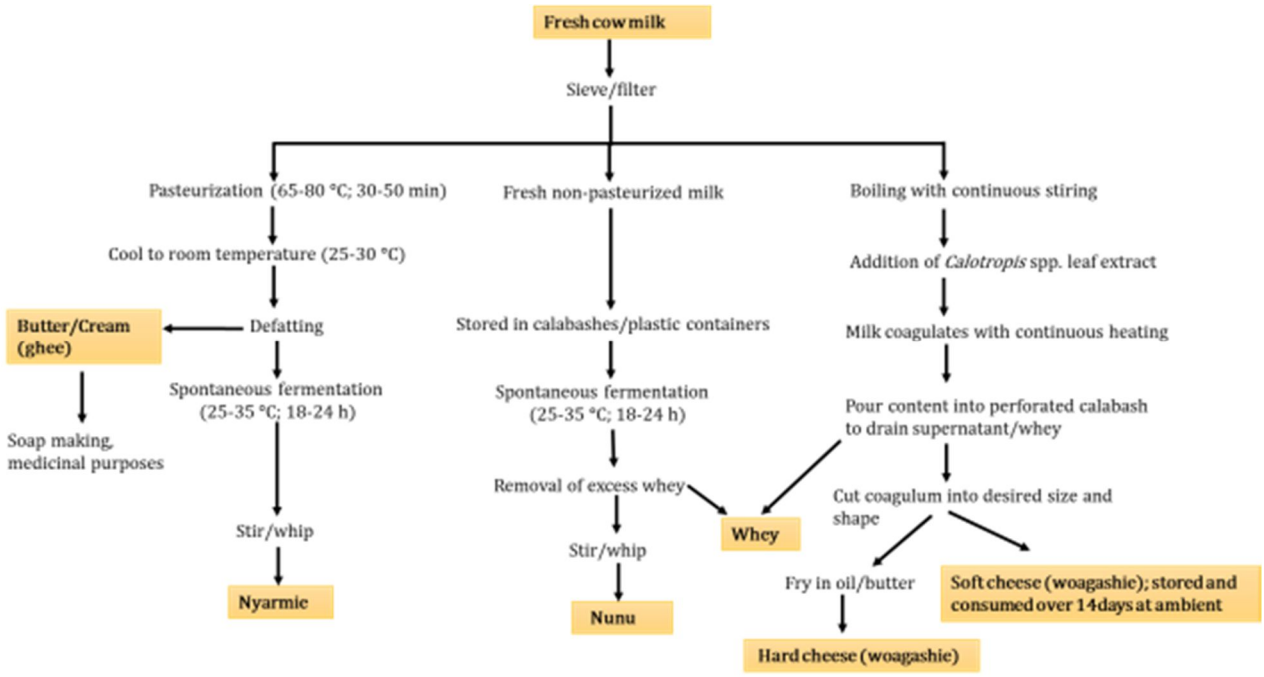

Figure 3. Production processing of milk into various traditional products

Most small-scale processors of the traditional dairy products often do not have access to training or formal education, and learn the processing as a family art by seeing, hearing and doing. The processing of the fermented dairy products is spontaneous (thus no starter cultures are employed), the processing methods are not standardised and quality protocols are not implemented affecting the decision of consumers to choose these products in the face of stiff competition from imported dairy products. Additionally, these products are characterized by poor packaging. These small-scale milk processing businesses are run without formal skills or training in business leading to high risks and limited cost-effectiveness. Small-scale equipment for pasteurization and packaging in plastic sachets may be available, but the traditional small-scale processors often lack access to these equipment they need. These challenges are exacerbated by seasonal fluctuations in milk production as milk production volumes are higher in the wet season than the dry season, especially from animals that depend largely on grazing.

3.5 Social and gender issues

Market-oriented, small-scale dairy production creates on-farm jobs and increases farm income, as well as creating off-farm employment and income opportunities in milk collection, marketing and processing. In many developing countries, dairying provides higher returns to small-scale farmers than crops, and generates more employment opportunities than other food value chains.

Milk production, processing and sales are one sector where women are highly involved. Women traditionally have an important role in milk production, especially milking and feeding, and are also involved in the collection, processing and marketing of milk products. Focus group discussions held with some Fulani pastoralists revealed that it may be taboo for a man to ask how his partner allocates milk and milk product in the household in certain communities. Women have exclusive decision power on milk and milk product related activities. Therefore, improving milk and milk product marketing has great implication in economically empowering women. However, it appears that women usually provide the labour and have the right to use dairy cattle but do not own the animals or make decisions regarding them or their disposal. Although much of their labour is non-monetized, women often decide the amount of milk to be sold and how to use the revenues generated from milk sales. The woman of

the household generally uses milk money to buy food items, clothing and other necessities and to pay for children's education and basic health care. Hence addressing the issues of milk and milk products in is synonymous to addressing the issues of women's livelihood improvement.

4. Constraints and potentials/opportunities for growth in the value chain

This section provides a brief overview of inefficiencies or constraints in the value chain and potential technologies or approaches to address the constraints. The target end user is the small-holder dairy processors. For this reason the project will focus on technological enhancements and innovations that can contribute to higher incomes for small-holders. While there are a broad range of key issues identified in the dairy value chain, this project focuses primarily on technological interventions that will improve the product quality, marketing and incomes of small-holder milk processors.

4.1 Constraints

Setting up an efficient, hygienic and economic dairy value chain Ghana is a serious challenge due to a number constraints. The major constraints observed in our value chain analysis are outlined below:

a) Poor breed and genetics of cattle for mortality and low dairy production. Cross-breeding with dairy genes and other technologies to enhanced dairy development in cattle stock is not applied. However, extensive focus on genetics and breeding technologies is outside the scope of this project.
b) Difficulties in establishing a viable milk collection and transport system because of the small quantities of milk produced per farm and the remoteness of production sites.
c) Seasonality of the supply of milk and milk products to the market.
d) Poor transport infrastructure leading to spoilage of milk during transportation of farms to market.
e) Deficiency of technology and knowledge in milk processing leading to product quality problems. These are characterized by lack of use of starter cultures for fermentation, poor packaging and shelf-life of products, inconsistent quality of product leading to consumer apathy.

f) Lack of low-cost and accessible pasteurization and/cooling technologies increases rates of spoilage and decreases the distance producers can travel, thereby shrinking market access and increases the frequency of sales at less than optimal prices.
g) Distances from production sites to processing units and on to consumers.
h) Difficulties in establishing cooling and pasteurization facilities.
i) Lack of appropriate business and market orientation for small-holder processors and SMEs.

4.2 Opportunities and Potentials technological innovations

a) High demand for milk and milk products throughout the year is an opportunity to expand the dairy sector to meet the demand for dairy products.
b) There is an opportunity to develop pasteurization and cooling techniques based on solar that do not increase cost significantly but increase the shelf life and nutritional value of milk. This will increase access to market and therefore pricing of milk and milk products.
c) Introduction of the use of starter culture for the production of fermented milk products, quality management systems and healthy products will increase consumer acceptance and market share
d) Development of inexpensive, environmentally sensitive packaging technologies could enhance milk quality, sanitization, and increase distances traders are able to cover with milk products.
e) Although small scale processing of milk is not currently generating the needed profits, the processing activity can serve as an entry point to economically empower women in the long run.
f) High social capital (networks of relationships among women producers, women processors/traders, transporters very strong).
g) High involvement of woman in the dairy value chain (managing the herd at household level and taking care of the milking cows, milk and milk products) increases the decision making power of the women and which in turn is an asset in improving the livelihood of the women and their families

Conclusions

1. Interventions aimed at value-addition along the dairy chain from production to the consumer is important for alleviation of poverty and malnutrition
2. There is a '**big Potential**' to alleviate poverty and malnutrition and generate incomes through **value-added processing** dedicated both local and international markets coupled with enhanced trade opportunities
3. Research, Innovation, Technology transfer (from the public to the private sector) and financing are important requirements

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