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Constraints and growth potential in the dairy value chain

A value chain assessment

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List of Acronyms

AVB	Association des Vétérinaires du Burundi
BAP	Burundi Agribusiness Program
CIRAD	Centre de Coopération International en Recherche Agronomique (France)
CNIA	Centre National d'Insémination Artificiel
DGE	Direction Générale de l'Elevage
FAO	Food and Agriculture Organisation
FBU	Burundian Francs
GOB	Government of Burundi
GDP	Gross Domestic Product
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
MAE	Ministère de l'Agriculture et de l'Elevage
MPC	Marginal propensity to consume
MT	Metric ton
PARSE	Project d'appui à la reconstruction de secteur de l'élevage
SORG	Sources of Growth Study
UHT	Ultra-high temperature

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Introduction

This report focuses on the livestock-dairy value chain, which is a major segment of the overall livestock sub-sector. It does not cover the meat or hides and skins value chains, which are entirely different sub-sectors with different producers, processors and market dynamics. Dairy is a vital component of the overall livestock sub-sector. Estimates from 2004 show bovine milk production at a value that is roughly similar to those of beef, goat and pork production.[1] More importantly, however, the dairy value chain is the most dynamic segment of the livestock sub-sector as improved production techniques that are transforming the Burundian livestock sector are being diffused into the countryside under the impetus of market-oriented dairy farmers. Furthermore, there is a groundswell of interest among private sector agribusiness investors in restarting small-scale modern industrial milk processing facilities to serve Burundi's growing urban market.

Research for this report was conducted over a two week period and consisted of a review of the relatively limited background documentation available on the sector, interviews with sector participants including dairy farmers in the provinces of Gitega, Bururi, Muramvya and Bujumbura Rurale, as well as collectors, wholesalers, retailers and processors in Bujumbura. A short survey of 70 points of sale in three Bujumbura neighborhoods was also conducted to provide a clearer picture of the structure of the milk distribution and marketing network in the capital. The main objective of this report is to present a synthetic picture of the dairy value chain and how current market dynamics are influencing its structure, in order to arrive at an "action plan" for accelerating growth presented in the final part of the study. This is intended to provide USAID with an idea of the potential return that can be had to working in the dairy sector and some indications of where the key leverage points are and what actions are required to address the major VC constraints.

Dairy Overview and Recent Trends

No estimates of the contribution of dairy sector output to GDP exist. However, the World Bank estimates that the livestock sector as a whole generates FBU 52.8 billion a year which represents 22.4 percent of agricultural GDP and 6.4 percent of total GDP.[2] An estimated 10 to 20 percent of Burundian rural households possess cattle, but only a small fraction of these are exploited in a market-oriented fashion for milk production.

Along with the rest of the livestock sector, the dairy value chain underwent significant disruption during the period of crisis that lasted from 1993 to 2004. The deteriorating security and economic situation imposed two major types of losses on the dairy sector. The first of these was a loss of capital investment with pillage and cattle killing that led to significant reductions in the herd. Although no figures on dairy versus non-dairy cattle are available, MAE (Ministère de

[1] The calculated values in USD are $17 million for beef, $14 million for goats, $14 million for pork and $16 million for bovine milk. These figures are based on 2004 production estimates from the MAE valued at 2004 Bujumbura market prices from the FAO market price data base. As discussed below, particularly for milk values, these are very rough estimates subject to a high margin of error.
[2] World Bank, SORG, P. 59.

l'Agriculture et de l'Elevage) figures show a decline in the cattle herd of 23% between 1992 and 2003. The second key development was the disappearance of the two industrial dairy processing firms who ceased operation during the crisis period. The first of these, a state-owned parastatal, Laiterie Centrale de Bujumbura closed its doors in 1993. The second, a private firm, PRODULAIT, functioned from 1989 to 2003, but reportedly filled much of its volume during the crisis period with reconstituted milk made from imported milk powder. These developments left the sector, at the end of the crisis period, with the double problems of a depleted production base and lack of a large-volume modern processor at the top of the value chain. Despite this disappearance, large volumes of fresh milk continue to flow into Bujumbura and other urban centers through a network of small and large traders and integrated household sales points that draw from family dairy farms.

The crisis period not only affected the size of the dairy herd, but also its geographical distribution. In response to increasing insecurity in the provinces, many civil servants based in Bujumbura who owned cattle in their home regions, decided to bring their animals into Bujumbura for safekeeping towards the end of the crisis period in 2003-2004. This period of forced enclosure provided further impetus to the pre-existing evolutionary trend in cattle production away from extensive grazing towards intensive enclosed "zero-grazing" or semi-enclosed systems in which animals are confined in pens and fed exclusively or partially with fodder crops. (See "supply" discussion below). With a subsequent improvement in security conditions and a government decision banning cattle from the Bujumbura Marie province, many of these animals have been moved to the Imbo plain in Bujumbura Rural or to neighboring Bubanza province from where they supply much of the urban market demand of Bujumbura. These farms, employing intensive production methods with liberal use of hired labor form an important hub of relatively advanced dairy farms in Burundi.

Since the end of the crisis and the low point of 2003, figures available from the Direction Générale de l'Elevage (DGE) show a clear turn-around in overall herd size. Between 2003 and 2005, DGE figures show an increase of from 355,222 in 2003 to 395,741 in 2005—a difference of 40,519 heads. With only 3,250 of this increase due to official repopulation programs, the clear inference is that the vast majority of the repopulation effort has been due to cattle owners' own efforts. World Bank estimates from the "Sources of Growth" work hold that the cattle herd had reached 91 percent of its pre-crisis level by 2005.[3] Although no subsequent figures have been published, it is not unreasonable to hypothesize that the cattle herd has now reached or surpassed its pre-crisis level, assuming continued growth at 2003-2005 rates.[4]

Reestablishing the dairy value chain will provide important indirect benefits in two main areas: poverty and nutrition. The poverty impact of improved dairy production is important, although it comes mainly through increasing employment opportunities rather than from its impact on increasing the household wealth of dairy owners and traders, who, given the value of assets

[3] Sources of Growth, p. 10-11 and GOB, PARSE working paper, Tableau 1.
[4] The trend in overall cattle population is relevant more as an indicator of producers' willingness to invest in livestock and in general security conditions than for actual dairy output, which is much more responsive to changes in herd composition and production techniques than to the numbers of animals.

required for intensive dairy production are, almost by definition, not drawn from poor or vulnerable populations. In areas where there are emerging centers of investment in intensive dairy farms, such as the Imbo plain, Gitega and Muramvya, these family-owned farms are important centers of employment, employing up to 15 people on some of the larger farms that combine both dairy production with cultivation of fodder crops. Although these numbers are still small, a significant increase in intensive dairy production, particularly in rural areas away from Bujumbura would have a significant employment effect in zones where income earning opportunities are limited.

In terms of nutrition, it is estimated that the self-consumed (i.e. non-marketed) portion of milk production accounts for fully 39 percent of rural households' protein consumption needs.[5] Thus any global increase in milk production, especially beyond the production areas in Bujumbura Rurale, will have a major nutritional impact on rural populations. In addition, anecdotal information collected during the field work for this report in urban areas would seem to indicate that milk is also a critical component of urban households' strategies for ensuring adequate child nutrition—as poorer households tend to reserve milk only for children. Only as income levels increase does milk consumption spread to other members of the household.

Supply

There are no authoritative estimates of milk supply or recent growth trends. The Direction Générale de l'Elevage (DGE) has milk production estimates that are based on generally outdated assumptions of productivity and herd composition. The FAO also produces estimates based on standard assumptions of productivity that are thought to be too low because they too are based on outdated herd composition assumptions.[6] Probably the best estimates are those produced within the framework of the MAE/IFAD livestock project design effort (PARSE) and in the subsequent background work for the World Bank Sources of Growth study, both of which made calculations based on revised herd composition hypotheses and estimates of the adoption of improved dairy practices. These are the estimates that appear in the last two rows of Table 1 below.

Table 1: Estimates of Milk Production and Marketed Volumes

Source of Production Estimates (year of estimate)	National Production (MT)	Est. Marketed Volume (MT)	Implied Consumption Per Capita (liters/year)
DGE (2004)	13,000	2,000	1.7
FAO (2005)	19,300	N/A	2.5
MAE working paper (2004)	28,000	N/A	3.7
World Bank/SORG (2005)	48,000	14,396	6.3

[5] World Bank, Sources of Growth, P. 63.
[6] These judgments on existing statistics are given in the background paper to the World Bank Sources of Growth report.

Interviews with milk traders in Bujumbura and the point of sale surveys conducted for this report seem to indicate that the larger volume estimates in the last row of Table 1 are probably closest to reality—since the volumes of milk reported to be moving into Bujumbura each day are broadly consistent with a national and marketed production levels of on those magnitudes.[7]

The implied consumption levels in Table 1 (based on total production divided by a population of 7.6 Million) show that levels of consumption in Burundi have at rebounded from the 4.9 liters/year figure reported by the FAO for the 2000-2002 period. Nevertheless, milk consumption is still low in Burundi by comparison with neighboring Rwanda (18.9), Uganda (22.6), Tanzania (24.8) and most of all Kenya (84.4).[8]

As is clear from Table 1, the majority of milk is produced in widely dispersed small holder systems and is mostly consumed by the household rather than sold into the market. Production volumes, productivity and approaches to dairy business opportunities vary widely according to the type of production system used. Box one presents the three major production systems now in use in Burundi. These range from the traditional extensive system to semi-intensive and intensive integrated farming systems.

Box 1: Typology of Dairy Production Systems

"Traditional" Extensive Production. Burundi's basic historical livestock system relies exclusively on openly grazed cattle of either the local "Ankole" variety or of cross breed Ankole-Sahiwal animals after programs introducing improved Sahiwal animals in the 1950s. In this system, farmers put the cattle out to pasture during the day and enclose them only at night. Manure is usually not collected. In general, virtually all food is from open grazing although some feed supplements may be used during the dry season. The Ankole and Ankole/Sahiwal cross-breeds are resistant to diseases and have lower nutritional requirements than improved breeds. Dairy productivity by cow is extremely low for the Ankole (41 liters per year per head) and low for the Ankole/Sahiwal cross breeds (82 liters per year per head)[9]. There are an estimated 295,805 head of both types in 2005. Thirty-five percent of national milk production is thought to come from extensive production. Although farms using extensive production methods are present everywhere, they are more prevalent in zones of low population density and farther away from Bujumbura. Herd size varies very widely with the availability of land.

Semi-intensive integrated farming production. In this system, cattle are partially confined in stables but also are sent out to graze. Nutrition is thus supplied by a mix of open grazing and fodder crops brought to the enclosures. Genetic types vary widely, consisting of Ankole/Sahiwals and also cross breeds with improved European dairy breeds that have been introduced by various programs since the 1980s (these include Dutch Friesian/Holsteins, Jerseys, Hershires, and Swiss Browns). Manure is generally collected and used by the household as fertilizer. Dairy productivity can amount to 282 liters per year. The number of improved cross-breeds with European stock exploited under this system is estimated to be

[7] See discussion of volumes below under "traders" in the Value Chain Participants section.
[8] The WHO norm for per capita consumption is 50 liters/year. MAE, Working Paper, P. 6.
[9] Productivity measures listed here are for excess milk after consumption by calves. They also give per head measures for a farm that is organized to keep one reproducing female in steady state production and therefore have other "unproductive" animals in the herd. See technical notes on models prepared by Marc Moens in World Bank, Sources of Growth, 2007 Annex 3.

79,148. The European cross-breeds are more subject to diseases and require higher levels of veterinary care. Numerous Ankole-Sahiwal cross-breeds are also present. Semi-intensive farms account for an estimated 40 percent of milk production. Most families possess only one or two animals.

Intensive zero-grazing dairy farms. On zero-grazing dairy farms, animals are completely confined to enclosures and fed with fodder crops and feed supplements consisting of mixtures of wheat or rice bran, soy, and molasses. These farms use only cross breeds with European stock, or even stock that is predominately (more than 7/8) of European breed origin. Manure is collected and generally used to grow fodder crops if the farm posses enough land. Dairy productivity is extremely high by Burundian standards—around 1, 496 liters per year. There were an estimated 19,787 nearly pure European stock dairy cattle exploited under these systems in 2005. These intensive dairy farms produce over 20 percent of the national milk production, despite only comprising an estimated 5% of the national cattle heard. These farms tend to have a minimum of 5 animals and can go up to 20 or even 30 head and employ a minimum of 2 to 3 workers and up to 15 for the larger farms with integrated fodder cultivation.

Sources: World Bank, Sources of Growth, 2007; study team field visits

Extensive and semi-intensive and intensive production methods involving confined animals and cultivated or purchased fodder seem to be growing in popularity. Zero-grazing dairy techniques were introduced in the mid-to late 1980s under FAO and MAE livestock improvement projects, and have received added momentum during the crisis, when many livestock owners adopted enclosed methods of production (*stabulation* in French) for security reasons. The other advantages of intensive or semi-intensive production are clear. They offer improved productivity and profitability and, most importantly, they make efficient use of increasingly scarce land resources. As shown below in Table 2, by moving to intensive systems of production based on cultivated or purchased fodder crops and by using improved genetic stock, farmers can achieve exponential increases in milk production relative to traditional systems (difference in productivity of over 36 times between an Ankole under extensive production and a European breed cow in an intensive system). With decreasing land availability due to the return of displaced persons and underlying population growth, the reasons for a generalized move to intensive systems is abundantly clear.

Table 2: Land Requirements for different cattle breeds

	Hectares required to support one producing female with calf	
	Open grazing pasture	*Fodder crops*
Ankole	3	0.14
Ankole/Sahiwal crossbreed	4	0.21
Ankole/Sahiwal-European crossbreed	6	0.30
European “purebred”	11	0.53

Source: World Bank, Sources of Growth, P.15.

Although there is no geographic breakdown of dairy cattle by breed, the locus of European stock (largely of undocumented genetic purity) knowledgeable informants contend that they are largely concentrated in intensive farms located in Bujumbura Rurale, Bubanza and Muramvya and near key provincial cities (mainly Gitega and Ngozi) in zones where past projects had introduced

them. In all these zones, a number of civil servants and other investors have invested in land and set-up intensively managed farms that are exclusively for dairy production. The success of these operations is also reportedly winning converts among their less wealthy neighbors who are increasingly imitating them and moving to more intensive systems relying on European crossbreeds. Evidence of this underlying trend towards more productive and intensive dairy technologies can be seen in World Bank figures on the annual rate of growth of different breeds, which show that by far the fastest growing breeds from 2000- 2005 are the European purebreds (+ 6.7%) and the European-Ankole/Sahiwal crossbreeds (+ 17.2%), while other types are either stagnating or declining (Ankole/Sahiwal +1.33%, Ankole – 2.0%). To conclude, given the clear trend towards more intensive systems with their vastly superior productive potential, the case for a generally rising level of milk production seems to be solid, despite the lack of data.

In addition to milk, Burundi produces a few other dairy products. Yoghurt and butter are both produced in retail businesses that sell milk. Yoghurt, which is consumed in a liquid form, is virtually the same product as milk, as it is produced by the same businesses, sold in the same locations and at the same prices as milk. Butter is a relatively minor product that is skimmed off and sold by some retailers. Cheese has received much attention in the past, as a donor supported activity, but with an estimated twelve project cheese producing entities in Burundi, less than half are reported to still be operating.[10] Operators generally prefer to sell fresh milk which has established distribution systems, lower technical risk of spoilage and requires much less capital than cheese production.

Demand

Demand for milk in Burundi is largely a question of purchasing power and demographics. Factors that increase purchasing power (rising incomes, lower prices) will raise demand significantly. Evolutions in the opposite direction will lower demand. Given the projected rebound in real rates of growth in GDP, which are projected by the IMF to exceed population growth for the foreseeable future, medium term prospects for milk demand are fairly good.

Table 3: Milk Demand Estimates

Projected real GDP growth (2006-2007 Ave.)	4.65%
Population growth	2.40%
Projected change in per capita GDP	2.25%
Marginal propensity to consume[11]	1.50%
Net income affect on milk demand	3.37%
Population growth impact	2.40%
Total annual projected change in demand	5.77%

[10] Two cheese producers interviewed reported that high milk prices and the ability to move larger volumes were important reasons for a general disaffection with cheese production. Anecdotal evidence from these producers indicates that market potential for cheese is limited to a network of high-end food stores in Bujumbura.

[11] From figures based on CIRAD work cited in World Bank, Sources of Growth Background Paper. This rate is not differentiated from among different livestock products and is probably conservative.

These projections would point to a total demand capable of absorbing 71,000 liters/year by 2012 without any change in current real or relative prices—which are agreed to be fairly high for milk in Bujumbura. This represents nearly a 50% increase on current volumes. There are some reasonable indications that this estimate of underlying demand is conservative and may be significantly undervalued. The first of these is that the World Bank has estimated a slightly higher growth rate in demand for milk at 8.2 percent (the difference stems from a more optimistic treatment of GDP growth and inflation). A possibly more dramatic case for undervaluation can be made by citing much higher marginal propensity to consume (MPC) figures calculated in 2001 for milk in Kenya, which show a MPC of 4.3 percent for the lower income categories and of 8.2 for higher income households.[12] Were even the lower MPC figure to be a better approximation of the Burundian reality than the 1.5 percent figure that is taken from the Sources of Growth study, the result would be a an increase in the rate of demand to over 12 percent per year. Should this be the case, assuming that the projected real rates of GDP growth are maintained, this would represent a fundamental explosion in demand for milk over the medium term.

Another important parameter of demand for milk is its relative price compared to other goods. In contrast to other livestock products which have relatively inelastic demand, the price elasticity of milk calculated over a large multi-country sample by Delgado, as reported in the Sources of Growth study, shows a price elasticity of -0.85 percent—implying that a 1 percent drop in price would increase milk consumption by 0.85 percent.[13] Given the state of the current market for milk, in which Bujumbura retail prices for raw boiled milk hover at around 800 FBU/liter, this would mean that a drop in prices of 50 FBU/liter would increase demand by 5.3 percent, almost equaling the low-end estimate of underlying structural growth in demand. This possibility is far from theoretical, since observers agree the price of milk in Bujumbura is currently at a very high level, both in terms of consumers' purchasing power and relative to prices in other areas of the country. In Gitega for instance the price at which boiled milk retails to urban consumers, 450 to 500 FBU/Liter, is less than the farmgate price for raw milk from dairy farms in Bujumbura Rurale (600 FBU/Liter).

This example, which can be repeated in other areas of dairy production shows that there is no national level milk market, but rather a succession of localized markets around urban centers, each with its own drawing area. Bujumbura, by far the largest market, draws on producers in Bujumbura Rurale, Bubanza and Muramvya. Gitega draws on producers in Gitega province but also in Mwaro. Other cities have their own drawing areas. The difference in retail prices with the capital is more than 50 percent in some cases[14]. The reasons for this atomization of the milk market are pretty straightforward. They include:

- Extremely decentralized and compartmentalized informal sector distribution systems that are often limited by the relational network and financing capacity of the small scale traders/producers who populate the value chain;

[12] Ebony Consulting International, "The Kenya Dairy Sub-Sector", September 2001, p.6.
[13] Cited in World Bank, Sources of Growth, p, 68.
[14] Current retail prices in milk producing areas near Gitega are around 300 FBU/Liter and around 250 FBU/liter in Kirundo.

- Problems in product conservation and transport, which place clear limits on the physical distance milk can travel before it spoils; and
- The lack of large units of production and processing that would serve as focal points at either end of the value chain and aggregate larger volumes that would facilitate investments needed to take advantage of opportunities for spatial arbitrage.

Given the generally low levels of spatial market integration in the milk market and the high price of milk in Bujumbura relative to the rest of the country and specifically to the potentially highly productive plateau areas of Ngozi, Gitega and Bururi, it would not be unreasonable to think that there is considerable scope in the near future for expanding production and strengthening market integration on a national level that would result in more milk coming into Bujumbura from areas farther away where fodder, labor and land are cheaper, thereby relieving some of the price pressure in the capital and attracting new categories of consumers.

Value Chain Participants

Key actors in the dairy value chain are described below.

Producers

Little firm data exists on dairy producers or even cattle raisers in Burundi. The Sources of Growth Overview paper estimates that around 180,000 households own cattle. However, only a fraction of these households raise cattle within the context of a rational market-based dairy exploitation. The traditional Burundian value system places great emphasis on the prestige value of owning cattle. In addition, protein from milk plays an important role in meeting household nutritional needs. Cattle have also been a useful form of savings (although security concerns have tended to erode this motivation for cattle ownership in recent years.) Thus, the majority of cattle are still held in largely extensive, low-maintenance systems that are not explicitly managed to maximize financial returns. Based on estimates of the share of European pure and mixed-race cattle in the total herd (which are only profitable for dairy production), this would imply that there are at least 45,000 rural households running dairy farms under a market-oriented logic.[15]

It is also important to note that the typology of productive systems given above in the discussion of supply is largely neutral with respect to the size of any individual farm. There are "large" and "small" producers using all three types of productive systems although the notion of what is large and small varies somewhat between the types. (Output, immobilized capital and operating costs are all much greater for intensive production for the same number of animals.)

In general, for farms practicing intensive production, dairy production is an afterthought. Household consumption of milk is almost certainly much higher among households practicing extensive methods than more intensive methods of cattle production. As shown in Table 4,

[15] This is almost certainly lower than the true figure, since it assumes that dairy farms (in some type of enclosed systems) are equal in size to extensively raised non-dairy farms. In reality the latter is probably larger. It also fails to account for Ankole and Ankole/Sahiwal cross-breeds that are exploited for milk production.

which models the distribution of expected revenues for small family-run farms not using hired labor, extensive systems are mainly producers of animals for sale—principally for meat. As more improved breed cattle are used and as more intensive production methods are adopted, the importance of milk and manure production increases. This does not mean that extensive system farms do not sell milk into the market, indeed as described below many do so through "milk collectors" in rural areas, just that such farms are not run to maximize the economic return to milk production. Although no models of intensive zero-grazing dairy farms using only European race cattle have been developed, the percentage shares of revenue from milk sales in this system is certainly vastly superior to even the semi-intensive system shown in Table 4.

Table 4: Distribution of farm revenue by productive system

	Extensive Systems		Semi-intensive integrated system using European/local race crossbreeds
	Ankole	Ankole/Sahiwal crossbreed	
Milk	34%	41%	52%
Animals/Meat	57%	49%	22%
Hides	0%	0%	0%
Manure	8%	10%	27%

Source: World Bank. Sources of Growth, Background Paper, Annex 3.

The literature on costs of production and profitability of different cattle production systems in Burundi is virtually non-existent. Once again, the only financial models of production identified are those from the World Bank Sources of Growth initiative that only modeled small farm versions of these systems that did not employ hired labor—excluding intensive dairy farms that do generally employ laborers. Chief findings of these models relevant to the dairy value chain are shown in Table 5.

Table 5: Cost and profitability data by productive system

	Extensive Systems		Semi-intensive integrated system using European/local race crossbreeds	Intensive system with European race animals
	Ankole	Ankole/Sahiwal crossbreed		
Production cost of 1 liter of milk	101 Fbu	86 Fbu	182 Fbu	N/A
Net profit per producing female	74,310 Fbu	131,412 Fbu	227,631 Fbu	359,000 Fbu
Internal Rate of Return	19%	29%	31%	31%

Source: World Bank. Sources of Growth, Background Paper, Annex 3.

Given market prices of milk around 200-300 FBU/liter in rural areas and of at least 600 FBU/Litter in Bujumbura, the positive profitability levels shown for all systems in Table 5 are thoroughly credible. Although the World Bank did not estimate production costs of completely enclosed intensive dairy farms, it is thought that these would be in the 200-300 FBU/liter range

with a significant rate of variation based on productive efficiency, the share of purchased versus grown fodder and higher labor costs for farms closer to Bujumbura.

The data table in table 5 confirms the impression of farms gained from field visits that cattle producers are facing powerful market incentives to transform their mode of production by moving "upscale" to more intensive modes of production. Making this move is largely dependent on four factors:

- Access to fodder (either from own land or purchased/exchanged from neighbors)
- Access to improved genetic bovine stock (local/European crossbreed or European "purebreds")
- Knowledge of the relatively complex technical requirements of the more intensive systems
- Access to veterinary services, medicine, and vaccines

In terms of milk sales strategies, there are important differences between producers that are based less on the type of productive system they use, than on the geographic distance to their main market. Producers who are the closest to urban markets generally privilege direct sales of raw milk to customers, be they end consumers or milk retailers and will often send family members on daily bicycle routes to supply one or two established customers. This is usually done on a fixed subscription basis with customers taking previously agreed amounts. Many larger farmers make use of family contacts or connections in urban areas to set-up integrated retailing operations for the family's milk. In these operations, they usually receive raw milk daily from the farm transported by car or bicycle, boil it on site (often at the family residence) and then retail it to a regular network of customers. The zone of this type of production around Bujumbura is generally defined as the distance a bicycle can travel with raw milk before encountering problems with transport or spoilage. The limit seems to be those parts of Bubanza province that are closest to Bujumbura on the Imbo plain (Gihanga, Mpanda).

Beyond this radius, producers need to have larger volumes to justify transport and devise strategies to reduce losses of raw milk. The main areas supplying Bujumbura in these longer-distance trading relationships are in Muramvya province and to a somewhat lesser extent in Mwaro, Bururi and further out Bubanza. Larger producers in these zones can justify arranging their own motorized transport either on a regular basis, usually with a collective taxi who agrees to carry their milk to Bujumbura. Including arrangements for the return of empty containers, prices are reported to be around 50 Fbu/liter for a 38 liter container from Muramvya. As with closer-in producers, these larger producers may also have their own agents or family members who are responsible for retailing and distribution in Bujumbura as part of an integrated production-retail supply chain (essentially integrating retail functions) or they may sell at wholesale prices to one or two clients. Smaller producers in more distant zones sell at the farm-gate via collectors working in coordination with wholesalers/distributors in Bujumbura. Milk coming from these more distant areas must also be boiled before transport to reduce spoilage risks during the longer journey. Larger producers do this on the farm themselves while, for smaller ones, this service is normally provided by the collectors.

As with livestock producers in general, the level of organization of dairy farmers is very weak. There is an incipient association of cattle raisers in the Gitega area, whose leaders are among the more advanced farmers having adopted intensive production methods. Another similar association exists in Bururi province. But in general, all production and sales issues are dealt with at the farm level and there are no dairy cooperatives as exist in other countries. The MAE is, however, planning on forming a small number of dairy producer associations under the IFAD-financed PARSE project to operate three small-scale dairy processing units. Although funding for this has been approved, an implementation time table has yet to be established.

Traders

Given the decentralized nature of the Burundian milk market and the proliferation of both points of origin and sale, the remarkable feature of the Burundian milk market is the seemingly low numbers of specialized milk traders. As said above, there seems to be strong incentive for producers on short distance axes to integrate distribution functions by supplying points of sale in Bujumbura at a 600 FBU/Liter price in quantities as small as 10 liters which is basically the same price that practicing wholesalers receive or even by going into informal retail operations themselves.

The major opportunities for specialized traders center on spatial arbitrage opportunities along the longer-distance axes. The milk collection/trading system is based on a solid relationship of trust between a wholesaler in Bujumbura and one to three collectors in the zones of production. The collectors, who may be supplied with some basic equipment (hydrometer, containers) and bicycles by the wholesaler, are responsible for setting up collection points in production zones at which they receive daily deliveries of raw milk from farmers or arrange for pick-ups at the farm by employees on bicycles. The price to farmers is 300 FBU/liter. Farmers' names and delivery amounts are kept in registers for payment at the end of the month. The collector is responsible for testing the milk with a hydrometer to ensure it has not been adulterated with water or flour. He also does the boiling of the milk and pours it into containers for transport. Transport to the wholesaler's premises in Bujumbura is done by collective taxi.

Wholesalers in turn agree to pay "their" collectors 450 FBU/liter and cover transport payments to the taxi (50 FBU/Liter). They function by paying collectors a certain amount up-front each month and then regularizing, according to recorded volumes, at the end of the month so that the collectors can pay the farmers. Wholesalers sell on a combination of cash and weekly or monthly supplier credit to their customers who are mainly nearby households that retail milk or milk bars/restaurants (often called "patisseries"). Sales are usually in containers of 20 liters or more at 600 FBU/Liter. Most clients receive their milk at the wholesaler's location. Wholesalers generally function out of their home and may also function as retail points of sale selling small quantities at the going retail price of around 800 FBU/Liter. Since wholesalers do not generally keep milk on premises for very long, they do not usually invest in refrigerated storage—which is more common at the retail level.

The number of wholesalers is unknown as are the total volumes they treat. An association of wholesalers has been formed with sixteen active members on all the major axes coming into Bujumbura. The major elements of the farmer-collector-wholesaler network, including prices and procedures for payment, are codified in writing by the association whose members all sell in Bujumbura. One informant estimated that the sixteen association members total around 7,200 liters per day or around 2.5 million liters per year which translates to approximately 450 liters per day per wholesaler. Wholesalers provide the cement to these trading relationships, essentially acting as the locus of accountability for collectors and retailers and managing the credit and payments relationships. Gross margins of 17% for wholesalers are not unreasonable. The 50% gross margin for collectors may seem high, but there are actual processing costs (employees for collection and boiling) which are covered within this margin. Also actors at this level generally have lower volumes on which to spread their margins. In any event, these traders are an important focal point in the value chain since they represent the beginning of a product aggregation process and are virtually the only players now operating in the chain that are set up to take advantage of economies of scale.

Milk Retailers

The urban areas of Burundi are dotted with numerous retailers of "pasteurized milk." These can take a variety of forms and are not always immediately perceptible to the passing eye. The most visible are small bakeries or "patisseries" which are usually rented shop-fronts which function as small restaurants from which a selection of baked goods and milk are sold. In addition, restaurants also serve fresh pasteurized milk and may function as milk bars. Probably the most numerous type of retailer is the simple back-door milk retail operations from household residences. In the central area of Bujumbura, there are several larger patisserie/restaurants which cater to nearby employees and do a brisk morning business selling milk and baked goods. A minority of retailers operate as integrated sellers for family-owned dairy farms, serving as retail outlets for household production that is delivered daily without any prior sales transactions.

Regardless of the type of establishment, all retailers function along similar lines. To function they need to have a stable supply relationship with one or two suppliers—where they contract to receive a fixed amount of milk per day (often termed as a ceiling amount). Supply may come from their own family farms, directly from other producers or from wholesalers. About two-thirds of retailers operate on a subscription basis with their suppliers, paying with a delay of either one week or one month for the quantity of milk received at the agreed price (currently around 600 FBU/Liter). Deliveries are scheduled at a regular time, generally late morning for nearby farms and late afternoon for milk coming from longer distances. Delivered milk may be either raw (if from nearby farms) or boiled (if from further away). In general, retailers will boil the milk received and reserve a fraction (around 40%) with which to make yoghurt using live retained yoghurt cultures. Milk and yoghurt are sold for exactly the same price either by the glass, in plastic bottles or in various containers brought by customers. Retailers possess refrigerators to conserve their stock and some test milk received for adulteration with hydrometers. Sales are by cash or on a mix of cash and subscription basis with delayed payments either weekly or monthly. The median current sales volume of the 70 neighborhood

retailers surveyed for this report was 20 liters per day. Retail prices in Bujumbura are generally around 800 FBU/Liter, although there is some variation according to the business strategies of individual retailers who may opt for higher quality/higher price approach or who may seek to differentiate themselves with lower prices than the prevalent market price.

Input Suppliers

There are a number of important input supply functions in the dairy value chain. These are detailed below.

Livestock feed

Increasing the supply of fodder crops are a critical component of the trend towards the adoption of more intensive modes of dairy production. While statistics on fodder production in Burundi are virtually non-existent, there are a number of indications which point to the fact that, in aggregate terms, the supply of fodder is not a major limiting factor. Calculations by the World Bank for the Sources of Growth show that, on relatively modest assumptions about surface areas transitioning from open grazing lands to cultivated fodder crops, the global supply of fodder can easily surpass the expected needs for a significant increase in intensive dairy production.[16] This does not mean there are not gaps in supply in areas where land availability limits producers' ability to grow their own fodder; but even in these cases, markets seemed to have developed to supply this need. In the dairy areas of the Imbo plain near Bujumbura, for instance, a spontaneous fodder market has developed in the past several years. In this market individuals with bicycles circulate all over the plain and the near foothills to harvest wild fodder grasses (elephant grass, Napier grass, Guatemala grass) which they bring to the market and sell to nearby dairy producers for 1,500 FBU for a fully loaded bicycle. Intensive producers further out from Bujumbura generally either have enough land to grow their own fodder or have non-monetary exchange relationships with neighbors in which they provide manure in return for fodder.

No industrial composite feed supplements are currently marketed in Burundi for dairy cattle. Intensive dairy producers generally either formulate their own mixes from commonly available agro-industrial by-products (wheat and rice bran, cotton seeds, brewery malt, molasses, etc…) and protein supplements (soybeans, peanut cakes..), or they buy pre-mixed blends that are prepared by informal traders. Larger producers tend to prepare their own mixes for reasons of cost and confidence. As with fodder crops, World Bank estimates of global supplies of agro-industrial by-products indicate that supply of the raw components of feed supplements is generally sufficient even for significantly increased levels of intensive production. This does not mean, however, that local availability and know-how to ensure effective formulation and utilization are always present.

[16] The hypothesis advanced is that if cattle-raising households cultivate 0.3 ha of fodder crops and that households with small ruminants grow 0.1 ha, the global supply of fodder would be enough to supply 300 tons of milk in intensive systems. World Bank, Sources of Growth, Background Paper, p. 16.

The recent purchase and announced rehabilitation of the former state-owned animal feed factory ALCOVIT may provide a partial solution to the problem of a lack of standard composite feed formulas. It remains to be seen however, if capacities for regulating product quality are sufficient to ensure producer confidence in the quality of the feed mixes.

Veterinary services

The market for veterinary services in Burundi has been severely disrupted by the disappearance of the former, all-embracing, public system which was administered by the MAE and employed one veterinary doctor per province, communal level veterinary technicians and local level veterinary assistants. With MAE reorganizations in the late 1980s and the crisis period in the 1990s, funds to support actual field work through this system evaporated and the veterinary assistants were eliminated. The ensuing vacuum has yet to be filled. The number of practicing private veterinarians in Burundi varies between three and zero, as they each report that they are unable to earn enough income to live by providing fee-based veterinary services in a purely private framework and must find income from other sources.

Smaller producers generally make no use of veterinary services, while larger producers are reported to make unofficial payments to the public communal veterinary technicians for curative veterinary services and to obtain veterinary medicines, which are often administered with no supervision. Preventive veterinary measures are largely absent. The very largest dairy farms may offer an exception to this generally bleak picture, as one entrepreneur visited during the field work for this report had actually hired a full-time veterinary doctor to provide on-site supervision of two dairy farms that each had more than 15 head. But this is obviously an exceptional case.

Artificial Insemination

Given the extremely high price of a pure-bread European adult cow (reported to be up to 2.0 million FBU) there is clearly a large potential demand for artificial insemination (AI) with certified genetic material as a way of improving the genetic stock of the dairy herd, as these levels of prices are clearly beyond the means of the majority of potential dairy farmers. Artificial insemination is, in theory, available only through the public Centre National d'Insémination Artificiel (CNIA). Currently however, pillage of infrastructure and breakdowns in the necessary cold-chain for ensuring successful AI have limited or ended the CNIA's capacity to provide the basic materials for AI. However, planned rehabilitation of the liquid nitrogen machine under the IFAD-financed PARSE project should, once again, provide the basic infrastructure to restart AI services.

Privately provided AI services do not now exist. According to formerly practicing veterinarians, in the past they attempted to offer these services, with material available from the CNIA, but were unable to effectively market these services to dairy producers who preferred to contract for AI through purely public or project sources at a lower, subsidized costs.

Extension services

No effective public extension services exist currently for the livestock sector. Despite the success of extension efforts to promote intensive dairy production methods in the 1980s, currently there is no such center of expertise. The *moniteurs agricoles*, who are the base of the new extension system of the MAE, clearly lack the technical background necessary to advise farmers on either semi-intensive or intensive systems of diary production. The only functioning extension services now operating are of the completely informal variety. General knowledge of new techniques and methods is spread informally between neighbors. Although it is hard to get an idea of the scale of this phenomenon, anecdotal observation would suggest that this is nevertheless significant in areas where there exists a core of more advanced farmers, practicing intensive methods.

Value Chain Map

The dairy value chain map is shown below in figure 1. It describes the flow of milk that is destined for urban consumption. The prices shown are based on the market zone of Bujumbura. Volumes at the bottom and top of the map are based on estimated national production and marketed volumes from recent World Bank work given in table 1 and expressed in terms of average daily product flow. Import figures are from published customs records. Marketed volumes comprise only milk flows that enter the supply chain for urban consumption (40,000 liters/day), the major portion of which is in Bujumbura. A much larger volume (estimated at 130,000 liters/day) does not enter this supply chain. This milk stays in rural areas and is used for three purposes:

- it is used to nourish calves
- it is consumed by the producing household
- it is sold or exchanged with neighbors (most often from evening milkings)

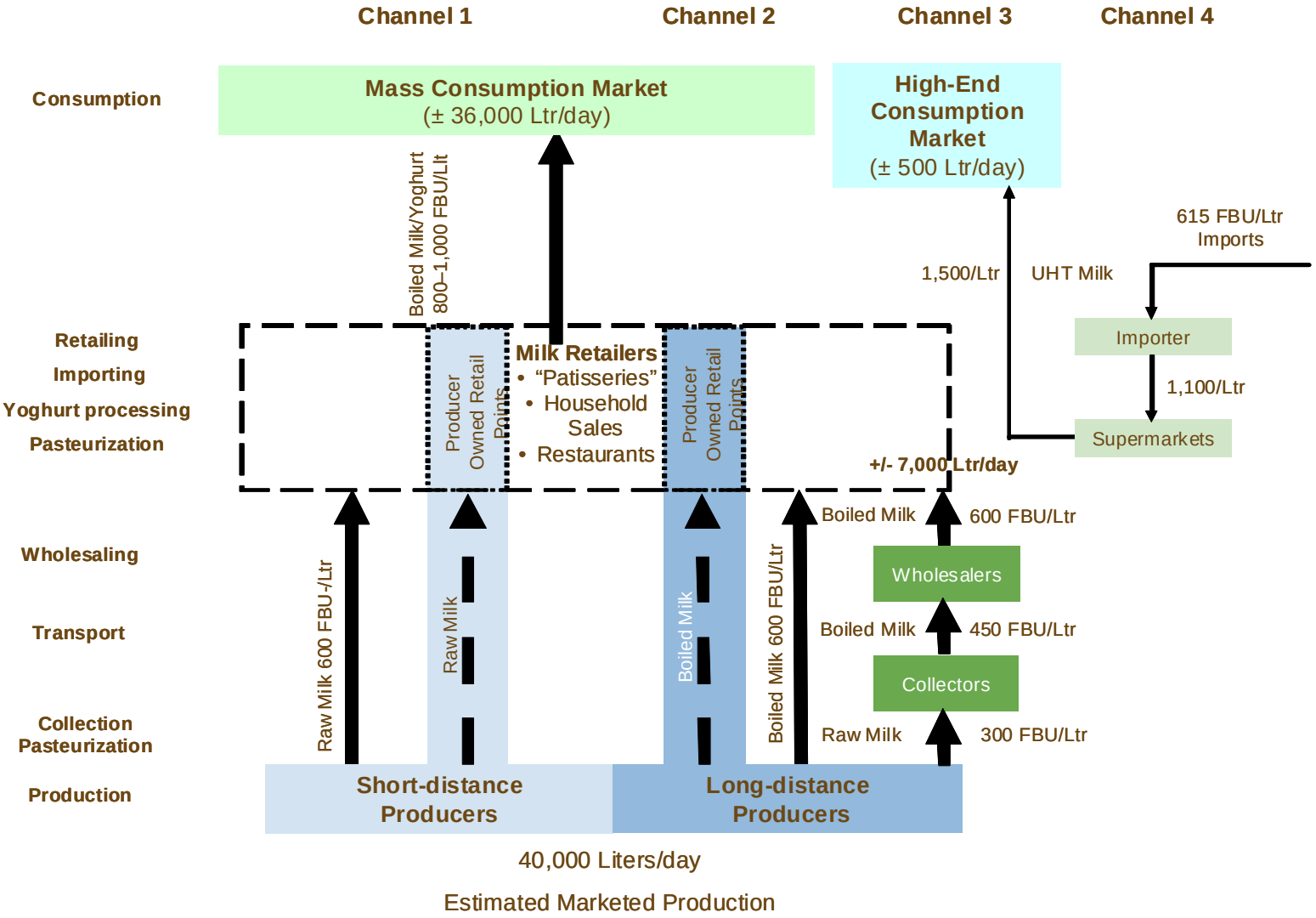
In general, the larger part of these 130,000 liters consists of milk produced by households using the traditional extensive systems of production, largely in zones that are beyond the market drawing area around urban centers of consumption.

The four market channels described below are archetypes that are representative of the general organization of the milk market. The map does not present estimates of marketed volumes or numbers of actors in all of the market channels. No statistical, survey or secondary source information is available to calculate any sort of reasonable estimates of the relative magnitudes going through the first two channels, which together with the third one, account for most of the flows. Volumes are well known for the fourth channel (imports) and we have some indications that permit the formulation of hypotheses for the third channel. Each channel is described in the following section.

Channel One

This channel describes the “short-axis” channel for milk that is produced within bicycle range of an urban center of consumption. The major example of this type of production is the Imbo plain region around Bujumbura, although similar, smaller, centers of production exist in Gitega and are reported to exist close to Ngozi. This market channel is characterized by the small number of intermediaries. In general, the milk changes hands not more than one time before consumption. Producing households, benefiting from their close proximity to consumers, seek to integrate downstream into distribution and retailing as much as possible. They provide daily deliveries to the city. These deliveries are usually provided by employees on bicycles, but also by cars or pick-up trucks for more wealthy producers. Milk is delivered either directly to a small number of retail customers (the solid line in the value chain map) or to an integrated retail operation owned by the producing household (shown as the dotted line in the map). In the case of sales to independent retailers, this relationship is almost always on a subscription basis with implicit contracts for specific amounts that are paid, most often, on a monthly basis. Milk on these axes is provided in raw form only, with no boiling or pasteurization. Risk of spoilage is minimal due to the short distances and time of travel involved. Pasteurization takes place at the retail level—where retailers take advantage of the boiling process to use a portion of the heated milk to make yoghurt. Retailers may also skim some of the cream during this process to make butter (although butter constitutes only a marginal part in most retailers’ revenue streams and many do not even bother). Retailers do not, in general, seek to maintain a stock of milk beyond a 24-hour period, although most do have refrigerators and have some capacity to store milk and yoghurt (which has a longer shelf life).

Figure 1: Value Chain Map



17 Rue de Coton, Quartier GATOKE
BP 1643 Bujumbura, Burundi

Channel Two

This channel depicts the flow of milk from producers who attempt to sell directly to urban markets, but from distances that are beyond the reach of bicycles. It shares the same basic structure as Channel one—with two parallel sales paths—one being an "integrated" retailing operation that is owned by the producing family and another being direct sales to independent retailers. The major differences in this channel vis-à-vis channel one are: (1) that the longer distances involved increase the risk of spoilage during transport. This means that milk needs to be pasteurized at the farm before it is sent to the market; and (2) The increased distances and transport costs mean that only larger dairy farms can afford to market directly to urban areas. Thus this channel is largely populated by larger producers who can manage both motorized transport and daily boiling of milk before it leaves the farm. At the retail level, there is no significant difference with regard to the other channels.[17]

Channel Three

Channel three is the market channel through which smaller producers in zones beyond easy bicycle distance, but still within the market draw areas, sell their milk into urban zones. This is the market channel in which the collectors and wholesalers operate. As with channel two, milk must be boiled for pasteurization before it leaves the production zone. But, this function is provided by the collector rather than the producer. The collector is also responsible for the first line of quality control with tests for adulteration conducted for each lot received from each farmer as part of the aggregation process. Transport and wholesale distribution are arranged by the wholesaler, who sells into the same basic retail system as all the other market channels. The 7,000 liter per day figure cited for volumes flowing through this channel is only a reported estimate of one of the 16 members of the wholesaler's organization based on his knowledge of the other members.

Channel four

Burundi imports liquid UHT-treated milk mainly from Uganda, but also other countries in the sub region on a small scale. This market is focused almost exclusively on the supermarkets in Bujumbura serving expatriates and higher income Burundians. The milk is imported and sold in one-half liter cardboard containers. Volumes are quite small, with declared imports of only 14.8 tons per year or 500 liters/per day (roughly equivalent to one informal wholesaler in Bujumbura). The main actor in this segment of the market is the local exclusive importer for a Ugandan dairy who imports directly from Uganda. Import prices, reported in publicly available statistics from the Direction des Douanes for the 12 month period from November 2006 to October 2007, show an average declared import value of 500 FBU/liter to which border taxes and fees totaling 23 %[18] must be added to obtain a price of 615 FBU/liter net of transport. Wholesale prices to supermarkets are around 1,100 FBU/liter and retail prices around 1,500/Liter. The high level of

[17] Retailers do not seem to regard pasteurized and raw milk as fundamentally different products—as most will boil pasteurized milk before selling just as if it were raw milk. Prices are also exactly the same.
[18] Applicable import payments include a 17% transactions fee and a 6% import duty under the preferential COMESA regime

gross importer margins suggests that there is substantial potential for importers to reduce their prices to resist losses of market share in this segment.

Losses and risk mitigation

The estimated final marketed volume of 36,000 liters per day in the mass consumption market is based on a simple assumption that losses do not exceed 10 percent. Eighty-five percent of retailers in our survey reported either no instances of loss due to unsold stock or having this happen less than once a month. Thus, our estimate of total losses (around 10%) is probably an overestimate of actual losses, which seem to be generally quite low. This somewhat surprising result, given the highly decentralized nature of the market, can be explained by two factors: (1) Much of the market functions on a multi-layered subscription basis in which retailers "subscribe" to their supplier for specific quantities and then in turn sell to households also on a subscription basis or on a mix of spot sales and regular recurring subscriptions. With these types of commercial arrangements involving on-going subscriptions, the risk of oversupply are minimal. (2) The risks of fraudulent practices (mainly adulteration of milk with water and flour) are reduced by the sheer lack of aggregation in channels one and two. In both these channels, producers sell directly to one or two retailers who rarely buy from more than three producers and who may schedule arrivals at different times during the day to avoid mixing of lots. Thus, producers have little scope for cheating on product quality, as any incidences of this result in immediate and direct sanctions from their clients[19]. In market channel three, where aggregation does occur, losses seem to be maintained at an acceptable level by rigorous quality controls exerted by collectors.

By far the larges source of losses is at the retailer level and is due to power outages that result in spoilage of stock. But since retailers do not seek to keep more than one day of stock, it does not seem plausible that these amounts are very large.

Dynamic Trends

In the current post-crisis environment, the Burundian dairy value chain is dominated by two important dynamic trends:

1. The first of these, which should be apparent from the above discussion, is that a fundamentally favorable growth environment is driving expanded production led by the adoption of more intensive dairy systems. All this is driven by swelling demand which leads to high profitability of milk production. This favorable environment can be inferred from the wide differences between the costs of production figures shown in Table 5 and the wholesale level market prices in Bujumbura. It is also apparent from the visible new investment that is taking place in intensive production systems on a medium to large scale led by relatively wealthy civil servants with access to land on the Imbo plain. Areas of investment in newly intensive dairy production also seem to be moving

[19] Risks of adulteration would seem to be the greatest in the "integrated" potions of Channels 1 and 2, where producers retail milk themselves.

out beyond the immediate peri-urban zone into neighboring provinces. In these areas with lower factor costs and greater fodder availability, adoption of more intensive methods is happening both among wealthier landowners who can invest in completely enclosed production, often with European purebreds, and by small farmers who perceive advantages to moving into dairy production with only one Ankole/Sahiwal-European cross breed, often by converting from extensive to semi-intensive production systems.

2. The second important new development, which has yet to become apparent, is the recent ground swell of interest among serious agribusiness investors in restarting small-scale industrial milk processing operations. During the research for this report, a total of four different investment projects were reported by entrepreneurs with start-up volume objectives for producing pasteurized milk and yoghurt in the 1,000 to 4,000 liter per day range. One of these has already begun operations, but is hamstrung by a lack of working capital which is preventing him from operating at capacity. The other three projects have yet to enter operational status, although one investor has a facility, has imported all the equipment to begin operations and projects to start before the spring months. The advent of one or more well-capitalized industrial processors using modern pasteurization technology would be a significant event in the dairy value chain, providing a missing locus for value chain governance, organization and upstream investment in what is has been a radically decentralized value chain.[20]

Vision for Value Chain Growth

Taking into account the current state of the value chain as shown in the value chain map and the important dynamic trends listed in the preceding section, a proposed vision of what a reinvigorated dairy value chain would look like in five years is given below.

Output levels and consumption in 2012

- Total marketed volumes of domestically produced milk increase from an estimated 14,000 MT in 2005 to 27,000 MT with the increases coming from two sources: an expansion in the percentage of milk that is sold into the market (9,000 MT) and from new production 4,000 MT).
- A significant increase in urban consumption of milk is realized with a greater per capita consumption fueled by a decline in the relative retail price of milk in Bujumbura.

Market structure in 2012

- Two or three industrial milk processors are in operation with a combined volume of over 20,000 liters per day of well packaged products that are sold both into the

[20] There are also obvious public health advantages to industrial operations with clear points of control that could be subject to food safety inspection and certification.

high-end market in Bujumbura and into the mass urban market in Bujumbura and major provincial cities.

- Provincial milk collection centers located beyond the current Bujumbura market draw area are managed by local producer associations using appropriate cold storage techniques. These centers are set up in high production areas as part of an integrated marketing arrangement with the industrial dairy processors.
- The national milk market is less fragmented, with a general convergence of prices such that relative prices drop in Bujumbura and increase in such outlying production zones.

Productive systems

- A commercial bovine reproduction farm is functioning on a sustainable basis under private management with adequate supervision and certification of the genetic purity of its products by the DGE.
- A marked acceleration in the rate of adoption of intensive dairy production techniques has been observed in the outlying areas benefiting from newly established market linkages to Bujumbura.

Market infrastructure

- Banks and microfinance institutions are making loans to small farmers to finance the acquisition of improved race dairy cows.
- Privately practicing veterinarians are providing preventative and curative animal health services for dairy farmers in several high production zones. AI services are also offered on private basis by these veterinarians with access to publicly provided AI infrastructure belonging to the CNIA, as part of a public-private sector agreement with the DGE.
- A commercial dairy-cattle feed mix has been formulated by a local supplier using mainly locally available components and is beginning commercial sales after several market tests.

Constraints

If one measures gaps in performance as deviations from a situation of theoretical perfection, then there is a nearly endless list of problems and constraints to increasing volumes and raising productivity in the Burundian dairy value chain. “Best practices” are far from international standards in production, trade and processing. But rather than present a catalogue of constraints that would serve to distinguish the current situation from an ideal case, we prefer to concentrate here on a smaller subset of constraints that are both binding in the current circumstances and that can be alleviated in the medium term by actors in the value chain, with support from BAP, the GOB and donor projects.

These most important constraints are described below

Constraints at the production level

Accelerating the existing momentum for the adoption of more intensive methods of production (both semi-intensive and intensive zero-grazing systems) is hindered by three major constraints:

1. *The scarcity of reliable improved dairy cows of known genetic characteristics*. These include both crossbreeds of Ankole/Sahiwal with European dairy breeds and "purebred" European breed cows. Past projects have succeeded in introducing sufficient numbers of purebred European animals to create "reservoirs" of genetic material that have produced a critical mass of improved animals that have had a noticeable impact on production, but the mastery of the reproductive chain has long ago been lost and there are now no sources of animals with known pedigrees. Producers either have to import their own animals or rely on sales from neighbors or friends who have animals of known quality.
2. *The high level of capital required to start an intensive dairy farm.* With the market value of a purebred European breed cow of reproducing age of up to 2.0 million FBU ($US 1,900), this top-level production stock is out of reach of all but the wealthiest potential dairy farmers. Even with a significantly lower cost for a local/European cross breed (400,000 to 600,000 FBU), the capital requirements represented by the initial investment in improved breed animals is beyond the reach of most households. These investment costs can be lowered through purchasing heifers and calves, but this strategy requires added maintenance expenses over several years.[21]
3. *The lack of extension services with an adequate technical understanding of intensive production methods*. The fine-tuning of intensive systems for maximum productivity under Burundian conditions is a complex equation. Setting the parameters for feed mixes, the right mix of open grazing and enclosure for semi-intensive production, the durations of lactations, and reproduction cycles are all complicated questions—many of which involve trade-offs between shorter and longer term productivity. Recognition and prevention of diseases in enclosed environments is also generally not well understood by novice dairy farmers. All these elements of the technical packages that should accompany a move to more intensive production need to be shown to farmers in order to speed the transition process—and at present there are little or no provisions for this.
4. *The lack of veterinary services*. The near total lack of veterinary health services is a serious constraint to the expansion of enclosed systems of production, as the susceptibility of animals to disease, as well as its costs in terms of lost output, increase significantly with the move to intensive production.
5. *The composition of fodder crops is too heavily weighted to grasses*. Productivity of intensive systems could be improved by introducing more leguminous crops into the fodder mix which would also improve soil retention.
6. *The lack of availability of standardized feed supplements.* Larger, more knowledgeable producers can generally formulate their own mixes of nutritional supplements for their

[21] Informants report resorting to strategies such as monitoring cows brought for slaughter to pick out those who appear to have European breed characteristics, which they can then purchase for low prices and often rehabilitate with a healthy nutritional regime.

dairy herd. As intensive production methods spread however, smaller and more neophyte producers will not have the same capacity, creating a corresponding need for generally available feed supplements of good quality.

Constraints at the level of collection, transport and wholesaling

The different market channels shown in the value chain map in Figure 1 are actually fairly efficient when measured in terms of product losses and gross margins. However the system as a whole does a poor job of market integration as shown by the persistence of widespread spatial price differentials and the small radius of effective demand around urban areas, including Bujumbura. Specific constraints which inhibit the overall efficiency of the milk collection and trading network include:

1. *The small scale of market actors and the lack of scale economies*. The proliferation of many small sellers and buyers, including many small producers trying to integrate as far down the value chain as possible, limits the potential for capturing scale economies that could come from greater cooperation and collective marketing. The fact that milk is often boiled twice in market channels 2 and 3, at the farm level and then again at the retail level, at both ends of a trading network that is usually not more than 60-80 kilometers long in quantities as small as 10 or 20 liters, is indicative of the high-cost strategies that actors are forced to adopt for lack of larger focal points that could serve as a nodes for investments in improved transport and storage.
2. *A lack of working capital and investment finance for the milk trade*. The wholesale networks set-up in channel 3 represents a first step in the direction of amassing greater volumes that could justify investments in improved storage and transport. However, most wholesalers finance themselves wholly on own capital or by managing the margin between supplier and customer payments. Scaling-up with new investments in improved storage and transport would require financing that is not available (as well as improved sales networks capable of absorbing greater volumes).

Constraints at the processing level

The dairy value chain would clearly benefit from the existence of new industrial processors who would provide a much needed single point of purchase for higher volumes and could serve as a value chain governance agent for promoting overall growth for the dairy sub-sector as a whole. The major factors hindering the dairy processing initiatives now under way are:

1. *A lack of finance for agro-industrial projects*. This is clearly the main obstacle reported by prospective entrepreneurs. One entrepreneur is already stalled for lack of simple working capital finance and the other projects are still looking for added investment financing. Although the capital required for the scale of investments planned is not that big (around $500,000), prospective entrepreneurs report that financing for even a share of the needed investment is not available.

2. *A lack of linkages to milk suppliers.* A number of the prospective entrepreneurs plan on sourcing a major part of their needs from their own farms. However, none of these projects will be able to achieve the scale of operations necessary to justify their initial investment unless they set up collection relationships to source milk from other suppliers. The logistics and commercial arrangements to ensure the success of these relationships, which will need to find a mechanism for collecting from many smaller producers, have not yet been defined.
3. *Unfamiliarity with dairy technology and procedures*. None of the prospective entrepreneurs has any prior experience with dairy production. There is a clear need for expertise and technical advice on such questions as securing the supply chain, achieving full operational efficiencies, establishing quality control and food safety procedures and business and financial planning.

Constraints at the retail level

There is really only one significant constraint at the retail level, which is related to the small scale informal nature of most of the sectors' actors (outside of a minority of larger restaurants and patisseries). This is:

1. Much of the retail distribution network serving the mass market has a limited sales capacity. Many of the retail operations, particularly the household sales points, rely on their personal acquaintances or neighbors to buy their milk. Retail is often a part-time activity. The capacity of such sales points to reach new clients, actively market or respond to changing market conditions is quite limited. Increasing marketed volumes through such outlets posses a real challenge.

Action Plan

The most important stakeholders for the dairy sector consist of dairy producers (represented by their associations), the new potential processors and the public sector represented by the DGE. Achieving any significant improvements in the dairy value chain will require a high level of cooperation among these three groups. Given the vision and constraints facing the value chain listed above we outline here the major elements of a potential action plan for the dairy chain that would involve all its stakeholders with support from the BAP project. The outline below is not meant as a detailed blueprint for implementation, nor as an exhaustive list of all potentially useful activities. Rather it is meant to give an indicative list of activity areas that BAP project direction and stakeholders can develop and refine over the next nine months in the perspective of a new round of project activities that could begin in October 2008.

The action plan presented below is designed around a specific objective that flows from the vision previously developed for the value chain. This objective is:

> *To expand the effective "drawing area" of the Bujumbura market for fresh milk into new geographic zones of dairy production that are not yet strongly linked to the market*

through a planned program that: (1) increases the supply of milk in these zones by accelerating the adoption and expansion of semi-intensive and intensive bovine production systems; (2) developing a milk collection and marketing program linking producer associations to emerging new dairy processors or existing wholesalers in Bujumbura.

The action plan to achieve this objective could comprise the following elements.

1. Develop a program of production support activities to be led by local producer associations with support from BAP and the DGE. The support program could comprise the following two activities:

a. Establishing a model breeding farm to produce improved-breed dairy cows that would operate on along sustainable commercial lines. One option to explore would have the local association contract with a private operator who would contribute the land and manage the farm according to a negotiated protocol in which the contributions of all parties would be negotiated and which would specify how the resultant improved animals would be allocated. This could include reserving animals for the following uses: association targeted grants of animals to individual small producers who would have gone through a training and screening process led by the association and who would then in turn pledge the offspring to smaller producers as part of a *chaine de solidarité* methodology that has been well established in Burundi;[22] sales to association members at an agreed price under the operating protocol; and free commercial sales at market prices. Initial capital investment in improved race animals could be provided through a mix of contributions from the operator, the association and BAP project subsidies. A critical component of the plan would be the verification of genetic background and continuing controls by the DGE to ensure the conformity of animals produced by the farm to established genetic specifications. BAP assistance would also be required to help the DGE establish the necessary control and certification systems to ensure that this would happen.

b. Establishing an association-led extension program for preparing smaller farmers who wish to go into semi-intensive or intensive dairy production. The association could capitalize on the experience of its more advanced members already practicing intensive methods to set-up a program that would offer training sessions and on-site inspections for neighboring households within the framework of a more general plan for expanded enclosed production.

2. Develop an association-based collective marketing system with improved storage and transport logistics. The existence of planned collection and storage of fresh milk is critical in

[22] The *Chaine de Solidarité* methodology has been adopted by various projects concerned with repopulating the cattle herd. In it, a project provides an animal to a selected farmer, who as reimbursement pledges the first off-spring to another selected farmer. The methodology has proved to be generally successful in allocating investments in new animals with a target beneficiary group, but requires close supervision of reproduction in order to guard against a rapid degradation of genetic quality. In repopulation projects, this genetic purity aspect was of secondary importance. For a project seeking to improve animal quality, the design and supervision of reproduction within the *chaine de solidarité* context will be paramount.

areas that are now beyond the immediate market area of the Bujumbura market, as buyers must be ensured of sufficient volumes and qualities. With the existence of a firm marketing agreement with a buyer in Bujumbura, such as one or more of the new processors, an association, such as the ones in Gitega or Bururi, could work with the buyer to put in place the necessary infrastructure to assemble and hold milk for daily delivery—possibly without necessitating boiling. Low-cost cold chain technology is available and well tested, although given the climactic conditions in some of the zones (Bururi specifically), this may not even be required. The exact technology and scale of investments required would have to be determined by the buyer and the association. BAP can play a useful role by providing management structuring and organizational strengthening to the association, technical advice on cold chain logistics, and possible cost-share support for any needed infrastructure investments.

3. Help improve the supply and demand conditions for veterinary supervision of bovine health. The private market for veterinary services is fundamentally flawed. A publicly provided system exists, through the *Direction de Santé Animale* in the DGE, but it lacks the ground-level personnel and intervenes, if at all, in an unplanned manner with subsidized services that undercut private veterinarians. Much of the problem stems from an overbroad mandate for publicly provided veterinary services and a total lack of professional regulation of private veterinarians. Efforts in the early part of the decade to develop legislative texts and implementing decrees to structure the veterinary profession did not produce results as they were displaced by more pressing legislative matters. BAP could work with the Burundian Association des Vétérinaires de Burundi (AVB) and the DGE to revise and draft texts that could provide a much needed regulatory framework for: (a) limiting the exercise of the veterinary profession to competent professionals; (b) developing public certification and oversight capacity; (c) setting the boundaries between public and private provision of services to eliminate biases against the use of private veterinarians. A critical component of an improved environment for the value chain is an effective articulation between planned rehabilitated public AI infrastructure and veterinary providers of AI services, who should have a major role in administering AI in the field on a commercial services basis. In tandem with this policy level work, BAP could also help jump-start the actual market for veterinary services in targeted areas, for instance by implementing a voucher scheme in association with local authorities and the producers association to partially underwrite consultations with certified private veterinarians for qualifying smaller producers who are unable to pay the full cost.

5. Spur the development of commercially provided local livestock feed supplement. Technical and commercial feasibility studies are needed to see whether the potential exists for creating local feed supplement products that would be appropriate for intensive dairy farmers at an affordable cost. BAP can clearly help conduct this work and partner with potential suppliers including ALCOVIT and others to help support initial product launching, should this prove to be viable.

6. Provide assistance to milk processors. The development of larger milk processors would be a vital spur to the development of the whole dairy value chain. For instance, it is hard to imagine improved collection and transport infrastructure very far from Bujumbura without a market

linkage to a customer with a larger demand and reception capacity. The wholesalers in channel 3 may form an alternative option, but they are limited by a weak distribution capacity and inability to invest in improved modern distribution systems. To help nurture the nascent initiatives now underway into strong businesses, BAP can help by: (a) working with them and local banks to develop financing proposals and explore new sources of investment capital; (b) provide technical expertise from international milk processing experts to help them increase efficiency; and (c) explore co-financing of investments in production to link such suppliers with smaller dairy producers.

Implementation of the action plan will require coordination between public sector bodies (chiefly the DGE) and private actors including agribusiness investors, leading farmers and smaller farmer producer associations. BAP resources will be required as well, primarily in working to strengthen the producer associations, working with business plan development and implementation at the processor level, and providing targeted financing and grants assistance to overcome specific funding hurdles.

An indicative timeline with expected targets is given below in Table 6. Such a plan would need additional vetting with stakeholders before it could be considered to be anything other than a proposal for discussion.

Table 6: Action Plan Targets

	Year 1	Year 2	Year 3	Year 4	Year 5
Quantitative Results					
Total increase in marketed milk volumes[23]	10 % increase 1,400 MT $394,000	15% increase 2,100 MT $592,000	40% increase 5,600 MT $1,579,000	80% increase 11,200 MT $3,258,000	100% increase 14,000 MT $3,947,000
New dairy processor sales	4,000 Liters/day	8,000 Liters/day	12,000 Liters/day	15,000 Liters/day	20,000 Liters/day
Key VC transformation thresholds					
New Market entrants	- 1st new dairy processor	- 2nd new dairy processor - private breeding farm enters operation	- new dairy feed mixes produced by industrial feed mill		
Key enabling environment change requirements	- new financing packages developed for dairy processors	- new regulations enacted to improve private veterinary practice			

[23] This assumes that 14,000 MT is an accurate estimate of current marketed volumes. This would need to be verified with a baseline survey. Values are calculated at 300 FBU/Liter as the representative current rural farmgate price.