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The Dairy Value Chain in Kenya

**A report by TechnoServe Kenya for the
East Africa Dairy Development Program
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EXECUTIVE SUMMARY

Various agencies estimate the total annual milk production for Kenya at 3.5 billion liters in 2007, translating to an average yield per cow at 564 kilograms per year. The dairy industry has been growing in the current decade, after years of decline and disruption, largely highlighted by the notable collapse of Kenya Cooperative Creameries in 1997. The recent growth in the dairy production has been driven by increases in yields per cow. However, notwithstanding the recent growth, Kenya's yields remain significantly below international standards; South Africa and Argentina have yields ranging between 2,500 and 3,500 kilograms per year, while the USA stands at an average of 9,000 kilograms per year.

The recent growth in production has re-fueled the growth in the formal sector—a sector that nearly disappeared after the collapse of KCC. Current estimates show that 55% of all milk produced in the country is marketed, but only 20% of that marketed milk goes through the formal channels. While still small in absolute terms, the formal dairy industry is now the fastest growing agricultural sub-sector in Kenya.

With the fast growth comes fierce competition. There are over thirty registered processors in the country, but three large processors dominate the industry. Brookside, New KCC and SpinKnit account for over 80% of the formal market. This group of three is constantly looking for new milk sources to fill processing plants to capacity; capacity utilization in the industry is at a low 40%.

Growing consumption and latent capacity had led to a fragmented value chain, with numerous players vying for profits along the chain. Despite the competition, farm gate prices are largely indistinguishable between the formal and informal chains. The informal market has one main advantage over its formal counterpart; the informal market is a cash-based market, with producers (farmers) being paid immediately for their goods. Within the formal chain, farmers can wait up to a month to receive payment for their

milk. As smallholder farmers are generally facing immediate cash flow needs, the informal market provides an advantage.

Most smallholder farmers view dairy as subsistence farming and not as a business, therefore generating a poverty trap. With low production comes low income, preventing investment in good feeds and animal health. Lack of investment leads to low production, and so on. Smallholder farmers are estimated to sell an average of 3 to 5 liters per day; calculations in this report estimate that 15 liters per day is the required production to bring a family over the poverty line.

Processors also face challenges. Capacity utilization is low, and the formal market is facing daily competition from a fluid, cash-based informal market. For processors, the largest cost is that of the raw milk itself. Fluctuations in farm gate prices have large, and immediate impacts on the formal market's profit margins. Though actual profit margins are difficult to ascertain, this report estimates that processors in Kenya are averaging profit margins between 10% and 20%, in line with international standards.

Cost control is an issue at the foundation of this industry. Farmers lack the knowledge or business skills to measure their costs per liter of milk produced. Benefits of additional feed or animal care are rarely examined in the context of increasing yields. Farmers rely on cash flow from the informal channel—cash flow that is not sufficient to allow for investment in production. With limited cash, farmers often depend on open grazing to feed their animals. Feed costs may drop in open grazing, but farmers then become susceptible to the effects of seasonal weather patterns.

Better integration, especially in the initial steps of the value chain, would allow for more cost control, and profit maximization. Transport could be managed by the chilling plant, optimizing routes and minimizing costs. Increases in volumes benefit all those on the chain—producers, transporters, chilling plant owners, etc.

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LIST OF ABBREVIATIONS

AI	Artificial Insemination
CAGR	Compounded Annual Growth Rate
EADD	East Africa Dairy Development Program
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GNI	Gross National Income
ILRI	International Livestock Research Institute
IMF	International Monetary Fund
KCC	Kenya Cooperative Creamery
KDB	Kenya Dairy Board
Ksh.	Kenyan Shillings
SDP	Smallholder Dairy Project
TC	TetraPak Container
UHT	Ultra-high temperature processing

INTRODUCTION

The East Africa Dairy Development (EADD) project commissioned this study to provide information on the chain of players involved in the dairy industry in Kenya, from the producers, or farmers, to the end consumers of dairy products, referred to as the dairy value chain. This study seeks to inform the public about the economics and challenges facing each segment of the value chain and ultimately identify opportunities to increase farmers' income and/or expand the dairy industry.

The vision of EADD is to “move smallholder farmers out of poverty by delivering farmer-focused, value-chain activities that are implemented simultaneously. These activities will stimulate dairy farm production, dairy-sector services, business development and dairy market pull. Developing technically trained, business-savvy farmers and services providers will generate success and sustainability. Research and documentation of effects, outcomes and lessons will inform decision-making as this project develops and will identify future opportunities for effective interventions in the dairy value chain. The project will deliver direct economic benefit to rural dairy households—the common vision of the implementing partners.”¹

OVERALL ECONOMIC PERFORMANCE

Since independence, Kenya's economy has grown slowly but steadily at 4.6% compounded annually: slightly more than the population growth (3.2% CAGR). This period can however be divided into three sub-periods. Following the independence in 1963 until 1980, the economy grew at 3.3% CAGR. From 1980 until the change of government in 2002, the economic performance was erratic, with some years of growth and some of steep decline, resulting in a negative compounded rate of growth of -0.2%.² After 24 years of President Moi's government, in 2002 Mwai Kibaki won a landslide victory as the country's third president.

¹ EADD Grant Proposal – Summary Information for Submission of August 30, 2007

² World Development Indicators.

Kibaki's government has made significant progress towards economic growth and macroeconomic stability. The real GDP annual growth jumped from 0.6% in 2002 to 7% in 2007; and real per capita GDP growth rose from minus 1.6% in 2002 to plus 5.1% in 2007.³ However, five years of continuous economic growth were badly disrupted by the political violence following the presidential elections in January 2008. The violence that ended with a power sharing agreement in February 2008 claimed over 1,000 lives and displaced more than 300,000 people.⁴ Initial disruptions to supply lines led to shortages and price hikes, and the resulting insecurity devastated Kenya's tourism industry. Tourism which makes approximately 11% of Kenyan GDP fell by 90% in February 2008.⁵ As a result, GDP growth in 2008 is expected to be much lower than the 7 percent achieved in 2007. The IMF estimates 2.5% GDP and 0.7 per capita real GDP growth for 2008.⁶

Despite the high GDP growth over the last few years, Kenya is still classified as a low income country. Per capita GNI (Atlas method, current US\$) is only US\$580⁷ or just \$1.6 per day. 45.9% of population lives below absolute poverty line.⁸ While the official unemployment rate is not high at 10.5%,⁹ only 14% are employed in the formal sector, while 50% work in agricultural self-employment, and 36% in the informal sector.¹⁰ The most serious problem facing Kenya is thus not unemployment but that even those who are working are probably still living below the poverty line.¹¹

³ IMF.

⁴ IMF, Economic Outlook for Sub-Saharan Africa, 2008.

⁵ Reuters, February 2008.

⁶ Id.

⁷ World Bank, Kenya at a glance, last available data is for 2006.

⁸ Economic Survey 2008 and Kenya Integrated Household Budget Survey 2005/2006, Kenyan Bureau of Statistics. The food poverty in monthly adult equivalent terms is Khs 988 and Khs 1,474 for rural and urban areas respectively. The overall (absolute) poverty lines are Ksh 1,562 and 2,913 for rural and urban areas, respectively.

⁹ Economic Survey 2008, Kenyan Bureau of Statistics.

¹⁰ UNDP.

¹¹ UNDP, An Employment-Targeted Economic Program for Kenya, 2008.

DAIRY SECTOR: PRODUCTION

Agriculture is an important sector of the economy, constituting about 27% of GDP. 70% of population is rural and 50% is classified as agricultural self-employment.¹² Within agriculture, dairy plays an important role as a contributor to GDP and an important source of livelihood for a huge portion of Kenyan rural population. Calculated at international prices, cow milk is the most significant agricultural commodity for Kenya.¹³ Estimating the size of the dairy industry, however, is a challenge. Most of the sector is informal, and the official statistics capture only a small portion that is formal.

Almost all Kenyan dairy statistics are only estimates, at best. The last cattle census was conducted in the 1960's. The current official cattle population statistics come from the Ministry of Livestock and Fisheries Development, through its field reports compiled by extension officials. The methods used for estimating livestock size by extension officials are questionable.¹⁴ The official statistics place the number of milking cattle at 3.5 billion. The survey conducted by Smallholder Dairy Project (SDP) asserts that the actual cattle number might be double the official figure.¹⁵ The Food Agricultural Organization uses the figure of 5.5 billion milking animals.¹⁶

The discrepancy in the cattle size leads to a very different estimate of average annual yield per cow. According to FAO an average yield per cow is 564 kg per year,¹⁷ while the official figures place it at around 1,000 kg per year per cow.¹⁸ That being said, the milk production figures which are used to determine the yield are also only an estimate. Both FAO and the official statistics place the milk production for 2007 at approximately 3.5 billion liters.¹⁹

¹² World Bank, Kenya at a glance.

¹³ FAOSTAT.

¹⁴ SDP Policy Brief 10: The uncertainty of cattle size in Kenya.

¹⁵ SDP Brief 10: The uncertainty of cattle size in Kenya.

¹⁶ FAOSTAT.

¹⁷ FAOSTAT.

¹⁸ Ministry of Livestock and Fisheries of Kenya.

¹⁹ FAOSTAT, last year available 2006.

The problem with establishing the milk production is that only a fraction of the production is processed and enters the formal sector, and thus the official statistics. In 2007, only 423 million liters were processed.²⁰ It is estimated that another 10.5% of milk produced is consumed by calves, 34.5% on-farm and 55% is marketed, including both formal and informal market channels.²¹ Valuing on-farm consumption at farm-gate price of 14 Ksh per liter,²² the informal market at 18-26 Ksh per liter²³ and the formal market at 56 Ksh per liter,²⁴ the value of the dairy sector could be approximately 73 billion Ksh. This represents approximately 4% of GDP and 19% of agricultural GDP.

When valuing dairy as a source of livelihood, the statistics are equally imprecise. It is widely cited that about 70-80% of milk production comes from smallholders, with the remainder from larger producers, estimated at about 5,000.²⁵ The estimates of the number of smallholders vary. The number of 600,000 (Omore et al, 1999) has been widely cited for many years. According to SDP, the Kenyan population has grown significantly over this period and the number is no longer valid. According to their revised estimate the number of smallholder dairy farms is much greater at about 1.8 million.²⁶ Kenya Dairy Board (KDB) estimates are lower at 1 million households.²⁷

1.8 million farms represent about 35% of rural households and 26% of total households in Kenya.²⁸ Most of them combine dairy production with maize, or other cash crops. ILRI estimates that about 40% of their income comes from dairy. In addition to being an important source of recurrent revenue cattle is also an important asset investment providing non-recurrent income (from selling cattle or meat)²⁹. Income from

²⁰ Kenya Dairy Board.

²¹ IFC, Kenya Dairy Sector Value Chain Study (January 2007). As with many other figures frequently cited by a number of studies, there are no recent surveys confirming this.

²² Economic Survey 2008, Kenyan Bureau of Statistics, and a number of chilling plants' financials.

²³ Average informal market wholesale prices in 2007, based on interviews.

²⁴ Average ex-factory price in 2007, Kenya Dairy Development Program.

²⁵ IFC, Kenya Dairy Sector Value Chain Study (January 2007).

²⁶ ILRI.

²⁷ Kenya Dairy Board.

²⁸ There is a total 6.9 million households in Kenya according to Household Budget Survey 2005/06 Kenyan Bureau of Statistics.

²⁹ SDP Policy Brief 7: Multiple Benefits of Smallholder Dairy Production

dairy is also the only year-long recurrent revenue from agriculture, though revenue flows do fluctuate with seasons.

Most of the dairy production is concentrated in Rift Valley and Central Province. 53% of dairy cattle is found in Rift Valley and 25% in Central Province.³⁰ From there milk moves either to milk deficient areas or to Nairobi and other urban areas.

Almost all Kenyan production goes to satisfy local demand. Trade in dairy products is insignificant. Kenya is a net importer of dairy produce. Net imports represent only about 0.5% of total milk produced in Kenya.³¹ Milk powder makes about 70% of imports by value, and is mostly used by Kenyan dairy processors during dry season to produce fresh milk. The only processor in Kenya with the capacity to produce milk powder is KCC. The collapse of KCC led to a surge in imports and almost complete collapse in exports. In value terms, the net imports represent a US\$3 million opportunity for Kenyan processors.³²

The unreliability of data makes it difficult to draw concrete conclusions about the milk production, consumption and marketing patterns. There is an agreement that Kenya has a significant cattle population and that the average yields are low, with the official statistics placing it on par with India and the FAO numbers at half the Indian average yields. Either way, the yields are well below some other developing countries, such as South Africa and Argentina with yields at 2,500 – 3,500 kg per year, and far below developed markets such as the US with yields of around 9,000 kg per year.

Using the data that is available, and bearing in mind that all numbers used are only estimates, the following patterns emerge:

³⁰ FAO, Land O'Lakes, Impact of Post-Election Violence on Kenyan Dairy Industry, February 2008.

³¹ Based on last available food balance data from FAO for 2001-2003. The net import of dairy produce, excluding butter, for Kenya was 14 million liters out of total production of 3.2 billion liters. FAO, Food Balance 2001-2003.

³² The value based on FAOSTAT.

- During the 1980's the production of milk has more than doubled, growing at 11% CAGR. With the liberalization of the sector, the production went into stagnation. Starting in 2000, the production has returned to growth, growing at an average of 8% CAGR.
- The production shows wide fluctuations year-by-year. Due to low usage of commercial feeds and high reliability on available grass, the production is highly dependent on weather.
- According to the production, cattle size and yield data it results that most of the growth in production over the last seven years has been driven by increase in yields.

However, despite an increase, the Kenyan yields are still substantially lower than the international standards. The reason is twofold:

- Poor and inadequate feeding. Most cows produce well below their potential because their nutrient intake is insufficient in both quantity and kind. Most smallholders feed their cows by letting them openly graze, mostly on common land, by the side of the road. This does not provide cows with sufficient quantity of food. Grazing is not normally supplemented by feeds, depriving cows from required level of proteins and minerals. The main reason for not using commercially or home-made feeds is their high cost. Also, the farmers often complain that the quality of commercial feeds varies, and is inconsistent. At the same time, some ingredients to make home-made feeds, such as cotton seed cake are not locally produced, and occasional shortages can increase the cost of production.
- Poor breeding practices. The bulk of Kenya's dairy herd has a relatively low genetic base due to years of inbreeding and the use of unproven bulls. This lowers potential productivity. Artificial insemination (AI) is still not

widely used. According to KDB only 140,000 inseminations were done in 2004.³³ The main reasons cited for a low usage of AI is its high cost.³⁴

The dairy sector was greatly impacted by the post-election violence. According to a survey done by Land O'Lakes, 36% of Rift Valley and 31% of South Valley population was displaced, about 10% of cows were lost or stolen, and milk collection and distribution was severely disrupted. Milk processors and cooling plants were unable to collect milk, a number of informal traders and milk bars were displaced or destroyed, and access to feeds and other inputs was severely disrupted. Total loss to dairy industry, including loss to consumers, is estimated at 7.1 billion Ksh.

According to interviews conducted in Rift Valley in late July (2008), the production and collection has returned to normal. Milk intake by processors has returned to its regular levels, recording 10% increase, from May 2007 to May 2008.³⁵ The final impact on the level of the milk production in 2008 is difficult to estimate. Using the decrease in the formal sector intake as a proxy for the fall in production, the overall milk production for 2008 could be 8% lower than the production in 2007.

DAIRY SECTOR: CONSUMPTION

As mentioned, it is often cited that only 55% of milk produced is marketed. 80% of marketed milk is channeled through informal channels, and about 20% is formally processed.³⁶

Prior to 1992 there was a high degree of government involvement in the dairy sector, with KCC being the only allowed milk processor in the country. With the liberalization in 1992 and collapse of KCC in 1997, the formal sector nearly disappeared.

³³ Kenya Dairy Board.

³⁴ The cost varies from 800 – 6,500 Ksh per insemination, depending on the quality and origin of semen, based on interviews.

³⁵ Kenya Dairy Board.

³⁶ The figure includes only industrial processing, and excludes home processing.

Since then, with the consolidation of the industry, the revival of KCC in 2002, increased marketing and innovation in packaging which brought down the price point, the industry has recovered, regaining the market share vis-à-vis the informal market. The general economic growth over the last five years has also benefited the formal dairy sector, with more people being able to afford processed milk. The processed milk now stands at 20% of marketed milk.³⁷ Although still small in absolute value, the formal dairy industry has grown at 32% CAGR (2003-200) over the last four years, the fastest growing agricultural sub-sector over that time period.

The demand in both informal and formal market channels is unsophisticated. Milk is consumed either raw or as its processed equivalent of fresh milk. In the informal market only about 16% of milk undergoes home or artisanal processing and is sold as home made sour milk (mala or lala) or yogurt. Very similar dynamics prevail in formal market. 85% of processed produce is sold as fresh milk either as short life pasteurized milk or long life UHT milk. Yogurt makes another 3%, fermented milk 7% and powder milk 3%, with value-added products such as cheese and butter making less than 2% of produce sold.³⁸

Most of the unprocessed and home processed milk is sold either through mobile traders or small retail outlets. The produce is often not properly packaged, but sold using re-usable containers or customers' own containers. In most urban areas, milk bars are licensed by KDB and the local government which subject them to occasional public health and sanitation checks. This is not the case with milk bars in rural areas.

The competition in dairy processing is strong. There are currently 34 registered processors.³⁹ However, more than 80% of market is controlled by three large companies that compete fiercely. According to the figures from December 2007, new KCC held 39%, Brookside 31% and SpinKnit 13% (closely followed by Githunguru with 9%)

³⁷ Figures refer to 2007. Kenya Dairy Board.

³⁸ Industry survey, 2008.

³⁹ Kenya Dairy Board.

market share.⁴⁰ The industry wide utilization is low at 40%.⁴¹ The utilization by top three processors is also low. KCC and SpinKnit use only about 30%-40% of their capacity, with Brookside being more efficient at 60-70% capacity utilization.⁴² Increased competition has led to the introduction of new packaging with the aim to bring the price point lower, and make processed milk more competitive vis-à-vis raw milk. Fresha brand was the first to introduce 250ml and 500ml pouch packaging at 25% lower price point. All major brands have followed suit.

DAIRY VALUE CHAIN

Overview

The value chain of both formal and informal market is fragmented with a large number of players at each step, and a low level of vertical integration (see Annex 1). In the formal value chain, the milk is usually transported to chilling and bulking centers, then to a processing facility. Once milk is processed, agents or distributors deliver it to a point of sale. Informal market connects producers to consumers normally via a number of brokers. In both formal and informal markets one or more steps may be missing.

Despite strong competition for milk between formal and informal market, the farm gate price is on average the same. The preference for selling into informal market is driven by preference for cash. The informal sector is a cash sector, while processors usually pay at the end of the month. Considering that milk is often the only recurrent revenue, the need for cash to cover daily expenses creates a strong preference for producers to sell to informal traders/hawkers. In addition, there is no quality control in the informal market allowing producers to sell poor quality milk that would be rejected by processors.

⁴⁰ Kenya Dairy Board, Land O'Lakes, Impact of Post-Election Violence on Kenyan Dairy Industry, February 2008.

⁴¹ About 1.17 liters is processed daily versus the installed daily capacity of 2.9 million liters. Kenya Dairy Board.

⁴² KDB, Industry sources.

The main characteristic of the supply chain is the poor cold chain. A huge portion of milk received from farmers for marketing is not cooled. Normally, milk needs to be cooled within 2-4 hours from milking. Milk marketed through the informal market is not cooled at all. Since milk collection is conducted only in the morning, evening milk in particular is of poor quality when received by processors and hawkers the following morning. A poor cold chain also lowers the quality of processed milk and prevents processors from producing long life products that need the high quality input.⁴³

Pricing

Milk takes various routes from producers to the end consumer. 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 17 Ksh per liter. The price to end-consumer, on the other hand, is on average 30-45% lower in informal market when compared to the prices in the formal market (see Annex 2).

However, this price differential is somewhat misleading. When processed milk sold in a pouch pack is compared with the equivalent quantity of raw milk, taking into account seasonal price fluctuations and deficient serving sizes, the price differential is no longer as large. The price of raw milk fluctuates with the season, while the price of processed milk is relatively stable throughout the year. During the wet season, when milk is abundant, a liter of raw milk can be purchased for 30 Ksh. — 38% cheaper than processed milk. However, during the dry season, the price increases to approximately 40 Ksh a liter, reducing the price differential to 20%. In addition, raw milk is often sold in containers of 250 ml that actually hold only 200ml. When this, and possible adulterations, are taken into account the price difference almost disappears.

⁴³ Dairy Industry Task Force: Recommendations (2004).

However, there are important drivers of consumer behavior that have more to do with perception and consumer awareness and less with price, and that will continue to make raw milk more attractive to a large number of consumers:

- Most milk is consumed immediately, usually mixed with tea, so most Kenyans buy milk in small quantities when needed. Most do not have a need for storing milk, and most do not have refrigerators.
- A number of consumer studies show taste preference for raw milk, perceived as creamier and richer.
- Consumers believe that boiling makes raw milk safe for consumption, reducing the willingness to pay a premium for pasteurized milk⁴⁴

Production

There are three types of dairy production, zero-grazing (intensive), semi-grazing (semi-intensive) and open range (extensive). Zero grazing involves confining cattle to a limited physical space where they are managed, fed, watered and milked. Open range involves free grazing by the cattle, often with no supplemental feeds. Semi-grazing falls somewhere in the middle and involves the combination of the two approaches. While zero-grazing requires higher investment in fixed infrastructure and closer management of cattle, it normally produces higher yields per cow. Semi-grazing and open range are less labor and investment intensive, but normally produce lower yields. In the case of zero grazing in Kenya, the yields can be as low as 1-2 liters per day per cow, much lower than the 15-30 liters observed on farms practicing the other two systems in Kenya.

For the purpose of this study, a number of interviews were conducted with both medium to large size farmers (15-100 cows) and smallholders in and around Eldoret. While individual costs and achieved yields vary widely by producer, zero and semi-

⁴⁴ Many diseases are not eliminated through boiling alone. Brucellosis and tuberculosis both can be transmitted through milk. Dairy Industry Task Force: Recommendations (2004).

grazing systems of production can be profitable at 10-15% margin.⁴⁵

Feeding is a major cost component accounting for 70-80% of total cost. Due to the lower usage of feeds and reliance on grazing, feeding costs are somewhat lower in the semi-grazing system. These lower costs, are however compensated by other higher costs, including labor per unit due to lower yields. Individual costs vary widely by farm depending on the quantity and type of feeds used and whether they are commercially produced or “home-made.” Interviews uncovered a wide range of practices leading to very different results both in terms of yields achieved and the cost structure. Switching to cheaper types of forage and home production of inputs were strategies used by farmers to mitigate price hikes of grain and commercial concentrates.

90% of production costs are variable, making cost and yield management the main drivers of production profitability. Effective dairy management requires instituting balanced feeding regime, and reducing seasonality:

- Balanced feeding is achieved when marginal increase in cost of feeding equals marginal increase in yield. Most farmers do not actively manage costs and are focused either on quantity of input or determine feeding regime based on available cash flow.
- Reducing seasonality requires reducing reliance on grazing and practicing annual feed planning. By reducing seasonality, farmers can capture more value in times of milk shortages, and can even reverse the cyclicity by producing more milk when there is a shortage of milk.

Since most costs are variable, there is no need for economies of scale to spread the fixed investment. However, effectively managing yield and cost requires a high investment of time and knowledge and thus minimum scale. It also requires moving from subsistence dairy production to dairy as a business. There is also a minimum scale needed to cover some fixed costs. In the model used to estimate the cost of zero and semi grazing

⁴⁵ Based on current price of 17 Ksh per liter.

production, to cover labor cost by maintaining 10% profit margin, zero-grazing model would require a minimum of 6 cows, and semi-grazing a minimum of 10 cows.

However, the reality of most Kenyan smallholders is very different. For most Kenyan farmers, even though dairy is an important source of income, it is not seen as a business where the aim is to maximize income and minimize costs. For many producers keeping cattle is cultural and meets the need for domestic consumption and while providing some cash flow.⁴⁶

When compared to best practices, most of Kenyan smallholders practice the opposite. They do not use AI, do not feed the cows properly, do not water them properly and use a minimum, if any, preventive health care. This results in low genetic quality of cows which substantially under-produce even in respect to their already limited potential due to poor health and insufficient nutrient intake. Complete reliance on grazing also makes milk production seasonal. In the months after main rains, April to August, abundance of pasture leads to a flush period when milk supplies are plentiful and in excess of the ability of the formal and informal marketing systems to absorb. Yet during the dry season—January to March—there is a huge shortage.⁴⁷

In a model which assumes that the only costs a producer incurs is a minimum salary⁴⁸ and a minimum veterinary costs (tick spraying), an average farmer who has four cows that produce two liters of milk a day barely breaks-even at the price of 17 Ksh per liter. If farmer's revenues are annualized, including both salary and profit, this provides an average of 7,276 Ksh (~US\$ 112) per family member (taking the rural average of five adult equivalents per family⁴⁹). This is well below the food poverty line of 11,856 Ksh (~US\$182) per adult equivalent.

⁴⁶ Dairy Industry Task Force: Recommendations (2004).

⁴⁷ Id.

⁴⁸ Minimum salary for producer is set 30% lower than the minimum wage of 150 Ksh per day, assuming alternative work is not readily available, and thus the opportunity cost is lower.

⁴⁹ Economic Survey 2008, Kenyan Bureau of Statistics.

Low production leads to low income which in turn leads to low production creating a poverty trap. Investing in feeding is impeded by low cash flow. To buy a bag of commercial concentrate at the price of 1,200 Ksh per bag, a smallholder would need to sell 70 liters of milk. Most sell an average of 3-5 liters a day. At the same time, since income from dairy is often the only recurrent revenue which goes to cover family daily expenses, saving is often difficult.

Without investing in feeding, the only other way to increase revenue is through increase in number of cows. However, the increase in number of cows increases competition for limited pasture, further depressing the yields. Additionally aggravating their position, the dependence on weather conditions exposes smallholders to negative price fluctuations. When production is high, prices are low and when production is low prices are high.

Assuming all costs of production are zero, at the farm-gate price of 17 Ksh per liter, to lift the family out of poverty a smallholder needs to sell a minimum of 15 liters of milk. Grazing by itself is unlikely to provide sufficient nutrients for this level of production. Developing cost effective ways of increasing yield thus becomes crucial to lifting smallholders out of poverty. As an example, if a farmer has an acre of land it may be more economical to turn maize into silage, than to sell it as maize, despite the current high price of maize. An acre of land can produce 30 tons of maize, which produce the equivalent amount of silage or 25 bags of maize. The cost of production is approximately 35,000 Ksh (including labor, land, fertilizer and storage cost). If maize is sold at 2,000 Ksh per bag, smallholder's net profit is 15,500 Ksh. When maize is used to produce silage to feed cows than 30 tons of silage can feed approximately three cows for a year at 30 kg per day per cow. If average yield per cow is 8 liters than the net profit is four times higher at 66,000 Ksh⁵⁰

⁵⁰ Valuing milk consumed or marketed, and excluding consumption by calves.

Transportation

Given the remoteness of most of the producers and the poor state of infrastructure, the first transportation mean used is usually a bike, foot or for particularly inaccessible areas a donkey.

A bike being the most prevalent mean of transportation, this study has focused on its cost dynamics. A number of interviews based on a random sample were conducted with bike transporters in Eldoret region. A maximum capacity transported on a bike is about 100 kg. An average distance observed was 10-30 km. Milk is purchased early in the morning and delivered either to a chilling plant or sold to a larger broker by 9-10 am. Most bike transporters use plastic jerry cans to transport milk. This is unhygienic as they are more difficult to clean than the more expensive aluminum cans.

Bikers earn a spread between purchase and sale price, normally around 4 Ksh per liter. Since all costs are fixed in the short term, the major driver of profitability is capacity utilization. Based on the average costs of interviewed bikers,⁵¹ the break even capacity was approximately 60 kg a day.

Since volume is the main driver of profitability, transportation by producers directly will in most cases be cost inefficient due to low volumes, unless distance is small. Small distance reduces the labor cost (lower time investment) and wear and tear of the bike. Most chilling plants deduct 2 Ksh per liter, or 3 Ksh if distance is large. This is 1-2 Ksh less than the spread usually made by bikers in the informal market. It is likely that the loss in spread is born by producers either in the form of lower farm gate price or, if producer is transporting the milk, by not properly accounting for his/her transport costs

When daily salary and net profit from bike transportation are annualized, the bike transport is still only a means to survive and not a business. To lift the family above the

⁵¹ Costs include the depreciation of bike, containers, repairs, labor and spillage.

poverty line,⁵² a biker would need to transport approximately 90 kg of milk daily. Increasing the spread by only one shilling could increase profit by 100%. This encourages opportunistic behavior. Bikers negotiate prices daily with both suppliers and buyers. While most sell to regular buyers (larger hawkers), switching to a new hawker who offers a higher price is considered normal. The ability to increase the spread by negotiating producer prices downwards will depend on the remoteness of a producer and available competition. This opportunistic behavior multiplies the effect of price increase during the dry season, as brokers try to recuperate low spreads during periods of abundant milk.

Most milk purchased by bike hawkers is sold to larger traders who operate pick-up trucks and collect milk from milk surplus areas to transport it to milk deficit areas. Some of the pick-up trucks also operate on behalf of processors. Based on a number of interviews with a random sample of traders in Eldoret region, the average size of vehicle used is 1.2 tons (occasionally packed to transport up to 1.5 tons). The average distance traveled varies by region. In western Kenya, the average distances are higher at 140 – 200 km one-way. Since most milk coming from Central Province is transported to Nairobi, distances are shorter at 30-50km one way. Since the truck needs to transport back the milk aluminum containers, the return trip can not be used to generate additional revenues. The average spread earned between the purchase and the sale price is 6-10 Ksh per liter. The roles of the owner of the vehicle, broker who purchases milk and the broker who sells milk are often split among different individuals.

The main profitability drivers of truck transport are utilization and fuel usage (i.e. distance traveled). If distance is kept constant, since all other costs are fixed⁵³ the average cost per unit drops with the increase in number of units transported. If volume is kept constant, than the cost raise with increase in distance due to increased fuel usage. Therefore, the key to reducing the cost of transportation is volume. When 1.2 ton transport is compared with 10 ton and 30 ton transport, assuming the same utilization of

⁵² With the average of five adult equivalent members per family, Economic Survey 2008, Kenyan Bureau of Statistics.

⁵³ The costs include depreciation of truck and containers, maintenance, insurance, labor and spillage.

80%, distance of 140 km one way (280 total) and spillage of 5%, the cost of transport drops from 5 to 3 to 2 Ksh per liter respectively.

Most of the transporters in the informal market do not have the size needed to reduce the cost. Transportation is still very much a ‘mom and pop’ business. The illegality of informal market is a barrier to entry for the establishment of a large transport company. It is also a barrier to entry to other transporters keeping the transportation margins high. The cash outflow needed to start the business for the first month of operation is about two million Ksh, one million Ksh for the purchase of the vehicle and another million to cover fuel, labor and raw milk expenses, at 21 shillings per liter of raw milk purchased. The illegality of the business prevents recourse to formal sources of financing, so the amount needs to be raised among friends, family and savings. This increases the barrier to entry and leads to the investment often being shared among different individuals. So while the margins at the higher end can go up to 50% of revenue per liter of milk transported, this margin is often shared among two or three individuals.

On the other hand, the large processors are able to drive the cost of transport down to 1-2 Ksh per liter, with spillage and utilization being the main cost drivers. For example, Brookside aggregates milk collected around Eldoret in its chilling plant in Eldoret from where it is transported using 30-ton cooler truck to their processing facility in Nairobi. This way the smaller trucks transporting milk from collection points to their chilling facility in Eldoret drive much smaller distances, keeping the cost of transport low. For a large distance of transport from Eldoret to Nairobi milk is aggregated in a large 30-ton truck.

Chilling

As mentioned, milk should be cooled within 2-4 hours from the moment it is milked. The main objective of chilling is to preserve the quality of raw milk and reduce spoilage before milk is subjected to further processing. If they are not established by

processors, chilling plants are most often owned in at least some percentage by producers, and sometimes they are donor funded.

Milk is either collected by the plant or delivered by producers or brokers. Many chilling plants do not actively manage transportation, leaving it up to members and other suppliers. After delivery, milk is tested for quality. If accepted, milk is placed in a cooling tank to reduce its temperature to approximately four degrees Celsius. After the milk is cooled, it is usually dispatched to processors and transported to their chilling or processing plant.

Most of the costs of chilling are fixed in the short term, making utilization the main driver of profitability. The main components of operating expenses are salaries and electricity/power. Labor cost is fixed in the short term, and the electricity needed to run the cooling operation is somewhat lower if volume is lower, but it is not proportional to the milk in the tank. Additionally, some chilling plants are not connected to the power grid, or have unreliable power supply and thus need to use diesel powered generators. This additionally increases the cost of operation.

All chilling plants currently charge a fixed spread of 2 Ksh per liter. As an illustration, if the farm gate price moves to 20 Ksh per liter, the ex-chilling plant price would move to 22 Ksh per liter. However, maintaining a fixed spread is problematic in the long run. If expenses grow at an average inflation rate of 10%, and spread remains constant, the profit margin will eventually disappear. To be sustainable a chilling plant needs to be either forward or backward integrated as a cost center of producers or processors.

Processing

The processors often receive negative press that their margins are too high, and that if they would reduce their margins than they could reduce the price of processed milk to the benefit of all. More consumers would be able to afford processed milk, which

would increase the intake by the formal market and encourage investment in cold chain and production. Eventually, better handling of milk and the extension of the cold chain would lead to higher quality of processed milk benefiting not only the local consumers, but also positioning Kenya to use its milk production potential to tap into regional markets. Currently, the quality of the milk produced in Kenya hardly reaches the regional standards, and falls substantially short of international standards.

The exact cost of dairy processing in Kenya is very difficult to determine considering that all financial data is confidential and that the competition is very strong, leading to confidential treatment of any data which may uncover margins and costs. The costs used in this study were estimated based on industry interviews and comparison to international standards.

As in dairy processing in general, raw milk is the most significant cost category, accounting for approximately 50% of ex-factory price. This means that the fluctuations in raw milk prices have a big impact on profit margins. The industry estimates for the cost of processing (excluding packaging) range from 12 to 16 Ksh per liter. As a comparison, the studies of the US dairy processing costs show the average cost for a US based milk processor to be about US\$0.21 per liter (approximately 14 Ksh per liter).⁵⁴ While some costs of processing in the US may be higher, such as labor, the processing itself is probably much more efficient.

When 12 Ksh is taken as an average cost of milk processing in Kenya and when cost of packaging per liter (8.6 Ksh for TC and 1.45 Ksh for pouch) is added, given the ex-factory price, the processors make an average of 10% unit profit margin for pouch packaging and 20% for TC packaging. A higher margin for TC packaging indicates higher willingness to pay for what is perceived as a premium product.

⁵⁴ T. J. Dalton, G. K. Criner, and J. Halloran, Fluid Milk Processing Costs: Current State and Comparisons, American Dairy Science Association (2002)

10-20% unit profit margin is in line with international standards. Given the number of players, recent bankruptcies and low utilization rates of even the successful processors it is unlikely that the abnormal profits would survive for a long time. Absent cartel price arrangement which does not seem to exist, if substantially lower price was possible an existing competitor or a new company would be incented to undercut the price to gain market share.

CHALLENGES AND RECOMMENDATIONS

Production

A complete lack of cost control is the main issue, especially for medium and large producers. None of the interviewed farmers knew their cost of production, or what increase in production resulted from adding an additional kilogram of food, or from altering the food regime. While medium to large farmers are not the target for EADD, they can play an important role as role models or milk aggregators. A number of more successful farmers interviewed played such a role for their neighbors, encouraging the time investment needed for better cattle management, and often purchasing and aggregating milk in their area. Developing a simple financial farm toolkit would enable farmers to start monitoring and controlling their costs. Chilling plants should assist farmers with developing this basic set of financial skills and instruments. At the same time, it is crucial that the feeding advice and manuals be based on cost-benefit analysis. Often manuals recommend the best feeding system bearing in mind the yield that can be expected, but ignoring the cost involved.

The main issue for smallholders is their cash flow. Income from selling 3-5 liters of milk per day is too low to provide cash needed for investment. In addition this income is normally used to cover daily expenses and is not invested in dairy production. It is crucial that feeding and cattle management advice incorporates this cash constraint. EADD should develop low cost methods to increase production, for example adding cut grass, growing Napier grass, using home made silage etc.

In addition, due to their reliance on grazing, smallholders are very much exposed to seasonality. Some of the seasonality may be removed just by instituting good feeding planning practices where forage is bought at a low price when it is abundant and used during the dry season when its price is high and pasture is not available. The endorsement of such practices requires an attitude change on behalf of smallholders. In other words, they need to start viewing dairy as an annual business that needs to be managed on an annual basis, rather than as a daily activity.

A number of interviews raised the issue of low or inconsistent quality of commercial feeds. A number of farmers now make home-made mixes by buying or producing the ingredients on farm and then mixing them. This can be a cost effective feeding regime and can provide a higher level of reliability regarding the content of feeds. However, there was a wide variety of home-made mixes in use, and not all of them necessarily provide a required level of proteins and minerals. The content can be tested at one of the Universities or laboratories providing farmers with the advice how to adjust the mixes to provide the required level of food ingredients.

Transportation and chilling

Due to lack of volume the cost of transportation is high, and due to high barriers to entry there are also high mark-ups for certain types of transport. Chilling plants should actively manage the cost of transport of its members. This will reduce the overall cost in the value chain and maximize profits for producers. The actual ways of managing the cost of transport will have to be determined case by case, depending primarily on the distance from farmers to the chilling plant, their accessibility and whether they are clustered in the same area or dispersed. The geographical location of farmers should also serve as one of the guiding principles when deciding on the location of new chilling plants.

The main challenge for a chilling plant is managing costs and utilization rates. However, if the spread remains constant, the profit margins will eventually disappear. As mentioned, to be sustainable a chilling plant needs to be either forward or backward integrated as a cost center. In other words, if owned by producers, then the production, transport and chilling should be seen as part of the same value chain with profit maximization achieved across the chain. Currently these three parts are seen as separate operations. This creates a conflict that the profit in one part is often made at the expense of the other two parts of the value chain. Cost minimization and profit maximization should be seen as cutting across the three parts, with producers being the main beneficiaries.

Finally, the final product of the chilling process should not be milk which is in no way differentiated from the milk that can be sourced directly from producers. If processors can source directly from producers, at the lower cost than buying from the chilling plant, then a chilling plant does not have a value proposition. The final product should be good quality milk that processors see value in buying because chilling plants provide them with quantity and quality of milk needed, and at the price which is competitive to the cost processors would incur by sourcing directly from producers. As noted in the interviews, the processors occasionally compete directly with chilling plants in sourcing the milk from producers. This indicates that at least in some locations processors could perform the role of chilling directly, cutting out the need for a producer owned chilling plant. That is why it is important to work closely with processors to determine which locations make most sense for new chilling plants. The new plants should extend the cold chain rather than duplicate it.

Processing

As was uncovered during the interviews, some elements of the taxation policy distort dairy investment decisions. For example, there is a high level of taxation for yogurt processing versus other forms of processing. EADD could work with KDB on establishing neutral taxation policy.

The high level of fragmentation increases transactional costs and amplifies the effect of seasonality. While this affects both formal and informal market channels, the effect on the formal is arguably much higher. Informal market seems to be effectively passing on input price increases and decreases to consumers. Formal market has much less flexibility as the retail price cannot change that quickly and frequently. Given that the raw milk constitutes 50% of processor costs and that the availability and price fluctuates with the season, it would make financial sense for processors to hedge their input price risk by long-term contracting. This would reduce the transactional costs, flatten the cost variations for processors throughout the year, and encourage investment by counter-parties in cold chain and production. There is a hold-up problem now: no one is willing to invest in the cold chain or in increased production because it is unknown if the milk will be sold and at what price. While opportunistic behavior may benefit the buyer or the seller on any particular day, it reduces profits overall.

Finally, milk purchases are currently driven only by volume and not quality. Processors are not willing to pay the premium for quality, discouraging investment in quality milk production and handling, and investment in cold chain needed to preserve the quality of milk. This creates a market failure to create and capture value through quality differentiation and makes exports impossible for not meeting the quality standards. The focus on quality will also increase the value proposition of extending the cold chain.

Recommendations

The major component missing on the ground is a basic system for data gathering and analysis, both on the farm and chilling plant level. Some chilling plants interviewed had a data gathering function in place, i.e. they were producing a basic set of financial data. However, the data was not used proactively to make strategic decisions. Most were unaware of even the basic metrics such as the break-even utilization rates. They also did not seem to practice any cost management, for example using flexible labor contracts to

reduce costs in times of lower utilization. Turning chilling plants into hubs with multiple functions will put an additional strain on the current management capacity.

A basic financial toolkit for farmers and chilling plants should be developed, that will select and track main performance metrics. The main objective would be to analyze performance, serve as a quick indicator when and what operationally needs to be adjusted and provide input for strategic decisions (e.g. should a chilling plant buy or lease a truck, or outsource transport etc.). As business advisors are the main point of contacts for chilling plants they should participate in the financial toolkit development and be trained in basic financial and analytical skills.

ANNEXES

Annex 1, Value Chain



Players

- ~ 1.8 M smallholders
- ~ 5K large farms

- Large number of individuals using bike, foot or vehicles

- A number of bulking centers
- ~ 70 chilling plants, not all operational

- 34 registered, 3 large

- Informal: a number of brokers and hawkers
- Formal: a number of agents and distributors

- Mobile: a large number of traders selling milk door to door
- Fixed: kiosks, stores, supermarkets

Integration

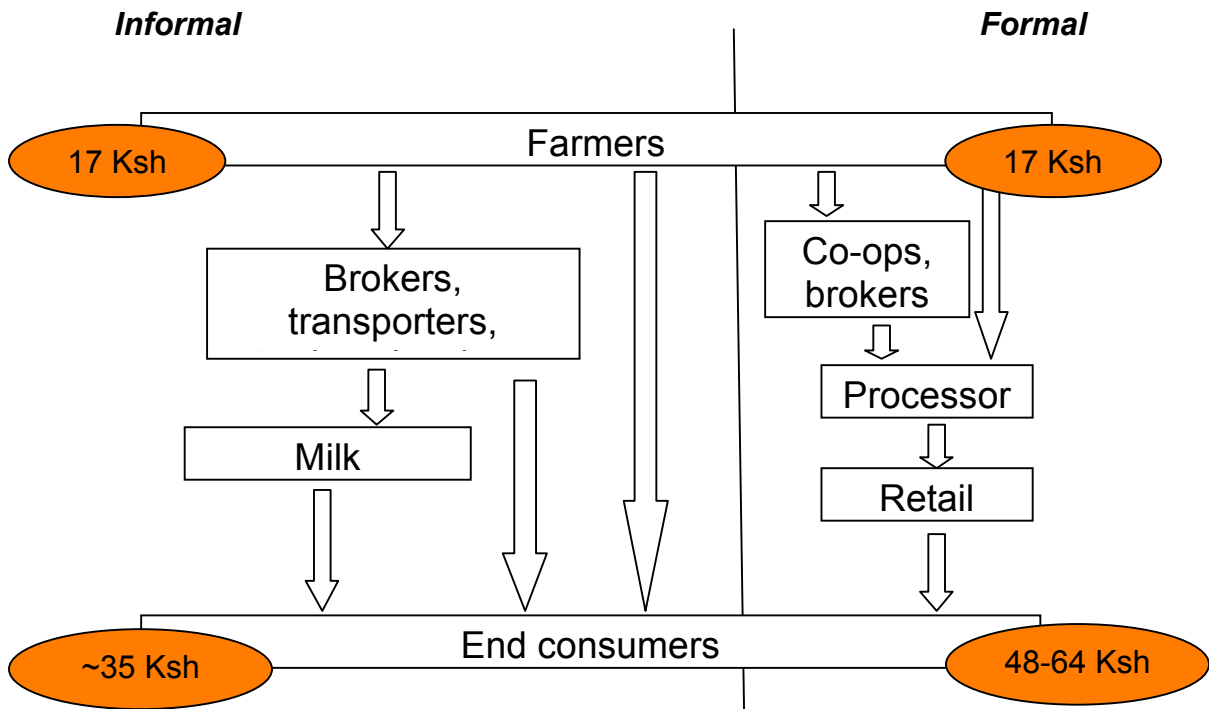
- Can be done by producers or by processors when they buy directly from producers

- Owned by either producers or processors, some donor-funded

- Own chilling plants and some parts of transport chain

- Producers and transporters sometimes sell milk directly to end consumer

Annex 2, Market Map



Note: Informal prices range from 30 to 40 Ksh, depending on seasonal availability of milk and distance to market. Formal market prices are based on 500ml pouch (25Ksh) and 500ml TC (TetraPak classic - pyramid TP packaging) (32Ksh) of pasteurized fresh milk.

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