



# Uganda Dairy Supply Chain Risk Assessment

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## Executive Summary

Cattle are one of the main instruments for economic (e.g., milk, meat, and cattle sale) and social (e.g., marriage, death, dispute settlement, and gift giving) exchange in Uganda. They serve as the main source of livelihood for a large majority of rural Ugandans, especially in the cattle corridor. Recent statistics demonstrate that the livestock sector contributes 13.1% of the agricultural gross domestic product (GDP) and 5% of the national GDP. Since 1991, the output of the livestock sector has grown on an average of 2.2% per annum, with most of the growth coming from the dairy sector. The dairy sector contributes up to 50% of the total output from the livestock sector. The cattle population in Uganda, as per the 2008 livestock census, is 11.34 million cattle head, of which more than 93% are indigenous cattle. Exotic or crossbred cattle for dairy purposes account for 5.6% and are largely concentrated (48% of the country's exotic/crossbred cattle) in the western region.

The Dairy Development Authority (DDA) estimates that Uganda's total milk production in 2009 was over 1.5 billion litres; however, key respondents indicate that this figure is an overestimation and that the actual production is much lower. It is estimated that 70% of this production reaches the market, while the producing households consume the remaining 30%. The consumption of processed milk is still limited, with approximately 10% of marketable milk channeled through formal sector milk processors. More than 90% of the milk supply is through the informal channel, which sells raw chilled milk or raw warm milk to consumers.

The dairy industry stakeholders are confronted with multiple constraints, including low cattle productivity and low-capacity utilization of processing plants; lack of extension/veterinary services; limited availability of pastures and water; limited milk-cooling infrastructure; poor road infrastructure; seasonal variability in milk prices; poor quality of raw milk; limited stakeholder coordination and regulation enforcement mechanisms; and limited purchasing power in urban centers.

Major risks for the dairy supply chain include the following:

- **Notifiable cattle diseases**, which are required by law to be reported to government authorities, are infectious diseases that quickly spread over a given area and often require quarantine measures (restrictions of cattle and cattle products movement) to contain and control them. They often infect the entire cattle head and lead to cattle mortality, reduced milk production, and abortions. The most prominent notifiable cattle diseases in Uganda are foot and mouth disease (FMD), contagious bovine pleural pneumonia (CBPP), lumpy skin disease, rabies, and anthrax. The most important risk management tools are prevention and control, which require a functioning veterinary system with clear procedures based on scientific principles and sufficient funding to execute the tasks required.
- **Non-notifiable cattle diseases**, which can be separated into tick-borne diseases and other non-notifiable diseases (e.g., bovine tuberculosis, leptospirosis) and can lead to substantial financial losses for the dairy industry. The control of these non-notifiable cattle diseases depends, to a large extent, on the farmers and their veterinary practitioners. Farmers' training and the strengthening of veterinary services are required to manage this risk. According to a recent document of the Ministry of Agriculture, Animal Industries and Fisheries (MAAIF), annual losses from cattle diseases (both notifiable and non-notifiable) amount to U.S. \$86.3 million. Major reasons for these losses include morbidity (58%), mortality (30%), and post-slaughter condemnation (10%).<sup>1</sup>

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1. Source: Development Strategy and Investment Plan 2010/11–2015/16, MAAIF, March 2010.

- **Drought** is a multifaceted problem because while it leads to a decline in milk production and cattle mortality, it also leads to cattle exodus, which increases the risk for cattle diseases and intercommunal conflict. This could be mitigated by keeping larger stocks of fodder and feed and developing water-harvesting and storage facilities. An early warning system should be put in place to advise and support farmers in adopting mitigation measures (e.g., stocking feed and fodder, finding alternate pasturelands, facilitating seasonal cattle migration, and destocking cattle).
- **Abrupt regulations** (e.g., the 2002 ban on the use of plastic containers for milk transportation and the 2006 law mandating dairy traders to use chilling equipment and insulated tankers), which are often ad hoc and nontransparent, are challenges to the dairy chain stakeholders for which they are not prepared. In the absence of a national dairy development policy, it is very easy for the government to formulate and implement regulations abruptly. Greater involvement of stakeholders in the formulation of a long-term dairy development policy, regulations, and strategy could help manage this risk.
- **Failure of key organizations.** The dairy sector in Uganda is dominated by a few key organizations, whose collapse could have a widespread impact on the entire supply chain. This could be prevented through better coordination mechanisms, increased competition, and the promotion of sound business practices.

Dairy is an important and growing sector of Uganda's economy, and it is increasingly proving to be a lucrative livelihood option for a large number of households engaged in milk production and trade. Frequent realization of risks, however, impacts the performance of the supply chain. Effective management of these risks will require increased efforts to mitigate the identified risks and strengthen coping mechanisms. However, rather than a stand-alone risk management strategy, these efforts should be an integral component of a broader dairy development policy and strategy.

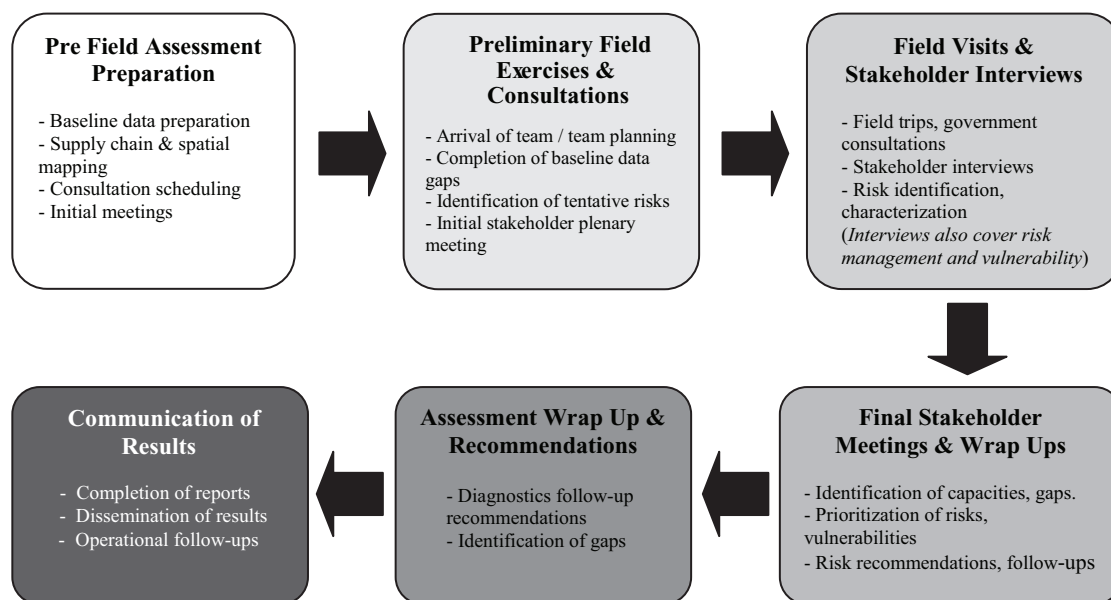
# 1. Background

At the request of the Ministry of Agriculture Animal Industries and Fisheries (MAAIF), and the government of Uganda, the Agricultural Risk Management Team (ARMT) of the World Bank Group, in collaboration with the Ugandan Dairy Development Authority (DDA), conducted a dairy supply chain risk assessment in Uganda. This report is the outcome of that assessment and is intended as an advisory note to MAAIF and DDA to enable them to identify a strategy and potential public investments to improve risk management practices in the dairy supply chain.

This report identifies the major risks facing the dairy supply chain, ranks them in terms of their potential impact and frequency, and offers a framework for improving risk management practices. The recommendations and findings will provide a basis for follow-up planning work by the government of Uganda, the World Bank, and other development partners.

The findings and analysis of this initial assessment are based on a methodology designed by ARMT for assessing risks in the agricultural supply chains. The assessment team followed a sequence of activities (Figure 1) while conducting the assessment.

**Figure 1: Overall Sequence of Analysis and Consultative Steps**



Source: Rapid Agriculture Supply Chain Risk Assessment, the World Bank, 2010

In-depth interviews were conducted with key dairy supply chain stakeholders in the northern, eastern, western, and central regions (i.e., dairy farmers, veterinary input suppliers, traders, financial intermediaries, milk processors, wholesalers and retailers, service providers, government officials, and research institutes). The mission schedule (Annex 1) and contact details of the key stakeholders interviewed (Annex 2) are provided at the end of this report.

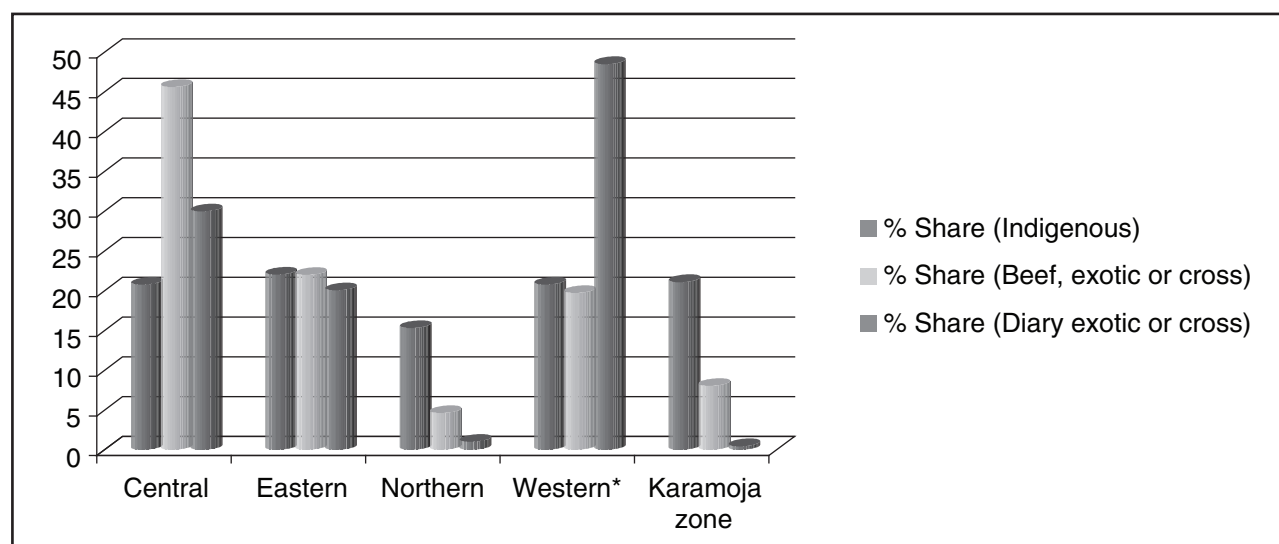
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wishes to acknowledge the invaluable support provided by MAAIF, DDA, government officials, farmers, cooperative officials, nongovernmental organizations (NGOs), and private sector stakeholders as partners in this activity.

## 2. An Overview of the Ugandan Dairy Industry

Cattle have traditionally been the dominant form of economic (e.g., milk, meat, and cattle sale) and social (e.g., marriage, death, dispute settlement, and gift giving) exchange in Uganda. They currently serve as the main source of livelihood for a large majority of rural Ugandans, especially in the cattle corridor. The livestock sector contributes 13.1% of the agricultural GDP and 5% of the national GDP. According to the 2002 livestock census, Uganda's livestock population consists of goats (12.5 million), sheep (3.4 million), pigs (3.2 million), poultry (37.4 million), and cattle (11.34 million). Since 1991, the output of the livestock sector has grown on an average of 2.2% per annum, with most of the growth coming from the dairy sector. The dairy sector contributes up to 50% of the total output from the livestock sector.<sup>2</sup> Of the total cattle population, more than 93% is indigenous, and only 13.4% is engaged in milk production. Figure 2 provides a distribution of the cattle population by region and breed.

**Figure 2: Regional Distribution of the Cattle Population in Uganda in 2008**



Source: Ugandan Bureau of Statistics Livestock Census, 2008

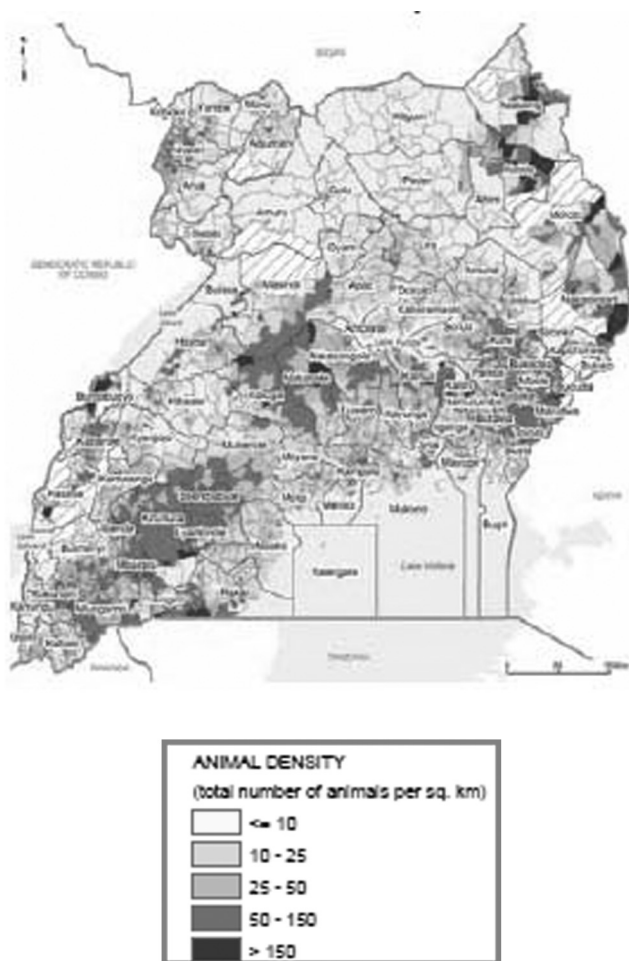
\* This includes the western and southwestern regions as per DDA's classification (Table 2).

The majority of the cattle population (65.4%) is confined to a narrow area (Figure 3), often called the cattle corridor. This area is semi-arid, experiences a low incidence of tsetse fly infestation<sup>3</sup> (Figure 4), and has suitable climatic conditions that make it conducive to cattle rearing. Tsetse fly control and the prophylactic and curative treatment of cattle against trypanosomiasis are required to keep cattle outside the cattle corridor.

<sup>2</sup> Source: DDA Web site.

<sup>3</sup> The tsetse fly is the vector of trypanosomiasis (sleeping sickness) in people and cattle.

Figure 3: Cattle Density in Uganda



Source: WRI, 2010, p. 16

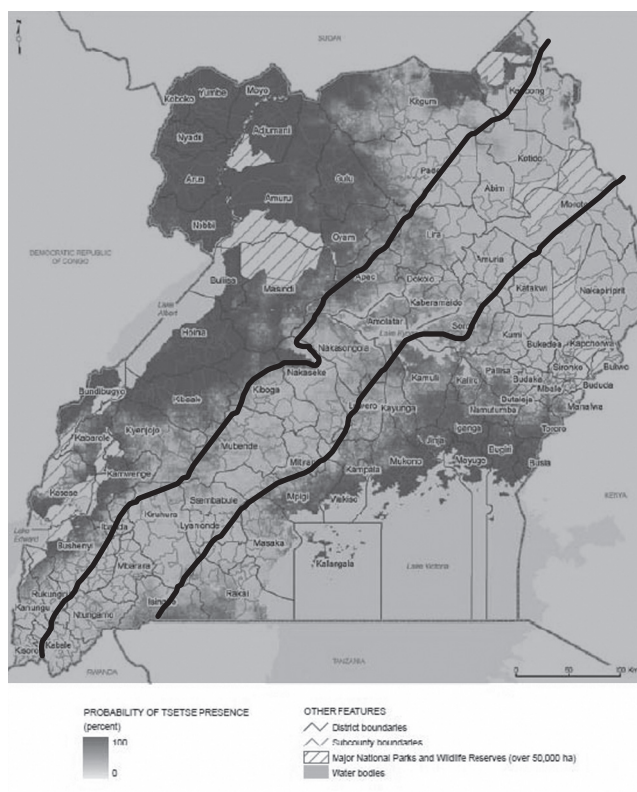
Exotic or crossbreed dairy cattle constitute 5.6% of the total cattle population, and only 10% of cattle-owning households own such cattle. The largest concentration of exotic/crossbreed cattle is in the western region, which contains approximately 48% of country's exotic/crossbreed cattle. A very small proportion of exotic/crossbreed cattle are totally purebred dairy animals. The majority are a cross between exotic and indigenous cattle, with a varying percentage of exotic blood. Table 1 provides a brief description of the different cattle breeds and their average milk production.

Table 1: Classification of cattle in Uganda

|             | Daily milk production (Key informants) | Cattle breed                  |
|-------------|----------------------------------------|-------------------------------|
| Indigenous  | 2–3 litres                             | Ankole Longhorn, Zebu, Nganda |
| Crossbreed  | 5–6 litres                             |                               |
| Pure exotic | 10–12 litres                           | Holstein, Friesian            |

Source: Authors' elaboration

Figure 4: Map of Tsetse Fly Infected Area &amp; Cattle Corridor



Source: Authors, adapted from World Resources Institute (WRI), 2010

Dairy production systems in Uganda can be divided into subsistence farming (more than 90%) and commercial farming (less than 10%) systems. Subsistence farming systems is being practiced by pastoralists as well as agriculturalist and consists of: i) free range grazing and ii) communal grazing on unfenced, but predefined, communal lands. Commercial grazing, which is largely being used for exotic (purebred or crossbred) cattle consist of: i) perimeter-fenced land where cattle graze on individual plots and ii) zero grazing. Despite government and NGO promotion of zero-grazing, its adoption has been limited and only a few farmers, largely peri-urban cattle farmers in south-western, eastern, and central regions, have adopted it.

Mixed farming smallholders and pastoralists together own over 90% of the national cattle herd, with dairy as an integral part of the agricultural system in most parts of the country. The farmers are now looking at cattle as a source of cash income, although the social and cultural significance of cattle remains strong, especially among the tribes that occupy the cattle corridor.

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Commercial milk production and marketing in Uganda date back to the 1960s, when the post-independence government started promoting exotic dairy breeds, through various projects, to increase milk production. The share of the dairy animals in the national herd has increased over the years with the importation of purebred exotics and through the crossbreeding of local breeds with dairy breeds. Over the past 50 years, the industry has gone through two distinct phases:

**Post-independence and government control period (1962–1993):** In 1967, the first Dairy Industry Act set up the Dairy Corporation (DC) as the government body responsible for dairy development, dairy products marketing, and industry regulation. Areas with the potential for milk production were identified, including the northeastern region (Soroti, Kumi), the central region (Mukono, Kayunga, Luwero, Nakasongola), the western region (Kasese, Kaborole, Hoima and Masindi), and the southwestern region (Mbarara, Bushenyi, Ibanda, Rukungiri, Kabale, and Ntungamo). Dairy farmer marketing cooperatives and milk collection centers were established in these areas. A milk-processing plant was built in Mbale (eastern region) to process milk from the north-eastern milk catchment area, while a bigger one was built in Kampala to process the milk from the central, south-western and western parts of the country. The dairy sector suffered a major setback in 1970s, when the country experienced political unrest, which led to civil wars. The national cattle population was badly affected and declined from 8 million in 1970 to 3.5 million in 1985. The government-controlled cooperative marketing structure collapsed, not only because of the civil wars but also because of mismanagement, and more than 50% of the DC-owned milk collection infrastructure became obsolete. The country's milk-processing capacity was also affected, and by 1990, only the Kampala processing plant was operational.

**Dairy market liberalization period (1993 and beyond):** In 1993, the government, with assistance from the Danish Development Agency (DANIDA), developed a master plan for the dairy sector with three major recommendations: (1) liberalization of milk marketing; (2) creation of a Dairy Board for overseeing the liberalized dairy industry, and (3) privatization of the DC. The government of Uganda enacted the Dairy Industry Act of 1998, which created DDA and Dairy Corporation Limited (DCL). DDA took over the development and regulatory functions of the dairy industry in 2000, and DCL, the commercial company, was later leased to Sameer Agriculture and Livestock Ltd. in 2006. After liberalization, the central government withdrew from the direct delivery of veterinary/extension services and delegated this role to districts (local government) and private sector where this was feasible. Later, in 2001 the government created the National Agricultural Advisory Services (NAADS)

programme for the development of private extension services. In addition, the government provided some support for the revival of the cooperative movement in the country.

Liberalization led to private sector investment in milk collection, cold chain infrastructure, milk distribution, and marketing. At the time of liberalization, there were only three government-owned plants, with a total installed capacity of about 160,000 litres per day. From 1993 to 2006, 15 medium- to large-scale processing plants were set up, which increased the total installed capacity to over 350,000 litres per day. Currently, there are nine operational processing plants with a combined installed capacity of over 400,000 litres per day; however, most of them are operating at 45% capacity utilization (Annex 3).

According to DDA estimates, national milk production grew from 365 million litres in 1991 to 1.5 billion litres in 2008. These figures, however, according to key informants, are gross overestimates, and the current milk production may be between 800 million and 1 billion per annum (Annex 4). It is estimated that 70% of total milk production reaches the market, while the producing households consume the remaining 30%. The liberalized environment also saw the emergence of an informal raw milk trade, which currently accounts for 90% of the marketable milk trade, leaving only 10% for the formal sector milk-processing companies.

Milk is an integral part of the Ugandan diet, and the cultural practice, especially among the urban population, is to boil all milk, even pasteurized or ultra heat-treated (UHT) milk, before it is drunk. In the rural areas, it is more common to find people drinking raw milk, although the practice is gradually changing because of the ongoing sensitization to the dangers of drinking raw milk. Kampala, with a population of 1.2 million, is the largest urban center and by far the biggest market for milk. Entebbe, Jinja, Gulu, Mbarara, and Mbale are other big urban centers with a sizable milk demand. The consumption of dairy products is on the rise, and according to DDA, Uganda's per capita milk consumption has gone up from 22 litres (1992) to 50 litres (2009). In comparison, Kenya's per capita consumption was 76 litres, and Tanzania's was 26 litres.

DDA divides Uganda into five milk production regions, of which the southwestern region has the highest milk production, especially the area surrounding Mbarara and Bushenyi. Table 2 provides a brief breakdown of the different milk production regions and their share of the total milk production. Annex 5 provides a detailed account of the regional differences and similarities.

**Table 2: Distribution of milk production regions in Uganda**

| Total Milk Production, % |                                                                         |           |           |
|--------------------------|-------------------------------------------------------------------------|-----------|-----------|
| Region                   | Districts                                                               | 2000–2004 | 2006–2008 |
| Southwestern             | Bushenyi, Mbarara, Rakai, Rukungiri, Kabale, Kiruhura, Ntungamu, Ibanda | 32        | 36        |
| Central                  | Masaka, Sembabule, Mpigi, Luwero, Mukono, Kampala, Nakasongola          | 22        | 34        |
| Northern                 | Gulu, Lira, Apac, Kitgum, Soroti, Kumi, Arua                            | 21        | 15        |
| Western                  | Kabarole, Kasese, Bundibugyo                                            | 9         | 8         |
| Eastern                  | Kamuli, Mbale, Pallisa                                                  | 16        | 7         |

Source: DDA

### Figure 5: Distribution of Milk Coolers in Uganda and Their Current State

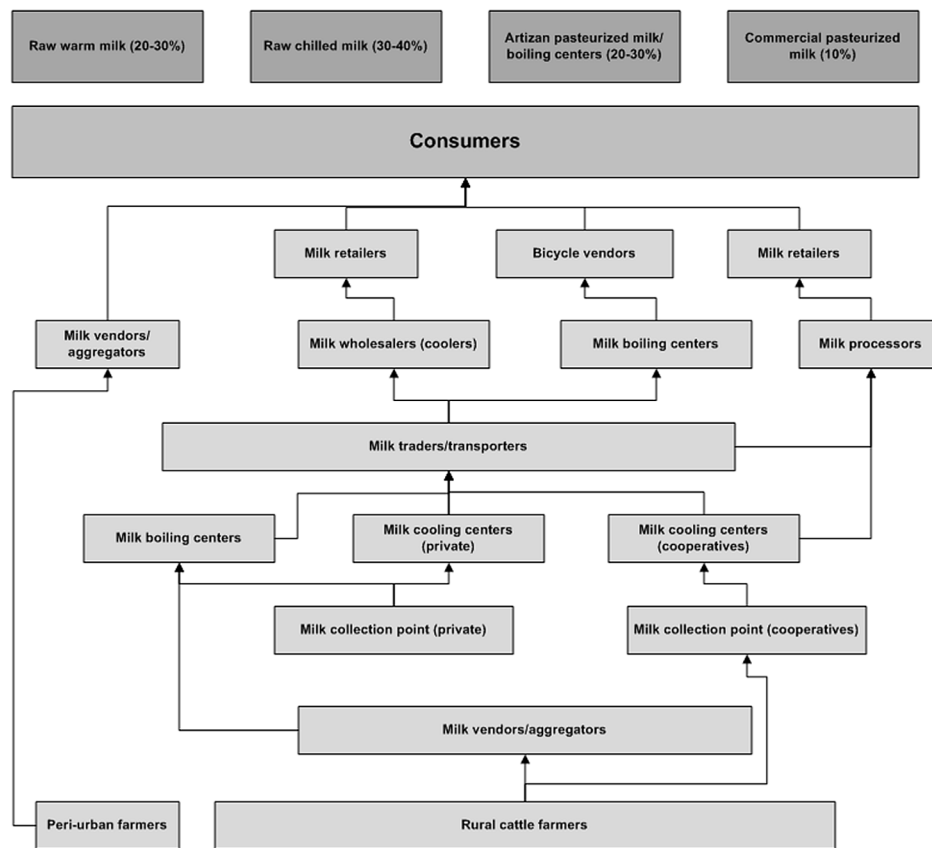


Despite the events that the dairy industry has faced over the past five decades, it continues to grow and provide a livelihood for thousands of households engaged in the chain. Recognizing its development impact, a number of development initiatives, notably the U.S. \$10.2 million East Africa Dairy Development Project in Uganda funded by the Bill and Melinda Gates Foundation and the U.S. \$8 million Heifer International and SNV Biogas Project, are focusing on this sector.

### 3. Dairy Supply Chain Structure

There are four prominent channels for delivering milk to the consumers in Uganda: (1) raw warm milk, (2) raw chilled milk, (3) artisan-pasteurized milk, and (4) commercially pasteurized milk. Although the market for processed dairy products like cheese, yoghurt, butter, cultured milk, and ghee is gradually rising, it represents a very small part of the dairy sector. The majority of the households buys milk and makes these products in their households with traditional methods. Figure 6 (supply chain map) provides a snapshot of the above-mentioned channels.

**Figure 6: Map of Ugandan Dairy Supply Chain**



Source: Authors

- 1. Raw warm milk:** In this channel, raw milk is directly delivered, without undergoing any cooling, from farm gate to consumers. The majority of the rural households get their supply of warm milk directly through farmers or vendors. A large number of bicycle vendors collect milk from dairy farmers and supply it directly to consumers in urban areas. Farmers living within a 20- to 30-km periphery of major consumption centers, largely classified as peri-urban dairy farmers, largely supply milk to this chain. Since this milk needs to be boiled by households within 4 to 5 hours of milking, the catchment area of this supply chain is limited. Although there are no reliable data, key informants assert that 20 to 30% of total milk sales in Uganda are routed through this channel.
- 2. Raw chilled milk:** The majority of households in urban centers receive their milk supply through this informal channel. Long chains of intermediaries, including bicycle collection agents, private bulking

centers, transporters, cooling plants, wholesalers, and retailers, connect milk producers with consumers. This chain usually starts with a bicycle or motorbike transporting milk to either a cooling center or an aggregation center, where milk is then picked up in a truck and transported to a cooling center. In a few locations, milk is boiled at collection centers before it is placed in the cold chain. The milk is transported to consumption centers for sale through wholesale and retail channels.

3. **Artisan-pasteurized milk/boiling centers:** A sizable proportion of milk in Kampala is channeled through boiling centers, which are essentially transfer/aggregation centers. Usually, the milk is brought by transporters from the villages, and traders collect and “locally pasteurize” the milk in big vats/small boilers before distributing it among their hawkers, who take it to customers, households, restaurants, or shops. There are five registered boiling centers in Kampala, and they play an important role in assuring the safety of milk brought into town. Annex 6 provides an income breakdown of the different stakeholders engaged in this chain.
4. **Commercially pasteurized milk:** This is the formal channel, consisting of 16 dairy processors, of which seven are not operational, that produce a wide range of pasteurized products. Sameer Agriculture and Livestock Ltd. supplies 70 to 80% of the formal sector dairy product requirement in Kampala, with pasteurized milk the number 1 product, followed by UHT milk. Most of the milk comes from the western and south-western regions, largely from cooperatives. The company is currently trying to develop central and eastern Uganda milk catchment areas by supporting the establishment of milk collection and bulking centers. Jesa Dairy Farm covers around 15 to 20% of the pasteurized milk market of Kampala. This privately owned farm and dairy processing plant gets more than 60 to 65% of its milk supply from its farm and 35 to 40% from neighboring dairy producers. Jesa farm has built an outgrower model of supporting and sourcing milk from the local dairy farmers. They have raised the management capacity of the surrounding farmers, and through increased vaccination and reduced movement of cattle, they have created a de facto disease control zone around their own farm.

Other major stakeholders of the dairy supply chain include the following:

**Uganda National Dairy Traders’ Association (UNDATA)** is the association of informal dairy traders created with the support of NGOs, development projects, the Ugandan National Chamber of Commerce and Industries, and DDA. UNDATA’s membership is largely limited to central and south-western Uganda, and it currently has 10,000 members, of whom 500 are based in Kampala. UNDATA lobbies on behalf of traders, assists DDA in performing inspections of adulterated and contaminated milk, and supports DDA in the enforcement of various regulations.

**Dairy cooperatives** were the primary institutional structure created by the government of Uganda for the collection and marketing of milk. During the sixties and early seventies, almost the entire country’s milk supply was routed through cooperatives, and they provided vital services (e.g., vaccination, animal health, genetic improvement) to their members. However, because of armed conflict, political instability, and mismanagement, the majority of the cooperatives stopped operating. Currently, there are 131 functional primary dairy cooperative societies. As shown in Figure 7, they are mainly concentrated in the south-western region. In that region, there is a tripartite structure consisting of primary, secondary, and tertiary cooperatives, which subscribe to a regional apex body, the Uganda Crane Cooperative Creamery Union (UCCCU), consisting of seven unions and 98 primary cooperatives. For the rest of the country, primary cooperatives operate individually in their respective areas. These cooperatives supply milk to formal (pasteurized) as well as informal (chilled milk) channels and also sell some milk locally.

**Legend**

- Coops
- Coop Location
- Uganda\_Districts 2006

**Veterinary services** in Uganda consist of public veterinarians, private veterinarians, and veterinary diagnostic laboratories. While the public veterinarians manage and control outbreaks of notifiable diseases, prevent the import of new diseases, and ensure public health and food safety, the private veterinarians deliver field veterinary services on a fee-for-service basis. Veterinary laboratories play a role in sero-surveillance to determine the presence or absence of diseases and give diagnostic support. The Ugandan Public Animal Health Service is managed by the Directorate of Animal Resources within MAAIF.<sup>4</sup>

4 World Organization for Animal Health (OIE) Performance of Veterinary Services (PVS) Appraisal (2007) indicates that there are 50 veterinarians in central government; 322 in local government acting as veterinary officers in the districts; 129 private practitioners; 94 in the universities/colleges, laboratories, and research institutes; and 76 in NGOs or other businesses. There are 1,216 veterinary paraprofessionals and technical staff who work under the supervision of veterinarians and provide veterinary field services. The Uganda Veterinary Association (UVA) has 800 registered members. UVA estimates that approximately 20 of its members operate as private veterinarians in the countryside.

**Pharmaceutical industry:** Uganda's government has, except for vaccines for some notifiable diseases (e.g., FMD, rabies, brucellosis, lumpy skin disease), liberalized the import, distribution, and sale of vaccines and veterinary drugs. All major international pharmaceutical companies are present in the country, either with their own representation or through an agent. The size of the current veterinary drugs and vaccine market is estimated at U.S. \$ 15 million annually. A considerable part of this market has been captured by unlicensed traders, who are often accused of importing and selling substandard veterinary drugs and vaccines.

## 4. Major Risks and Capacity to Manage

Uganda's dairy supply chain is confronted by multiple risks (Table 3), which are grouped into three main categories: production, market, and enabling environment risks. Because of the paucity of time series data regarding milk production, livestock population, disease outbreaks, etc. at the national and district levels, the quantification of risks and associated losses was difficult, and most of this exercise has been qualitative in nature by necessity. Although this assessment is geared towards analyzing risks in the dairy supply chain, it is also important to look at the major constraints. Effective risk management often requires resolving the underlying constraints because the presence of some constraints increases the likelihood of risk and intensity of losses. Annex 7 provides a detailed account of the major constraints affecting the Uganda dairy supply chain.

**Table 3: Major risks in the dairy supply chain**

| Identified Risks                  |
|-----------------------------------|
| <b>Production risks</b>           |
| Notifiable cattle diseases        |
| Non-notifiable cattle diseases    |
| Drought                           |
| Flood                             |
| <b>Market risks</b>               |
| Milk spoilage                     |
| Failure of key organizations      |
| <b>Enabling environment risks</b> |
| Armed conflicts                   |
| Cattle rustling                   |
| Abrupt regulation                 |
| Erratic power supply              |
| Human disease                     |

Interviews with key dairy industry stakeholders and a review of dairy sector documents was undertaken to identify and analyze the risks. Subsequently, identified risks were assessed according to their potential to cause losses and the frequency with which they occurred. This assessment is captured in Table 4. The identified risks located in the darkest gray area (upper right corner) of Table 4 represent the most significant risks because of their potential to cause the greatest losses and the high frequency of their occurrence. The second level of importance is represented by the light gray boxes, whereas the clear boxes (on the left side of table) represent identified risks that have a low potential to cause damages and/or occur infrequently.

This analysis, based on frequency of occurrence and intensity of losses, indicates that the most important risks for the dairy supply chain in Uganda are notifiable cattle diseases, non-notifiable cattle diseases, droughts, abrupt regulations, and potential failure of key organizations. While the other risks are also important, but from a macro perspective of the national dairy industry, the current vulnerability of the dairy supply chain against those risks, is relatively low. The following paragraphs provide a detailed account of the various risks.

**Table 4: Summary of risks: severity versus probability**

|                      |                 | Potential Severity of Impact |                                            |                                                   |                            |              |
|----------------------|-----------------|------------------------------|--------------------------------------------|---------------------------------------------------|----------------------------|--------------|
|                      |                 | Negligible                   | Moderate                                   | Considerable                                      | Critical                   | Catastrophic |
| Probability of Event | Highly probable | Erratic power supply         | Human diseases<br>Milk spoilage            | Non-notifiable cattle diseases                    |                            |              |
|                      | Probable        |                              |                                            | Drought                                           |                            |              |
|                      | Occasional      |                              | Flood<br>Cattle rustling<br>Armed conflict | Abrupt regulation<br>Failure of key organizations | Notifiable cattle diseases |              |
|                      | Remote          |                              |                                            |                                                   |                            |              |
|                      | Improbable      |                              |                                            |                                                   |                            |              |

## 4.1 Production Risks

Drought, flood, notifiable cattle diseases, and non-notifiable cattle diseases are the four biggest risk factors; they cause substantial volatility in milk production, leading to financial losses to the cattle farmers and the entire industry.

### 4.1.1 Notifiable Cattle Diseases

Loss ranking: Critical

Probability: Probable

Notifiable cattle diseases, which are required by law to be reported to government authorities, cause a major loss to farmers because of animal mortality, reduced milk production, abortions, and quarantine measures.<sup>5</sup> FMD, CBPP, lumpy skin disease, rabies, and anthrax are the major notifiable cattle diseases in Uganda. An upcoming disease is Rift Valley fever, which is also a zoonosis. Uganda has two main sources from which such diseases originate: from neighbouring countries because of livestock movement or trade of animal products and from the reservoir of disease in wild animals. It is extremely difficult under the current conditions in Uganda to prevent and control these diseases through the usual measures, such as movement control and quarantine. There have been frequent outbreaks of such diseases (Annex 8), yet there is most likely an underreporting of these diseases for the simple reason that in many parts of the country there are not enough veterinarians to diagnose and perform sero-surveillance. In addition, the capacity of the diagnostic laboratories would not be sufficient to test all such samples if they were taken. There are vaccines available to control these diseases; however, the purchase and distribution of these vaccines is still largely in the public domain. A rigid vaccine procurement and distribution system leads to reduced availability for normal routine prophylactic vaccination. Considering the fact that it is difficult to control the movement of traditional livestock through the cattle corridor, the lack of vaccination creates significant hazard and increases vulnerability to these diseases.

Animal diseases have been the biggest reason for the loss of cattle population among the respondents who participated in the focus group discussion (Annex 9). Because of the heavy concentration of dairy production in the southwestern region, the outbreak of a notifiable cattle disease in that region and the resulting quarantine measures could disrupt the milk supply to Kampala. Table 5 simulates the potential losses due to outbreak of FMD in Kihurara district and estimates that the financial losses from such an outbreak could be U.S. \$60 million.

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<sup>5</sup> The World Organization for Animal Health (OIE) defines quarantine as “all measures relating to the entry and detention of animals in the quarantine establishment, including controlling their movement to and from this establishment and activities rendered to ensure the disease-free status of the animals.” This includes no commercial transaction of animal products (including milk) during the quarantine period, which may extend from a few weeks to up to six months.

**Table 5: Estimate of the overall cost of an FMD outbreak in one district with six-month quarantine**

| Model calculation for Kihururadistrict of cost of a FMD outbreak<br>(based on assumptions in line with information received) |         |               |                                                                       |                        |                   |
|------------------------------------------------------------------------------------------------------------------------------|---------|---------------|-----------------------------------------------------------------------|------------------------|-------------------|
| Exchange rate Ush/USD                                                                                                        | 2200    | In US Dollar: |                                                                       | in Ush:                | In US Dollar:     |
| Total cattle pop.                                                                                                            | 342350  |               | Value dead cows                                                       | 25,676,250,000         | 11,671,023        |
| % of breeding cows                                                                                                           | 50%     |               | Value dead calves                                                     | 3,081,150,000          | 1,400,523         |
| % of cows in lactation                                                                                                       | 70%     |               | Lost milk production                                                  | 10,784,025,000         | 4,901,830         |
| % of calves < 6 months                                                                                                       | 20%     |               | Lost lactations                                                       | 6,419,062,500          | 2,917,756         |
| av. lactation yield                                                                                                          | 3000    |               | <b>Total Cost for farmers</b>                                         | <b>45,960,487,500</b>  | <b>20,891,131</b> |
| morbidity in overall herd                                                                                                    | 50.00%  |               | <b>total value milk in a year without FMD outbreak:</b>               |                        | <b>65,357,727</b> |
| value of average animal                                                                                                      | 500000  | 227           | <b>Quarantine cost of 6 month for non delivered milk for farmers:</b> |                        |                   |
| value of calf                                                                                                                | 150000  |               | a) the reduced production                                             | 5,318,149,315          | 2,417,341         |
| value of dairy cow                                                                                                           | 1500000 |               | b) non delivered milk sick cows                                       | 24,818,030,137         | 11,280,923        |
| abortion %                                                                                                                   | 25%     |               | c) non delivered healthy cows                                         | 35,454,328,767         | 16,115,604        |
| drop in lactation yield                                                                                                      | 30%     |               | <b>Total loss for farmers from milk not sold</b>                      | <b>65,590,508,219</b>  | <b>29,813,867</b> |
| calf mortality                                                                                                               | 30%     |               | lost trade for transporters (at 50 Ush/l)                             | 8,198,813,527          | 3,726,733         |
| cow mortality                                                                                                                | 10%     |               | lost margin for processor (at Ush 100/l)                              | 16,397,627,055         | 7,453,467         |
| average milk price farm gate                                                                                                 | 400     | 0.18          | <b>total loss to sector (farmer, trader, process.)</b>                | <b>136,147,436,301</b> | <b>61,885,198</b> |
| Days of Quarantine                                                                                                           | 180     |               |                                                                       |                        |                   |

Source: Authors

Uganda, as a member of the World Organization for Animal Health (OIE), has certain obligations in the prevention, control, and possible eradication of these diseases. However, it is difficult for Uganda to fulfil these obligations because of the current structure and functioning of veterinary services. A coordinated and concerted action, consisting of control strategies based on internationally agreed-upon scientific principles, increased beneficiary participation in covering the cost of vaccination, an effective animal disease control unit in the ministry working together with the district and private veterinarians, and good collaboration with neighboring states, will be required to control these notifiable cattle diseases. In addition, dairy processors and dairy cooperatives can play a role in organizing vaccination campaigns and financing them for cash-strapped farmers through deductions from milk payments.

### 4.1.2 Non-notifiable Cattle Diseases

Loss ranking: Considerable

Probability: Highly probable

The non-notifiable diseases can be classified as tick-borne diseases and other non-notifiable diseases (e.g., bovine tuberculosis, brucellosis, leptospirosis, blue tongue, hemorrhagic disease, septicemia). Most have effects on the fertility of animals (in the case of brucellosis abortion during first pregnancy) and the general vitality of animals, thus negatively influencing milk production. The zoonoses also pose serious risks for humans, giving rise to serious diseases in humans that are difficult and expensive to cure. There is anecdotal evidence that the incidence of these diseases is increasing for various reasons. Recent weather events have caused an increase in the incidence of diseases and the area infected with vectors (biting flies, midges, ticks, tsetse flies). The reduced capacity of the veterinary services to control and eradicate these diseases has led to a steady increase in the number of infected areas, thus creating a larger infective pool of animals from which vectors spread the diseases further. A complicating factor is wildlife as a reservoir of such diseases. According to a recent document of MAAIF, annual losses from cattle diseases (both notifiable and non-notifiable diseases) amount of U.S. \$86.3 million. Major reasons for these losses include morbidity (58%), mortality (30%), and post-slaughter condemnation (10%).<sup>6</sup>

Vector control and vaccination are the two most effective solutions to manage this risk. Since the privatization of veterinary services, many drugs, formerly administered only by veterinarians, have become available on the market and can be purchased freely. Unprofessional use of such drugs, however, can lead to resistance in the pathogen, which makes future treatment more complicated, but more importantly, it can pose a threat to human health. Another important danger is the risk of residues in milk and meat if the withholding periods are not observed. In the past, there was a national plan on the use of acaricides for tick control and a system for testing dips for the right strength. Such a system is currently not in place, and although acaricides are freely available, their use in certain areas is limited.

### 4.1.3 Drought

Loss ranking: Considerable

Probability: Probable

Although Uganda has abundant water resources, its distribution is uneven. A large number of pastoral milk producers live in the semi-arid areas of the cattle corridor. The corridor has a fragile ecosystem, and the people living there depend on water bodies like lakes, ponds, valley dams/tanks and rivers for human consumption and livestock production. These sources usually dry up during droughts, resulting in a severe shortage of water. Drought events are a recurrent problem that poses a serious threat to agriculture and livestock production. Key informants mentioned that during the last 10 years, the annual dry season has become more prolonged. As a consequence of the increasing frequency and severity of drought, particularly in the semi-arid areas of the cattle corridor, milk production is undermined because of the lack of water and natural pastures.<sup>7</sup> To minimize the negative effects of drought on milk production and cattle mortality, pastoralists are forced to displace their animals to alternate water and feeding grounds. Prolonged drought conditions also cause inter-communal conflicts. The severe drought experienced, mostly in the cattle corridor, during La Niña of 1998-1999 affected over 3.5 million people in 28 districts<sup>8</sup> and caused the massive movement of livestock to other, less affected

<sup>6</sup> Development Strategy and Investment Plan 2010/11-2015/16, MAAIF, March 2010.

<sup>7</sup> Uganda Disaster Preparedness Plan, 2005.

<sup>8</sup> Poverty Eradication Action Plan (PEAP).

districts.<sup>9</sup> In 2008, drought conditions forced the government to deploy army troops to contain Karimojong cattle herders and therefore avoid conflicts in the Teso and Acholi regions.<sup>10</sup>

Cattle exodus during drought conditions also increases the risk for spreading diseases. The indirect or direct contact of infected animals with susceptible animals, especially at water holes, may lead to the outbreak of diseases, especially FMD and CBPP. In addition, the interaction between domestic animals and wild animals increases the risk for zoonotic diseases. In 2009, the Lake Mburo National Park Authority reported that farmers, mostly from Sanga, Kanyaryeru, and Kyakashashara subcounties, moved over 15,000 cows to the park that competed with wild animals for food and water and increased the risk for the transmission of animal diseases.

#### **4.1.4 Floods**

Loss ranking: Moderate

Probability: Occasional

From July to September 2007, Uganda experienced its heaviest rain in the past 35 years,<sup>11</sup> which led to severe flooding in the eastern and northern regions of the country. Prior to that, in 1997, the same regions were affected by severe floods. During both occasions, El Niño rains were largely responsible for flooding, which had a severe impact on the human and cattle populations. Although livestock mortality from these floods was not very high, dairy farmers were unable to market their milk because of flooding conditions and had to forego milk earnings for a long period. In addition, flooding leads to an increase in disease incidence (e.g., coccidioidosis, lumpy skin disease, mange, foot rot, *peste des petits ruminants* [PPR], CBPP)<sup>12</sup> and vector infestation (including ticks, worms, mites, and black flies). The impact of flood on the overall dairy industry, however, has not been significant because the major milk production regions, so far, have not experienced floods.

### **4.2 Market Risks**

The major market risks facing the Ugandan dairy supply chain are milk spoilage and the failure of key organizations.

#### **4.2.1 Failure of Key Organizations**

Loss ranking: Considerable

Probability: Occasional

The dairy sector in Uganda is dominated by a few key organizations, which often have a monopolistic position within their market segment. Snowman is the only company that sells and services milk coolers, Sameer has more than 80% of the market share of the pasteurized milk channel, UCCCU manages more than 70% of the country's functional cooperatives, and only one factory produces the liquid nitrogen that is required for artificial insemination. This, to a certain extent, is a legacy of a past wherein state monopolies have been replaced by private monopolies. But excessive reliance on a single organization exposes the dairy sector to systemic risk in the eventuality of any key organization failing.

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<sup>9</sup> Uganda National Water Development Report, 2005.

<sup>10</sup> The U.N. World Food Programme (WFP) estimated that the agricultural output was reduced to as low as 30% in some areas of the country.

<sup>11</sup> Source: government of Uganda, 2009.

<sup>12</sup> Source: FAO/WFP Assessment of the Impact of 2007 Floods on Food and Agriculture in Eastern and Northern Uganda, January 2008.

The failure of the former DCL is the case in point that led to a systemic breakdown of the dairy industry, prompted liberalization of the sector, and led to the emergence of the informal sector. Liberalization also led to establishment of a few processing plants, many of which failed, having an adverse impact on the entire supply chain. While this risk is difficult to manage, better coordination among the stakeholders, greater competition, and support to key organizations could help mitigate this risk.

### **4.2.2 Milk Spoilage/Post-production Losses**

Loss ranking: Moderate

Probability: Highly probable

Loss of milk due to spoilage is a major risk for all the stakeholders in the dairy supply chain. Farmers suffer the maximum spoilage losses, largely on account of their inability to market their milk, especially during the rainy season. Lack of a proper cold chain and transportation of milk in plastic containers leads to occasional spoilage, especially during hot seasons. Improper handling and erratic power supply cause significant milk spoilage for milk cooler operators and milk processors. A study by FAO (2003) estimated that the total economic value of the post-production losses in the milk supply chain was U.S. \$23 million per year.<sup>13</sup> While the FAO figures appear exaggerated, they illustrate the possible scale of milk post-production losses.

Over the past several years, improvements in collection centers, the development of the cold chain, the use of metal containers, and increasing demand for milk have led to a decline in post-production/milk spoilage losses. Improvement in milk marketing, the cold chain infrastructure, milk handling, and the power supply would further reduce the losses from milk spoilage.

## **4.3 Enabling Environment Risks**

Armed conflicts, cattle rustling, abrupt regulation, risk for political interference, abrupt power supply, and risk for human diseases are the major enabling environment risks that can lead to serious losses.

### **4.3.1 Abrupt Regulation**

Loss ranking: Considerable

Probability: Occasional

The Dairy sector master plan of 1993 provided policy guidelines for the industry which resulted in the enactment of the Dairy Industry Act (1998). DDA developed two strategy documents (2002-2007 and 2008-2012) and with support from FAO, they are currently in the process of updating the dairy industry strategy document. DDA, as the regulator of the sector, is tasked with creating rules and regulations for the governance of the sector. These regulations, however, are often ad hoc, with limited stakeholder engagement. In 2002, DDA banned the use of plastic containers for milk transportation, and in 2006 it introduced a law that required all dairy traders to use chilling equipment and insulated tankers. Food safety requirements necessitated both these regulations, and they eventually helped upgrade the supply chain. These regulations, however, also threatened the collapse of the informal supply chain. The informal sector was not prepared for the investments required to comply with the new regulations, there were insufficient aluminium/ metallic cans and insulated tankers to meet the requirement, and limited time was allocated for the transition from the old to the new systems. These regulations,

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<sup>13</sup> <http://www.fao.org/ag/againfo/themes/en/dairy/pfl/home.html>.

however, were enforced only for a limited period of time, and because of political pressure, the enforcement of the regulations has gradually ceased, and many of the informal sector players currently do not abide by them.

The dairy industry is often exposed to political inference, which increases the probability of abrupt regulatory changes. Greater coordination among stakeholders, proactive lobbying, and stakeholders' engagement in the regulation formation process could help manage this risk. While the development of food safety and quality standards should be an integral part of any dairy development strategy, rather than ad hoc decisions, a systematic plan with a clear time frame for upgrading the infrastructure and technology should be developed by DDA in coordination with all the stakeholders.

### 4.3.2 Cattle Rustling

Loss ranking: Moderate

Probability: Occasional

The pastoral communities in Karamoja (northeastern Uganda) have a traditional belief that all cattle belong to them by divine right, and they customarily raid cattle as a way of increasing their herds to gain status, negotiate for a bride, settle disputes, or fulfill other social obligations. They are therefore involved in conflicts centered on rustling cattle from their neighbors, the Iteso in Uganda, the Dinka in South Sudan, and the Pokot in Kenya. Up to 1979, the communities neighboring Karamoja considered the cattle raids as a bearable nuisance against which they would defend themselves. This position took a tragic turn when the Karamojong acquired large quantities of guns and ammunition abandoned in a military barrack in Moroto in 1979. The now well-armed Karamojong have attacked their neighbors at various times since then, with disastrous consequences for the entire region.<sup>14</sup>

The consequences of cattle rustling on the economic development of areas where pastoralists live are very clear. This conflict has scared away potential investors while at the same time rendering the local people poor. Large areas close to Karamoja have been abandoned because of cattle raids, and there is no economic activity. Currently, the situation is stable, and government efforts at containing the Karomojong have been successful, with no major raiding incidences reported in the past few years. This risk has been classified as moderate since areas prone to cattle rustling (eastern and northern) contribute marginally to the country's milk supply, and unless the cattle raiding spreads to the southwestern part of the country, it is not likely to have a major impact on the country's milk production.

### 4.3.3 Armed Conflict

Loss ranking: Moderate

Probability: Occasional

Uganda has experienced three major civil disturbances in the past that culminated in armed conflicts. The first major armed conflict was in 1979. Thereafter, there was a civil war in central Uganda that particularly affected

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<sup>14</sup> Prior to 1980, people in northern and northeastern Uganda had enough cattle to support a fairly productive dairy and livestock sector. However, after the Karamojong started raiding their neighbors for cattle with guns, the situation became nasty. The districts of Kitgum, Gulu, Soroti, Pader, and Katakwi are among the worst hit, having lost all their oxen and ox ploughs during the raids (Ministry of Finance, Planning and Economic Development, 2002). The continuous raids have also caused massive displacements of the affected people and the loss of property and lives. By 2005, there were over 88,500 people displaced and living in 58 IDP camps. Mr. Julius Ochen, the Katakwi district chairperson, says cattle rustling by Karimojong warriors in the district has made it difficult for people to farm as most of them either run away from their fields or are too afraid to venture far from their homes. In Katakwi alone, over 200,000 head of cattle, which have been an alternative source of income, were raided by Karimojong warriors between the early 1990s and 2000 (Tracing the Root Cause of Hunger in Northern Uganda, *The Daily Monitor*, 22nd July, 2009).

the lives of the population living in the milk-producing areas of Luwero, Nakasongola, Masindi, Mukono, and Kayunga. The third major armed conflict was in the northern and northeastern parts of Uganda and ended in 2008. These conflicts caused extensive disruption and a total breakdown of the dairy and livestock sector in Uganda. As a result of armed conflict, the cattle population declined from 8 million in 1970 to 3.5 million in 1985.

In pastoral or agro-cattle-farming communities, armed conflicts can have a devastating impact on livestock numbers and hence milk production. Animals may be killed or stolen, or they may succumb to disease because of the collapse of the veterinary and extension service delivery in the area. This significantly reduces milk production and reduces a family's ability to secure food. In the northern and northeastern parts of the country, the insecurity that has prevailed for the last two decades has caused extensive disruption and a breakdown of socioeconomic processes, leading to the total destruction of the dairy sector in this region. The lawlessness exacerbated the cattle-rustling problem in the region. Although the situation has stabilized now, the occurrence of any future conflicts might have negative implications for the dairy sector.

#### 4.3.4 Human Disease

Loss ranking: Moderate

Probability: Highly probable

One of the effects of the increase in the number of dairy cows in Uganda has been an increased incidence of brucellosis and tuberculosis<sup>15</sup> in the cattle population, as exotic cattle are more susceptible to these diseases than indigenous cattle. Both of them are zoonotic diseases and are transmitted from cattle to humans through direct contact with cattle and consumption of raw milk. Research done in 2002 in the major milk-producing area of Uganda by CIRAD indicates that herd prevalence for brucellosis was 55.6% and individual animal prevalence was 15.8%.<sup>16</sup> Two students at Makerere University did a survey in Mbarara and Kampala in the population at high risk for brucellosis and found infection rates between 7 and 14%. Most districts lack diagnostic capacity, and the delayed diagnosis of brucellosis and tuberculosis leads to advancement of the disease. This makes treatment difficult and of longer duration than when disease is detected early. The cost of treatment of a patient with antibiotics is estimated to be between U.S. \$35 and \$60. This is, however, only the expense for drugs, and the real costs of these diseases is estimated to be three times higher.<sup>17</sup>

In the past, vaccination of dairy heifers with S19 and branding them were standard practice; however, such activities are not being performed currently. A planned vaccination campaign with S19 in heifers in 2009 was canceled at the last minute, as the funds had to be diverted to the purchase of FMD vaccine to respond to an ongoing outbreak. It is evident from the above that the current situation of brucellosis and bovine tuberculosis is alarming and could have a significant impact on animal and human health in Uganda. In addition, it could lead to quarantine measures, disrupting the milk supply and causing losses to the dairy sector. To prevent such a calamity from happening, vaccination with S19 of dairy heifer calves between 3 and 9 months and annual tuberculinization of all dairy animals could help control these diseases.

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15 Brucellosis (Bang's disease, caused by *Brucella abortus*) and bovine tuberculosis (nonpulmonary tuberculosis). Some say that these diseases were introduced with the first exotic animals at times when there were no tests available to detect these diseases.

16 Faye, B., Castel, V., Lesnoff, M., Rutabinda, D., Dhalwa J. CIRAD-EMVT (2005). Tuberculosis and brucellosis prevalence survey on dairy cattle in Mbarara milk basin (Uganda). *Prev Vet Med*. 2005 Mar 15;67(4):267–281. Epub 2005 Jan 4.

17 Information on brucellosis and bovine tuberculosis from Dr. Monica Musenero of the Ministry of Health/AFENET (African Field Epidemiology Network).

### 4.3.5 Erratic Power Supply

Loss ranking: Negligible

Probability: Highly probable

An erratic power supply causes significant problems to the dairy supply chain and generates some moderate financial losses (largely milk spoilage) when milk cannot be effectively chilled. At the milk-processing level, an erratic power supply causes the power-sensitive processing units to malfunction, leading to long equipment breakdown time, idle capacity utilization, and high costs to purchase and replace burned-out parts. Furthermore, it contributes to low-capacity utilization and inflicts losses to processors due to spoilage of milk and dairy products.<sup>18</sup> Sometimes, processors have been forced to use expensive generators to supplement electricity from the national power grid. According to the chairman of UCCCU, Mr. George Nuwagira, over 60% of the episodes of milk spoilage at the milk collection centers can be attributed to an unreliable power supply.

In response to the power problem, the government set up an energy investment fund in 2008 and attracted private sector investors to help build the country's capacity to generate power. Thermally generated power has since been introduced and has helped improve the situation. Despite this development, the risk for erratic power still remains an important threat to the dairy supply chain.

## 5. Vulnerability to Risk

Based on the risk assessment and capacity to manage risks described in the previous sections, this section offers an additional step to classify the risks according to different levels of vulnerability. For the purpose of this exercise we can define vulnerability as a function of the expected losses from an adverse event and the capacity to respond to risk. This last step in the analysis of risks not only allows a more comprehensive assessment of the level of risk, but also helps to identify priorities to improve current risk management approaches. At this stage, the analysis seeks to pinpoint clear gaps in the prevailing approach(es) to risk management and/or circumstances where prevailing practices are unlikely to be sufficient given the potential severity of loss.

Even though at this stage the analysis is more qualitative than quantitative, the results shown here are useful for contrasting these findings with current risk management practices by stakeholders in the supply chain. Based on the information that was collected during the mission and background information, the effectiveness and current capacity for managing pertinent risks has been reviewed and rated utilizing the 1–5 scale outlined in Table 6 below.

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<sup>18</sup> According to Fr. Peter Ssekaayi, the project coordinator of Maddo Dairies, a small-scale milk-processing plant based in Masaka, they spend close to U.S. \$30,000 per year to repair equipment that has malfunctioned because of power supply-related problems. Fr. Ssekaayi also says that erratic power supply contributes to over 50% of the product losses they experience during production and affects processing schedules, particularly during peak hours.

**Table 6: Vulnerability to risky events based on expected loss and capacity to manage risk**

|                 | (-) ----- Capacity to manage risks ----- (+)  |                                                   |                       |                                 |                      |
|-----------------|-----------------------------------------------|---------------------------------------------------|-----------------------|---------------------------------|----------------------|
| Expected losses | 1                                             | T1 2                                              | 3 T2                  | 4 T3                            | 5 T4                 |
| High            | Notifiable cattle diseases                    |                                                   |                       |                                 |                      |
| Medium          | Non- Notifiable cattle diseases<br>T1 Drought | Abrupt regulation<br>Failure of key organizations | Armed conflict        | Human diseases<br>Milk spoilage | T5                   |
| Low             | T2                                            | T3                                                | Cattle rustling<br>T4 | Flood<br>T5                     | Erratic power supply |

The resulting matrix classifies vulnerabilities to the identified risks into five groups, from the highest vulnerability containing the risks in the boxes with the darkest shade marked as T1 (tier 1) upper left corner, towards the risks ranked with lowest vulnerability shown in the boxes with the clear shades towards the right bottom side of the table marked as T5 (tier 5). There are three additional intermediate vulnerability levels in between which are in lighter shades. The importance of this matrix is that, through a process of prioritization, it is possible to identify those risks in Tier 1 and Tier 2 that are mainly responsible for causing volatility of earnings for the various stakeholders. Managing those risks will, to a large extent, reduce vulnerability of the dairy industry.

## 6. Priority Measures for Risk Management

The Ugandan dairy supply chain is exposed to multiple risks (described in detail in Section 4). While some of those risks have caused massive damage to the industry in the past, many of them continue to make the supply chain vulnerable to losses. The predominant risks that continue to threaten the industry, based on frequency of occurrence and severity of impact, are (1) notifiable cattle diseases, (2) non-notifiable cattle diseases, (3) droughts, (4) failure of key organizations, and (5) risk for abrupt regulation.

Although it is beyond the scope of this exercise to come up with a comprehensive framework with detailed measures on how to manage the identified risks, an illustration of how this next step can be approached is presented in Table 7.

For a comprehensive risk management framework, it is useful to classify the measures or tools for risk management in terms of three main groups:

*Risk mitigation:* actions taken to eliminate or reduce events from occurring, or to reduce the severity of losses (e.g., pest and disease management, crop diversification, extension).

*Risk transfer:* actions that will transfer the risk to a willing third party, at a cost. Financial transfer mechanisms will trigger compensation or reduce the losses in the case of a risk-generated loss (e.g., insurance, reinsurance, financial hedging tools).

*Risk coping:* actions that will help cope with the losses caused by a risk event (e.g., government assistance to farmers, debt restructuring). It could also be managed by shifting a country's focus from a post-disaster response to a proactive (ex-ante) risk management policy (e.g., through financial provisioning).

**Table 7: Priority measures for risk management**

| Identified Risks                                                                                           | Proposed Mitigation                                                                                                                                                                                                                                                                                                                                                                                                            | Proposed Risk Transfer Tools                                                             | Proposed Risk Coping                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notifiable cattle diseases                                                                                 | <ul style="list-style-type: none"> <li>• Follow OIE disease control standards, guidelines, and recommendations</li> <li>• Regional vaccination strategies</li> <li>• System of licensed importers of registered vaccines with guaranteed cold chains</li> <li>• Animal movement control</li> <li>• Sero-surveillance program</li> <li>• Clearly defined and communicated public-private veterinary responsibilities</li> </ul> |                                                                                          | <ul style="list-style-type: none"> <li>• Strategic stock of vaccines</li> <li>• Ring vaccination</li> <li>• Enforce quarantine and movement regulation</li> <li>• Strengthen the system of delivery of veterinary services</li> </ul> |
| Non-notifiable cattle diseases                                                                             | <ul style="list-style-type: none"> <li>• Develop effective control and mitigation strategies, based on science and international practice</li> <li>• Develop training programmes to prepare farmers to control these diseases in collaboration with the private sector</li> </ul>                                                                                                                                              |                                                                                          | <ul style="list-style-type: none"> <li>• Strengthen the system of private veterinary services</li> </ul>                                                                                                                              |
| Drought                                                                                                    | <ul style="list-style-type: none"> <li>• Build up strategic stock of feed</li> <li>• Develop water-harvesting and storage facilities</li> <li>• Develop early warning systems</li> </ul>                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Macro-level drought/cattle insurance</li> </ul> | <ul style="list-style-type: none"> <li>• Facilitate cattle migration</li> <li>• Feed and fodder supply</li> <li>• Water supply</li> </ul>                                                                                             |
| Abrupt regulation                                                                                          | <ul style="list-style-type: none"> <li>• Create a national dairy development policy</li> <li>• Engage informal and formal private sector in regulation formation</li> <li>• Improve transparency and accountability at all levels</li> <li>• Clear distinction of the regulation and development function</li> <li>• Proactive advocacy</li> </ul>                                                                             |                                                                                          | <ul style="list-style-type: none"> <li>• Strong sectoral organizations</li> <li>• Advocacy</li> </ul>                                                                                                                                 |
| Potential failure of key organizations<br>- Cooperatives<br>- Private processors<br>- Cold chain providers | <ul style="list-style-type: none"> <li>• Better coordination mechanism</li> <li>• Promote competition</li> <li>• Promote sound business practices</li> </ul>                                                                                                                                                                                                                                                                   |                                                                                          | <ul style="list-style-type: none"> <li>• Government support</li> </ul>                                                                                                                                                                |

**Notifiable cattle diseases:** There is a high frequency of occurrence of these diseases, and they are capable of causing significant losses for the sector. The most important risk management measures are prevention and control, which will require a functioning veterinary system with clear procedures based on scientific principles and sufficient funding to execute the tasks required. Regional collaboration to control trans-border animal diseases (TADs) is important, as the infections move across borders. The issue of availability and quality of vaccines is crucial for disease control. Currently, it takes too long before vaccination, in the case of an outbreak of a TAD, for the simple reason that there is usually no strategic stock of vaccine in the country, and the government procedures to obtain vaccines are too cumbersome and time-consuming. The government of Uganda should collaborate with regional initiatives<sup>19</sup> to speed up the provision of vaccines of the right strain and type in the case of emergencies.

**Non-notifiable cattle diseases:** The control of non-notifiable cattle diseases depends, to a large extent, on the farmers and their veterinary practitioners. The strengthening of farmers' training and veterinary services is required to manage this risk. The National Agricultural Research Organization (NARO) is working hard in collaboration with the Consultative Group on International Agricultural Research (CGIAR) institutes on better diagnostics, preferably in situ, for early detection. There is an increasing realization that people cannot be healthy without livestock being healthy, and specialists in veterinary medicine and human medicine need to work together to tackle such diseases as brucellosis, tuberculosis, and parasitic diseases. A better understanding of the incidence and cost of these diseases will be an important tool to convince the government to allocate sufficient budget and for private farmers to increase their investment in the control of these diseases.

**Drought:** Uganda used to have occasional droughts, but the incidence and severity of droughts have been increasing, as described in this report. The traditional practice of the movement of cattle herd to areas not affected by drought is confronting many challenges now and may not be a viable option in many situations. Government needs to support the farmers in developing a system of building up the stock of fodder and feed, which so far has not been necessary because of the reliability of rainfall. Attention needs to be paid to developing water-harvesting structures, especially in the drier part of the cattle corridor, along with developing a system of water supply for the cattle during the drought period. Early warning mechanisms should be developed to inform farmers so that they can take necessary measures, such as purchasing additional fodder and feed and destocking or moving (part of) their stock to areas with more abundant fodder and feed reserves.

**Abrupt regulation:** Uganda needs a comprehensive national dairy development policy and strategy to resolve contradictions between the formal and informal sectors and between the public and private sectors, and to develop consistent regulations to ensure growth of the dairy sector. Consumer safety, process & product upgrading, and improving competitiveness of the dairy industry should be the priority, however, regulations required for supporting these objectives should be introduced in a planned, phased, and coordinated manner. Regulations need to be harmonized with the East African Community's dairy trade norms, but they should be customized to the local context and prepared in close collaboration with all the local stakeholders. This means that the capacity and capability of the various stakeholders in the supply chain to comply with regulations are taken into account when the time schedule of regulation enforcement is prepared.

**Potential failure of key organizations:** The above-mentioned dairy development policy and strategy should include measures to avoid potential failure of key organizations in the supply chain. Improved coordination and exchange of information will help in the early detection of a potential failure. Increased competition will have a

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<sup>19</sup> OIE, FAO, African Union-Interafrican Bureau for Animal Resources (AU-IBAR), and the Regional Animal Health Centre, Nairobi, are developing a plan to establish vaccine banks.

positive effect on the business practices of the various stakeholders in the dairy supply chain and guard against unsustainable and unprofitable practices. The application of sound business practices and the fair distribution of value addition over the whole supply chain should be promoted. The sector should have an impartial overseer who can speak on behalf of all stakeholders and to all stakeholders.

## 7. Final Remarks

Dairy is increasingly proving to be a lucrative livelihood option for a large number of Ugandan households engaged in milk production and trade. The industry has grown and diversified significantly since the introduction of commercial dairy operations five decades ago. Since then, the industry has survived many shocks (armed conflict, political uncertainty, collapse of key institutions, outbreak of cattle diseases, droughts) and proved its resilience. These shocks, however, are associated with significant economic losses, and they threaten the livelihoods of dairy industry stakeholders. The identification, prioritization, and selection of risks that have the potential to cause significant losses for the dairy supply chain stakeholders and the development of proactive ex-ante risk management plans to manage those risks will contribute to the long-term sustainability of the industry.

Notifiable and non-notifiable cattle diseases pose the biggest risks for the dairy supply chain. Droughts, with increasing frequency and magnitude, pose another serious risk for the industry. The industry is prone to abrupt regulations and the collapse of key organizations, which can have a widespread impact on the entire dairy industry. The effective management of these risks will require a strategy consisting of activities across the mitigation-transfer-coping spectrum. A strategic plan for risk management needs to be prepared in consultation with all relevant stakeholders to ensure their buy-in. The plan should allocate responsibilities for the different activities and detail the mechanisms of coordinating their implementation. There should also be a realistic plan for generating resources required for implementation.

An effective risk management plan will require resolution of some fundamental issues being confronted by the livestock sector. Currently, there is ambiguity regarding the role of public and private sector and there is a need for clear delineation of the roles and responsibility of public and private sector and develop mechanisms of collaboration between the two. The issue of centralization and de-centralization of veterinary services have a huge implication on disease control and this issue needs to be resolved. In addition, an appropriate balance between national level coordination and monitoring of diseases and local level delivery of veterinary services is required.

The prospect of the dairy industry seems bright, and there is enough interest among stakeholders to make the dairy supply chain more profitable for all, which will require efforts to mitigate the indentified risks and strengthen coping mechanisms. This document highlights and prioritizes risks in the Ugandan dairy supply chain and should be used to stimulate discussion and inform the development of a risk management strategy. However, rather than serving as a stand-alone risk management strategy, it should be an integral component of a broader dairy development policy and strategy.

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## Annex 1. Mission Schedule

### Team A

| Institution/Individual Met                                 | Location              | Category                                             |
|------------------------------------------------------------|-----------------------|------------------------------------------------------|
| <b>16/08/10</b>                                            |                       |                                                      |
| Dairy Development Authority                                | Nakasero, Kampala     | Government body (regulation and development)         |
| Heifer International/East Africa Dairy Development Project | Nakasero, Kampala     | Development organization/NGO                         |
| Urban local milk-boiling/pasteurizing center               | Nansana, Kampala      | Milk trader (boiled milk)                            |
| Urban local milk-boiling/pasteurizing center               | Kawempe, Kampala      | Milk trader (boiled milk)                            |
| SNV—Netherlands Development Organization                   | Bugolobi, Kampala     | Development organization/NGO                         |
| <b>17/08/10</b>                                            |                       |                                                      |
| SNV—Netherlands Development Organization                   | Bugolobi, Kampala     | Development organization/NGO                         |
| Uganda Dairy Processors' Association                       | Kampala               | Industry association                                 |
| Visit to four milk outlets                                 |                       | Milk traders (chilled raw milk)                      |
| <b>18/08/10</b>                                            |                       |                                                      |
| Sameer Agriculture and Livestock Ltd.                      | Bugolobi, Kampala     | Milk processor                                       |
| Centenary Bank (U) Ltd.                                    | Entebbe Road, Kampala | Financial institute providing credit to dairy sector |
| Post Bank (U) Ltd.                                         | Nasser Road, Kampala  | Financial institute providing credit to dairy sector |
| Katwe Dairies                                              | Katwe, Kampala        | Bulk raw milk transporter, wholesaler, and retailer  |
| Ndeeba milk-boiling center                                 | Ndeeba, Kampala       | Milk trader (boiled milk)                            |
| Uganda Veterinary Association                              | Nakasero, Kampala     | Professional association                             |
| <b>19/08/10</b>                                            |                       |                                                      |
| Kinyongoga Dairy Producer Cooperative Society              | Kinyongoga            | Producer group                                       |
| Katuugo Dairy Cooperative Society                          | Kakooge               | Producer group                                       |
| Gulu women's milk collection and retailer shop             | Gulu                  | Milk trader (chilled raw milk)                       |
| <b>20/08/10</b>                                            |                       |                                                      |
| District Veterinary Officer (DVO), Gulu                    | Gulu                  | Local government department                          |
| Gulu raw milk trader                                       | Gulu                  | Milk trader                                          |
| HPI farmers                                                | Gulu                  | Producers                                            |

## Team A

| Institution/Individual Met                                                                          | Location             | Category                                 |
|-----------------------------------------------------------------------------------------------------|----------------------|------------------------------------------|
| AI and extension service providers                                                                  | Gulu                 | Service providers                        |
| Ageni I Kiristo Womens' Dairy Group                                                                 | Lira                 | Community-based organization             |
| <b>21/08/10</b>                                                                                     |                      |                                          |
| Teso Fresh Dairies                                                                                  | Soroti               | Small-scale processor                    |
| Small holder producers                                                                              | Pigiire, Teso        | Producers                                |
| Collection and boiling center                                                                       | Pigiire, Teso        | Collection and boiling center            |
| <b>22/08/10</b>                                                                                     |                      |                                          |
| Eastern Uganda Dairy Breeders' and Farmers' Association.                                            | Mbale                | Industry association                     |
| Eastern Dairies                                                                                     | Mbale                | Raw milk wholesaler and retailer         |
| Producers                                                                                           | Paliisa              | Producers                                |
| Urban milk-cooling tank retailer                                                                    | Paliisa              | Milk trader                              |
| Collection and boiling center                                                                       | Paliisa              | Collection and boiling center            |
| Milk transporter                                                                                    | Paliisa              | Transporter                              |
| Bicycle vendors                                                                                     | Paliisa              | Transporters and vendors                 |
| <b>23/08/10</b>                                                                                     |                      |                                          |
| Bicycle vendors                                                                                     | Bbaale, Kayunga      | Transporters and vendors                 |
| Bugerere Dairy Farmers' Cooperative Society                                                         | Bbaale, Kayunga      | Producer group                           |
| Bulk transporter                                                                                    | Bbaale, Kayunga      | Transporter                              |
| Producers                                                                                           | Bbaale, Kayunga      | Producers                                |
| <b>24/08/10</b>                                                                                     |                      |                                          |
| Snowmans Technical Services (U) Ltd.                                                                | Industrial area, Kla | Equipment and dairy ingredients importer |
| <b>25/08/10</b>                                                                                     |                      |                                          |
| Animal Health, Ministry of Agriculture (MAAIF)                                                      | Entebbe              | Government department                    |
| Jesa Dairy Farm (U) Ltd.                                                                            | Busungu              | Dairy farm and processor                 |
| <b>26/08/10</b>                                                                                     |                      |                                          |
| Meeting with WB Country Manager                                                                     |                      |                                          |
| <b>27/08/10: Stakeholders' meeting to share preliminary results, the World Bank office, Kampala</b> |                      |                                          |

## Team B

| Institution/Individual Met                                | Location                 | Category                                            |
|-----------------------------------------------------------|--------------------------|-----------------------------------------------------|
| <b>16/08/10</b>                                           |                          |                                                     |
| Dairy Development Authority                               | Nakasero, Kampala        | Government body (regulation and development)        |
| Meeting, Uganda Dairy Processors' Association             | Nakasero, Kampala        | Industry association                                |
| Urban milk-cooling tank retailer                          | Kawempe, Kampala         | Milk trader (chilled raw milk)                      |
| Urban milk-cooling tank retailer                          | Mulago, Kampala          | Milk trader (chilled raw milk)                      |
| East African Seeds Company                                | Bombo Road, Kampala      | Seeds and agro-chemical supplier                    |
| <b>17/08/10</b>                                           |                          |                                                     |
| Send a Cow                                                | Ntinda                   | Development organization                            |
| Cooper Uganda                                             | Nakasero, Kampala        | Trader in veterinary drugs and chemicals            |
| Ugachick                                                  | Ugachick office, Kampala | Livestock feeds company, chicken breeder            |
| <b>18/08/10</b>                                           |                          |                                                     |
| Production and Marketing, Ministry of Agriculture (MAAIF) | Kampala                  | Government department                               |
| Quality Chemicals                                         | Kampala                  | Trader in veterinary drugs and chemicals            |
| Katwe Dairies                                             | Katwe, Kampala           | Bulk raw milk transporter, wholesaler, and retailer |
| Department Commissioner, Meat and Milk                    | UVA office, Nakasero     | Government official                                 |
| Meeting with Uganda Veterinary Association                | UVA office, Nakasero     | Professional association                            |
| <b>19/08/10</b>                                           |                          |                                                     |
| Maddo Dairies                                             | Masaka                   | Dairy processor, linked to diocese                  |
| Field visits to model farms                               | Masaka                   | Individual farmers: zero grazing                    |
| Uganda Crane Cooperative Creameries                       | Mbarara                  | Tertiary cooperative                                |
| <b>20/08/10</b>                                           |                          |                                                     |
| DVO                                                       | Mbarara                  | Government veterinarian                             |
| Bushenyi Dairy Cooperative Union (BUDICU)                 | Bushenyi                 | Cooperative union                                   |
| Ndungamo Dairy Farmers' Cooperative                       | Ntugamu                  | Cooperative union                                   |

## Team B

| Institution/Individual Met                     | Location               | Category                                           |
|------------------------------------------------|------------------------|----------------------------------------------------|
| <b>21/08/10</b>                                |                        |                                                    |
| Ankole Dairy Farmers' Cooperative Union        | Kiruhura               | Secondary cooperative union                        |
| Meeting of selected farmers                    | Kiruhura               | Producers                                          |
| Equity Bank                                    | Kiruhura               | Financial services provider                        |
| <b>22/08/10</b>                                |                        |                                                    |
| Travel to Fort Portal                          |                        |                                                    |
| Visits to shops and coolers on the way         |                        |                                                    |
| <b>23/08/10</b>                                |                        |                                                    |
| Toro Dairy Cooperative Union                   | Fort Portal            | Cooperative union and processing                   |
| Farm visits                                    | Surrounding sub county | Producers                                          |
| DVO                                            | Fort Portal            | Government veterinarian                            |
| Agro Cottage                                   | Fort Portal            | Dairy processor and farmer                         |
| <b>24/08/10</b>                                |                        |                                                    |
| Farm visits                                    | Surrounding sub county | NAADS beneficiaries, large commercial dairy farmer |
| Chief Administrative Officer                   | Fort Portal            | Local government                                   |
| Coordinator NAADS                              | Fort Portal            | Government                                         |
| SNV portfolio coordinator                      | Fort Portal            | NGO                                                |
| <b>25/08/10</b>                                |                        |                                                    |
| Government Veterinary Services                 | Entebbe                | Government veterinarian                            |
| FAO consultant                                 | Kampala                | Dairy sector specialist                            |
| <b>26/08/10</b>                                |                        |                                                    |
| Meeting with veterinary public health official | Kampala                | MoH/AFENET                                         |
| <b>30/08/10</b>                                |                        |                                                    |
| Director EADDP                                 | Kampala                | Development organization                           |
| Cooperative Alliance                           | Kampala                | Development organization                           |

## Annex 2. Contact Details of Key Individuals

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## Annex 3. Analysis of Major Processing Plants

| Name of Company                           | Location | Installed Capacity | Average Capacity Utilization/Day |             |                |             |                |              |
|-------------------------------------------|----------|--------------------|----------------------------------|-------------|----------------|-------------|----------------|--------------|
|                                           |          |                    | 2006                             | %           | 2007           | %           | 2009           | %            |
| 1. Sameer Agriculture and Livestock Ltd.* | Kampala  | 122,000            | 34,000                           | 27.9        | 58,000         | 47.5        | 120,000        | 24           |
| 2. Jesa Dairy Farm                        | Wakiso   | 8,000              | 6,800                            | 85          | 7,000          | 87.5        | 9,000          | 112.5        |
| 3. White Nile Dairy                       | Jinja    | 6,000              | 3,000                            | 50          | 3,000          | 50          | 3,000          | 50           |
| 4. GBK Dairy Products                     | Mbarara  | 54,000             | 15,000                           | 27.8        | 15,000         | 27.8        | 9,500          | 17.59        |
| 5. Alpha Dairies/<br>Dariboard**          | Mbarara  | 40,000             | 15,000                           | 37.5        | 12,600         | 31.5        | 0              | 0            |
| 6. Birunga Dairy                          | Kisoro   | 15,000             | 4,500                            | 30          | 6,500          | 43.3        | 10,000         | 66.67        |
| 7. Gouda Gold (U) Ltd.**                  | Kampala  | 15,000             | 1,300                            | 8.67        | 1,500          | 10          | 0              | 0            |
| 8. MADDU Dairies                          | Masaka   | 1,200              | 600                              | 50          | 800            | 66.7        | 1,200          | 100          |
| 9. Paramount Dairies                      | Mbarara  | 3,000              | 1,800                            | 60          | 2,000          | 66.7        | 2,000          | 66.67        |
| 10. Kaisa**                               | Kamuli   | 10,000             | 0                                | 0           | 0              | 0           | 0              | 0            |
| 11. Nirma Dairy and Foods Ltd.            | Entebbe  | 8,000              | 0                                | 0           | 2,000          | 25          | 2,000          | 25           |
| 12. Country Taste**                       | Mbarara  | 25,000             | 0                                | 0           | 0              | 0           | 0              | 0            |
| 13. Nile Valley**                         | Mbarara  | 40,000             | 5,000                            | 12.5        | 0              | 0           | 0              | 0            |
| 14. Uganda Industrial Research Institute  | Kampala  | 10,000             | 0                                | 0           | 0              | 0           | 0              | 0            |
| 15. Teso Fresh Milk                       | Soroti   | 2,000              | 500                              | 25          | 800            | 40          | 800            | 40           |
| <b>Total</b>                              |          | <b>359,200</b>     | <b>87,500</b>                    | <b>24.4</b> | <b>109,200</b> | <b>30.4</b> | <b>157,500</b> | <b>43.85</b> |

\* Sameer Agriculture and Livestock is the largest processor in the country. Previously government-owned, its processing capacity was recently increased to 500,000 litres per day with the installation of a powdered milk plant. The capacity utilization percentage has therefore been calculated with the current installed capacity.

\*\* Processing plants that have gone out of business for various reasons, including but not limited to poor management/decisions, lack of sufficient capital investment, frequent equipment breakdown/high costs of maintenance, and low demand for certain products (poor market analysis prior to project startups).

## Annex 4. Calculation Model to Estimate Uganda's Annual Milk Production

The total milk production in Uganda is a hard figure to establish, but important for the development of any dairy development strategy. DANIDA's master plan used a methodology to calculate annual milk production in 1993 that was based on the following assumption. It was estimated that there were, at that time, 4.06 million indigenous cattle, with 45% adult cows, 50% calving, lactation period of 200 days, and daily production of 1.75 litres; the number of "improved" cattle was put at 0.14 million, of which adult cows were again 45%, calving 60%, lactation period of 240 days, and average production of 5 litres. This would bring the total milk production at that time to 365 million litres per year. Subsequently, the same formulae have been used to calculation milk production, the only variable being the cattle population.

The situation in Uganda has changed drastically since 1993, and perhaps some of the assumptions in the formulae are not valid anymore. Rather than dividing the cattle population into two categories of indigenous and exotic/crossbreed, it might be more useful to divide them into the following three categories:

- indigenous: especially in larger herds, only a fraction of the animals will be milked
- crossbred: anything between 25 and 75% of exotic genes
- dairy: animals with at least 75% or more of exotic genes

Furthermore, the DDA model assumes that all lactating animals are milked on daily basis. It is unlikely that all traditional cattle, especially in the larger herds in isolated places, will be milked on a daily basis. The authors made a slight amendment, adding the percentage of lactating animals actually being milked and dividing cattle into three categories, in the DDA model and came out the following estimation of milk production.

### Cattle inventory based on the 2008 livestock census

|                                                         |            |
|---------------------------------------------------------|------------|
|                                                         | 2008       |
| Total number of animals                                 | 11,400,000 |
| Total percentage with exotic blood                      | 5.60%      |
| Total percentage almost or totally purebred dairy breed | 0.50%      |

### Total milk production in country

| Herd production parameters:       | Indigenous cattle    | Crossbred cattle                         | Dairy cattle |
|-----------------------------------|----------------------|------------------------------------------|--------------|
| Adult females, %                  | 40%                  | 50%                                      | 60%          |
| Calving, %                        | 60%                  | 70%                                      | 80%          |
| Being milked, %                   | 50%                  | 80%                                      | 100%         |
| Lactation length, days            | 200                  | 250                                      | 300          |
| Average production per day        | 3                    | 5                                        | 12           |
| Total production per category     | 770,731,200          | 223,440,000                              | 98,496,000   |
| Overall production in the country | <b>1,092,667,200</b> | <b>Litres of extracted milk per year</b> |              |

This, however, is also a broad approximation, and a more granular approach consisting of district level milk production estimates, based on a combination of interviews with key informants, a compilation of actual milk sales, and the cattle population, will provide a more realistic account of the actual milk production in the country.

## Annex 5. Regional Differences in the Dairy Industry of Uganda

The country is divided into five milk regions/sheds—namely, southwestern, central, western, northern, and eastern. There are important differences in the milk sheds in terms of the economic importance of the dairy industry to the region, herd population and production levels, farm size, grazing systems, practices, and cattle breeds used for milk production.

- 1. Southwestern milk shed:** The southwestern milk shed has historically been a major milk producer. It has the highest concentration of milk-collecting and milk-processing infrastructure in the country. The major milk-producing districts in this milk shed include Kiruhura, Bushenyi, Mbarara, Ntungamu, Isingiro, Kabale, and Rukungiri. Milk is produced by pastoral farmers, agro-pastoralists, and crop/livestock (mixed) farmers. According to the Land O'Lakes (LOL), Heifer Project International (HPI), and World Wide Sires (WWS) baseline survey report (2002), farmers in the southwestern part of the country on average have the largest farms, with an average farm size of 19 acres.

The milk shed is generally inhabited by traditional cattle-keeping tribes and also has the largest settlements of pastoral communities whose main source of livelihood is cattle rearing. As a result of the increased demand for milk, the producers see dairy as a commercial activity and are intensifying production to increase output. In the southwestern milk shed, the common grazing systems include free-range grazing (cows graze all over the farm freely) and fenced grazing (cows graze around paddocks), although the farmers are quickly adopting the zero grazing system, particularly in areas where grazing land has become scarce (i.e., Kabale). The average number of workers employed on each farm is three and at least 92% of farmers in the milk shed employ at least one permanent worker (LOL report, 2002). Milking is done twice a day, in the morning and evening. The predominant cattle breeds include the local Ankole Longhorn, crossbreeds, particularly between the locals and Friesians or Jerseys, and exotic breeds, mostly Friesians and Jerseys.

- 2. Central milk shed:** Most of the milk production of the region comes from pastoral-dominated districts, particularly those in the cattle corridor. Apart from the pastoral communities, the culture of keeping cattle is not prevalent in this region, and unlike those in the southwest, many farmers here derive their livelihood from other agricultural sources. However, with increased demand for milk from an ever-increasing urban market, many farmers are diversifying into dairy farming to increase household income. It is also one of the milk sheds with the highest number of crossed animal breeds. It also has the closest proximity to the major urban markets. The major milk-producing districts in this milk shed include Kiboga, Nakaseke, Nakasongola, Ssembabule, Kayunga, Mukono, Wakiso, Masaka, Rakai, and Mpigi.

In the central milk shed, the predominant grazing systems are free-range, fenced, and zero grazing, and the average farm size is 11 acres (LOL, WWS, and HPI report, 2002). The predominant breeds kept include the local Nganda and Ankole Longhorn. Crosses are also kept, and among the exotics, Friesians, Jerseys, and Guernseys are the most common types. Eighty percent of farmers in this milk shed employ at least one permanent worker on the farm (LOL report, 2002). The workers come mostly from the south western part of the country because of their skills and knowledge of cattle handling. Milking is done twice a day, in the morning and afternoon.

- 3. Western milk shed:** As in the central milk shed, milk in this region is produced mainly by crop/livestock (mixed) farmers, agro-pastoralists, and pastoralists, with the highest production coming from the pastoral areas. The people in this area are not considered traditional cattle keepers like their immediate neighbors in the southwest. There are many people who keep cattle as a means of living, although a big percentage

also engage in crop farming. The milk shed benefited from the first cattle breed improvement programs in the 1960s because of its temperate climate, which is conducive to rearing exotic cattle breeds. The major milk-producing districts in the shed include Bundibugyo, Kabarole, Hoima, Masindi, Kibale, Kamwenge, and Kyenjojo, and milk production in this region is sufficient to meet local demand.

Fenced grazing is the dominant system, although free-range grazing is also practiced, particularly in areas occupied by pastoralists. The farm size is the same as in the southwestern milk shed. The breeds kept include the Ankole Longhorn, crosses, and exotic breeds. As in the southwestern milk shed, the farmers here employ at least one permanent farm worker, and the owners involve themselves in the day-to-day farm activities. Milking is done twice a day.

- 4. Northern milk shed:** Most districts in the northern milk shed do not produce enough marketable milk, and most of the milk sold in its major urban centers is brought in from other regions, although there is some milk production from the peri-urban farmers, who are mostly zero grazers. Apart from the pastoral and agro-pastoral communities, many of the farmers in this region are not considered traditional cattle keepers. The farmers in this area use cattle for land traction (one of the two regions in Uganda where cattle are used to plough gardens). In the olden days, there were some pockets of production in the region, but the 20-year-old insurgency and rampant cattle rustling have significantly affected milk production in the region.

Despite the large cattle population, production is low and scattered, and this region is considered a milk deficit area, as it experiences shortages of milk supply throughout the year. The major milk-producing districts include Adjumani, Apac, Nakapiripirit, Yumbe, Amolator, Kaabong, Kotido, and Moroto. In the northern milk shed, communal grazing (free-range grazing on communal land) and free-range grazing are the predominant grazing systems. There has also been an increased adoption of the zero grazing system, particularly by farmers who have received cattle from various livestock restocking agencies. The major breeds found in this area are the local Zebu and a few crossbreeds. The average farm size is eight acres (LOL, WWS, and HPI report, 2002). Sixty percent of the farmers can afford to employ at least one permanent farm worker, while the rest use casual laborers, who come mostly from the southwestern part of the country. In some areas, milking is done once a day because of the low productivity of the local animals.

- 5. Eastern milk shed:** Like the northern milk shed, this region is a milk deficit area, with much of the milk marketed in the major urban markets coming from the pastoral and agro-pastoral communities in the cattle-keeping corridor. There is also increasing production from zero grazing peri-urban farmers. In addition to using cattle for milk production, the farmers in this region use cattle for plowing their gardens. The milk shed was a major milk producer in the 1960s and 1970s and was among the first areas where a milk-processing plant was built. However, the cattle population in the area has been decimated by the repeated civil wars in the country, rampant cattle rustling in the area, and diseases.

Like the northern milk shed, the eastern milk shed is a milk deficit area; the major milk-producing districts are Kamuli, Pallisa, Mbale, Bugiri, Katakwi, Kumi, Pallisa, Soroti, Sironko, Bududa, and Amuria. In eastern Uganda, the predominant grazing systems are the communal and zero grazing systems, and the average farm size is three acres. The major breeds kept in this area are the local Zebu and crossbreeds (Friesians and local indigenous breeds). Forty-four percent of the farmers in this milk shed can afford to employ at least one farm worker (LOL report, 2002), while the rest use casual workers. Apart from the farmers in the pastoral areas, most farmers in the milk shed employ herdsman from the southwestern part of the country. In some areas, milking is done once a day, as in the northern milk shed, because of the low productivity of the animals.

## Annex 6: Income Details of Stakeholders Engaged in the Informal Milk Channel

It is estimated that 100 litres of milk generates cash income for approximately seven to eight people in the supply chain.

| Category                                 | Description                                                                                                                                                                                                                                              |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peri-urban milk producer                 | Dairy farmer produces 100 litres per day, living within 50 km of the urban center. Milk is collected by a middleman; bicycle or small truck is used to deliver milk.<br>Farm gate price is U.S. \$0.41.<br>Farmer earns U.S. \$41.00 for the 100 litres. |
| Transporter                              | Charges U.S. \$3.00 per 50-litre churn.<br>Transporter sells at U.S. \$0.47 per litre, earning U.S. \$47.00 for the 100 litres delivered. Price includes markup.                                                                                         |
| Boiling center owner                     | Charges the trader U.S. \$3.00 per 50-litre churn of pasteurized milk (U.S. \$0.06 per litre).                                                                                                                                                           |
| Trader operating at local boiling center | Sells a litre at U.S. \$0.53, earning U.S. \$53.00 for 100 litres.<br>Sells 50 litres to vendor and the other 50 litres to hawker                                                                                                                        |
| Vendor                                   | Sells a litre at \$0.61, earning \$30.00 for the 50 litres.                                                                                                                                                                                              |
| Door-to-door hawker                      | Sells a litre at \$0.71, earning \$35.89 from the 50 litres.                                                                                                                                                                                             |
| Retail shops, kiosks                     | Sells a litre at \$0.71, earning \$35.89 from the 50 litres bought from vendor.                                                                                                                                                                          |

Source: Key informants

## Annex 7: Supply Chain Constraints

Although this assessment is geared toward analyzing risks in the dairy supply chain, it is also important to look at the major constraints. Effective risk management often requires resolving underlying constraints because the presence of some constraints increases the likelihood of risk and the intensity of losses. A distinction between risks and constraints helps in the better categorization and development of strategies to manage them. Risks are unforeseeable events that cause losses (e.g., weather events, market events, pest and disease outbreak, foreign exchange volatility), while constraints are conditions that lead to the suboptimal performance of different stakeholders in the supply chain (e.g., lack of credit, limited access to extension services, poor infrastructure).

Some major constraints that hamper the performance of the dairy supply chain are the following:

**a. Suboptimal cattle management practices:** The current milk productivity in Uganda is 2 to 3 litres per day for indigenous breeds and 10 to 12 litres per day for pure exotic breeds, which is quite low. This is largely attributed to the poor genetic potential of the indigenous breeds and to poor farm management, mainly in terms of feeding and a lack of skills and knowledge of best cattle management practices. Low on-farm productivity affects the efficiency and profitability of milk production in Uganda, resulting in a high fixed cost per litre. This leads to high overhead costs for the dairy plants to aggregate, collect, and transport milk. Increased milk productivity of cattle, through better cattle management practices and breed improvement, would improve profitability for farmers, transporters, and processors.

**b. Lack of extension and veterinary services:** The majority of households engaged in cattle rearing currently cannot access or afford extension and veterinary services. The public veterinary services are seriously understaffed and underfunded. There is a ban on employing new government staff, and with the ever-increasing number of districts, many districts do not have a district veterinary officer. After liberalization, the government minimized its role in extension and veterinary services and expected private sector to meet the demand for such services. However, despite the support from the NAADS program, there is very little penetration of the private extension services on account of the inability or unwillingness of clients to pay, geographic dispersion of cattle herders, limited supply of trained veterinarians, and unwillingness of veterinarians to settle in remote rural areas. Furthermore, the veterinary diagnostic capacity in the country is limited and unreliable and not capable of early detection and quick response actions. Veterinary diagnostics and serology services are hardly available in the rural areas. Lack of public and/or private veterinary/extension services has led to unnecessary mortality, morbidity, and suboptimal cattle management, which leads to reduced milk supply and lowered profitability.

**c. Limited availability of pastures and water:** Cattle rearing in Uganda relies on the ready availability of pasture and water for animal feed. The dry season always leads to a limited availability of pastures and water, resulting in reduced milk production and, in extreme cases, the death of cattle. This is common in the dry areas along the cattle corridor. There is a sharp regional variation in pasture and water availability, and this has been articulated as a major concern during the focus group discussions (Annex 9).

**d. Limited milk-cooling infrastructure and poor milk-handling practices:** The quality of the raw milk supply is still inconsistent because of poor hygienic and milk-handling practices at different levels of the supply chain and the lack of milk-cooling infrastructure. Throughout the milk supply chain, milk is exposed to contamination through adulteration by unscrupulous individuals, dust, dirty hands, and unhygienic containers, leading to low quality. Many farmers do not adhere to the schedule of withdrawal days when cows are on antibiotic treatment, and this causes the supply of milk to be tainted with drug residues. This becomes a problem to the processors, particularly for the manufacture of fermented products. The frequent pouring, pumping, and

shaking during various stages in the milk supply chain damage the milk structure, resulting in a high percentage of free fatty acids. Milk, if not cooled to 40C within 2 hours after milking, quickly loses quality because of the buildup of bacteria. Because of a lack of milk collection and bulking infrastructure, milk from many parts of the country arrives at the collection center or processing plant when the quality has already been lost,– resulting in production losses and a poor quality of the raw milk reaching markets.

**e. Road infrastructure:** More than 90% of Uganda's roads are earth and gravel roads, and over 40% of the rural feeder roads are almost impassable in the wet season. The road network connecting some of the dairy farming communities is very poor and far from the main highways leading to the major urban markets. This leads to high costs of the transportation of milk from such areas. In addition, the roads are poorly maintained, which puts a lot of strain on the milk trucks, leading to vehicle breakdown, high fuel consumption, and loss of quality due to the time spent on the road.

**f. Perishability:** Milk is a highly perishable commodity and has limited options for storage, unless it is processed into other by-products quickly. This characteristic of milk, coupled with limited milk processing in the country and seasonal variability in milk production by the cattle, causes high variability in milk prices between the wet and dry seasons (table 4). In the wet season, farm gate prices go down as a result of surplus milk production. During the dry season, however, milk production drops significantly, leading to a scarcity of raw milk and an increase in farm gate prices. This also increases the temptation to adulterate milk with water, leading to quality problems. This price volatility is directly passed on to consumers, which impacts milk consumption. Fluctuation in milk prices has been articulated by farmers as a major concern during the focus group discussions (Annex 9). Annex 10 provides the past 10 years' data of farm gate milk prices and the variations between the wet and dry seasons.

**Table 6: Seasonal price variability: November 2009–August 2010**

| Time Period                               | 2–16 November | 16 Nov.–11 January | 11 Jan–28 February | 1 March–18 July | 18–26 July | 16 July–20 August |
|-------------------------------------------|---------------|--------------------|--------------------|-----------------|------------|-------------------|
| Milk price per litre* (Ugandan shillings) | 350           | 300                | 350                | 300             | 325        | 375               |

Source: Records of the Kiyongoga Dairy Cooperative Society, Nakasongola district

\* Milk procurement prices per litre paid to the farmers and agents for delivery at the cooperative collection center in Kiyongoga.

**g. Limited purchasing power in the urban centers:** A majority of urban dwellers are low-income earners with limited purchasing power to buy processed dairy products. This partly explains why the raw milk trade accounts for 90% of the market share in urban centers. Locally processed products have to compete with imported, often very competitively priced, products. The combination of imports and limited purchasing power in urban centers limits formal sector dairy processors from venturing into higher-value dairy products.

**h. Lack of regulation enforcement mechanism:** As part of the privatization process, the government set up the DDA to take charge of the regulation and development aspects of the dairy sector. However, the authority has limited financial and human resources to ensure a proper regulatory enforcement mechanism. This means that the existing regulations and ordinances for the dairy sector are easily contravened without penalties, leading to a potential risk for consumers.

## Annex 8. Outbreaks of Notifiable Cattle Diseases (1996–2004)

| Year | Disease                             | Districts Affected                                                                                                                                                                         |
|------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1996 | Foot and mouth disease              | Bushenyi, Kabale, Luwero, Masaka, Mbarara, Rakai                                                                                                                                           |
|      | Contagious bovine pleural pneumonia | Arua, Hoima, Kabaloro, Kalangala, Kasese, Kotido, Kumi, Luwero, Masaka, Masindi, Mbarara, Moroto, Moyo, Nebbi, Rakai                                                                       |
|      | Lumpy skin disease                  | Iganga, Kabala, Kabaloro, Kalangala, Kamuli, Kapchorwa, Kisoro, Luwero, Masaka, Mbale, Mubende, Pallisa, Tororo                                                                            |
| 1997 | Foot and mouth disease              | Kisoro, Mbarara                                                                                                                                                                            |
|      | Contagious bovine pleural pneumonia | Arua, Kabale, Kotido, Luwero, Masaka, Masindi, Mbarara, Moroti, Mubende, Nebbi                                                                                                             |
|      | Lumpy skin disease                  | Iganga, Jinja, Kalangala, Luwero, Masaka, Mbale, Mubende, Pallisa, Soroti, Tororo                                                                                                          |
| 1998 | Foot and mouth disease              | Kapchorwa, Moroto                                                                                                                                                                          |
|      | Contagious bovine pleural pneumonia | Arua, Kabale, Luwero, Mpigi, Moroto, Sembabule                                                                                                                                             |
|      | Lumpy skin disease                  | Busia, Kisoro, Luwero, Masindi, Mpigi                                                                                                                                                      |
| 2000 | Foot and mouth disease              | Kabala, Katakwi, Luwero, Masindi, Mbarara, Moroto, Mpigi, Mubende, Ntungamo, Tororo                                                                                                        |
|      | Contagious bovine pleural pneumonia | Arua, Kabala, Kalangala, Kamuli, Katakwi, Kotido, Luwero, Masindi, Mbarara, Moroto, Mpigi, Rakai, Sembabule                                                                                |
|      | Lumpy skin disease                  | Apac, Busia, Iganga, Kalangala, Katakwi, Kibale, Luwero, Masindi, Mbarara, Moroto, Mpigi, Mubende, Rakai, Sembabule, Tororo                                                                |
|      | Rabies                              | Iganga, Kabale, Masindi, Moroto, Mpigi, Mubende, Ntungamo, Sembabule, Tororo                                                                                                               |
| 2001 | Foot and mouth disease              | Kampala, Kiboga, Kisoro, Masindi, Mbarara, Mubende, Nakasongola, Ntungamo, Wakiso                                                                                                          |
|      | Contagious bovine pleural pneumonia | Arua, Gulu, Jinja, Kabala, Kalangala, Kampala, Kayunga, Masaka, Masindi, Mbarara, Moroto, Mpigi, Mubende, Nakapiripiri, Nakasongola, Ntungamo, Pader, Rakai, Soroti                        |
|      | Lumpy skin disease                  | Apac, Jinja, Kalangala, Kampala, Kapchorwa, Kasese, Kayunga, Kiboga, Lira, Masaka, Mbale, Mbarara, Moroto, Mpigi, Mubende, Mukono, Nakasongola, Ntungamo, Rakai, Sembabule, Tororo, Wakiso |
|      | Rabies                              | Apac, Arua, Kabala, Kalangala, Kampala, Kayunga, Lira, Masindi, Mbarara, Moroto, Mpigi, Mubende, Mukono, Nakapiripiri, Nakasongola, Nebbi, Ntungamo, Pader, Sembabule, Soroti, Yumbe       |
| 2002 | Foot and mouth disease              | Apac, Bushenyi, Hoima, Kapchorwa, Kasese, Kiboga, Kumi, Lira, Masaka, Masindi, Mbarara, Moroto, Nakapiripiri, Nakasongola, Soroti, Tororo                                                  |

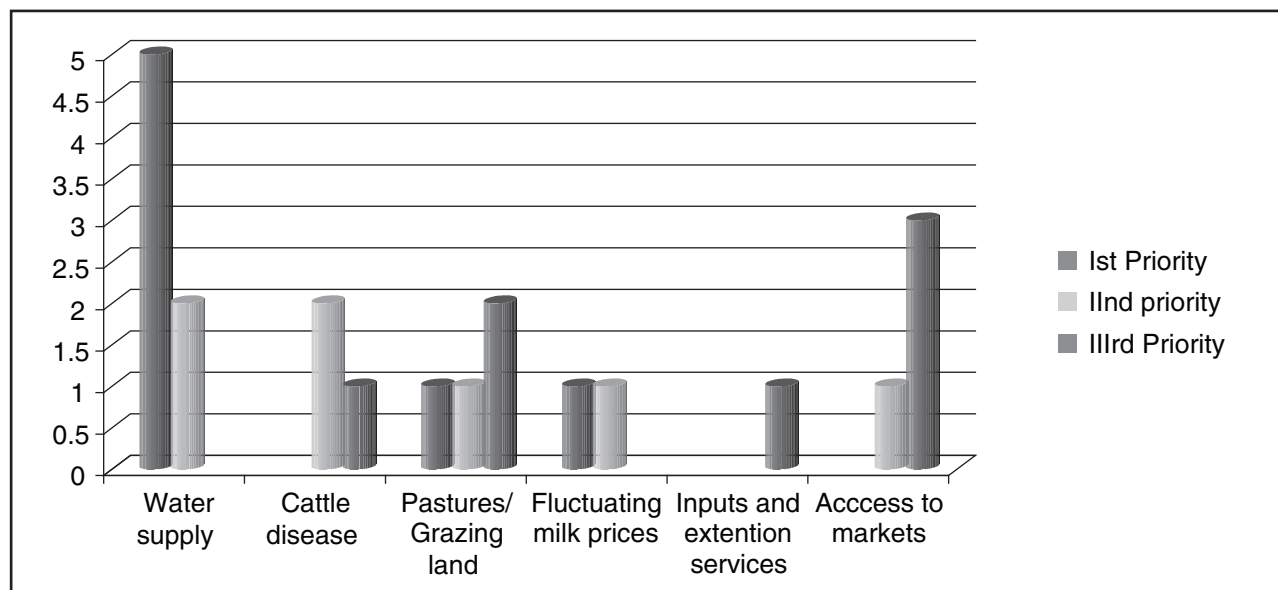
| Year | Disease                             | Districts Affected                                                                                                                                                                                                                                                                                                                                                |
|------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Contagious bovine pleural pneumonia | Adjuman, Arua, Bundibugyo, Gulu, Iganga, Kalangala, Kapchorwa, Katakwi, Kayunga, Kisoro, Kitgum, Kotido, Kumi, Luwero, Masaka, Masindi, Mbarara, Moroto, Mpigi, Mukono, Nakapiripirit, Nakasongola, Nebbi, Ntungamo, Sembabule, Soroti, Tororo                                                                                                                    |
|      | Lumpy skin disease                  | Apac, Bundibugyo, Bushenyi, Gulu, Hoima, Iganga, Jinja, Kabala, Kaberamaido, Kalangala, Kampala, Kamuli, Kamwenge, Kanungu, Kapchorwa, Kasese, Katakwi, Kayunga, Kisoro, Kotido, Kumi, Kyenjojo, Lira, Luwero, Masaka, Masindi, Mayuge, Mbarara, Mbarara, Moroto, Mpigi, Mubende, Mukono, Nakasongola, Ntungamo, Rakai, Sembabule, Tororo, Nebbi, Sorotiwakiso    |
|      | Rabies                              | Bugiri, Kotido, Nakapiripirit                                                                                                                                                                                                                                                                                                                                     |
| 2003 | Foot and mouth disease              | Apac, Gulu, Hoima, Jinja, Kamuli, Kayunga, Kibale, Kiboga, Ktgum, Kumi, Lira, Luwero, Masaka, Masindi, Mbale, Mbarara, Mubende, Mukono, Nakasongola, Rakai, Sironko, Wakiso                                                                                                                                                                                       |
|      | Contagious bovine pleural pneumonia | Arua, Bundibugyo, Bushenyi, Busia, Gulu, Hoima, Jinja, Katakwi, Kayunga, Kiboga, Kitgum, Kotido, Kumi, Lira, Luwero, Masaka, Masindi, Mbarara, Moroto, Moyo, Mpigi, Mubemde, Nakapiripirit, Nakasongola, Pallisa, Rakai, Rukungiri, Sironko, Soroti, Tororo, Wakiso                                                                                               |
|      | Lumpy skin disease                  | Apac, Bugiri, Busia, Iganga, Jinja, Kabala, Kalangala, Kampala, Kamwenge, Kapchorwa, Kasese, Katakwi, Kayunga, Kiboga, Kumi, Lira, Luwero, Masaka, Masindi, Mbale, Mbarara, Moroto, Mpigi, Mubende, Mukono, Nakapiripirit, Nakasongola, Pallisa, Rakai, Rukungiri, Sironko, Soroti, Tororo, Wakiso                                                                |
| 2004 | Foot and mouth disease              | Apac, Hoima, Kampala, Kamuli, Kayunga, Kibaale, Kiboga, Luwero, Masindi, Mbarara, Mubende, Mukono, Nakasongola, Rakai, Tororo, Wakiso                                                                                                                                                                                                                             |
|      | Contagious bovine pleural pneumonia | Arua, Bundibugyo, Gulu, Kanungu, Kasese, Katakwi, Kotido, Kumi, Lira, Luwero, Masaka, Masindi, Moroto, Moyo, Mpigi, Mukono, Nakapiripiri, Nakasongola, Nebbi, Sironko, Soroti, Wakiso, Yumbe                                                                                                                                                                      |
|      | Lumpy skin disease                  | Apac, Busia, Jinja, Kaberamaido, Kalangala, Kampala, Kamuli, Kamwenge, Kapchorwa, Kasese, Katakwi, Kayunga, Kiboga, Kumi, Lira, Luwero, Masaka, Mbale, Mbarara, Moyo, Mpigi, Mukono, Pallisa, Sironko, Tororo, Wakiso                                                                                                                                             |
|      | Rabies                              | Adjuman, Apac, Arua, Bushenyi, Gulu, Hoijma, Iganga, Jinja, Kabaloro, Kampala, Kamuli, Kamwenge, Kanungu, Kapchorwa, Kassese, Katakwi, Kayunga, Kibaale, Kiboga, Kitgum, Kumi, Kyenjojo, Liora, Luwero, Masaka, Masindi, Moroto, Mpigi, Mukono, Nakasongola, Nebbi, Ntungamo, Pader, Pallisa, Rakai, Rukungiri, Sembabule, Sironko, Soroti, Tororo, Wakiso, Yumbe |

## Annex: 9 Results of Farmers' Focus Group Discussion

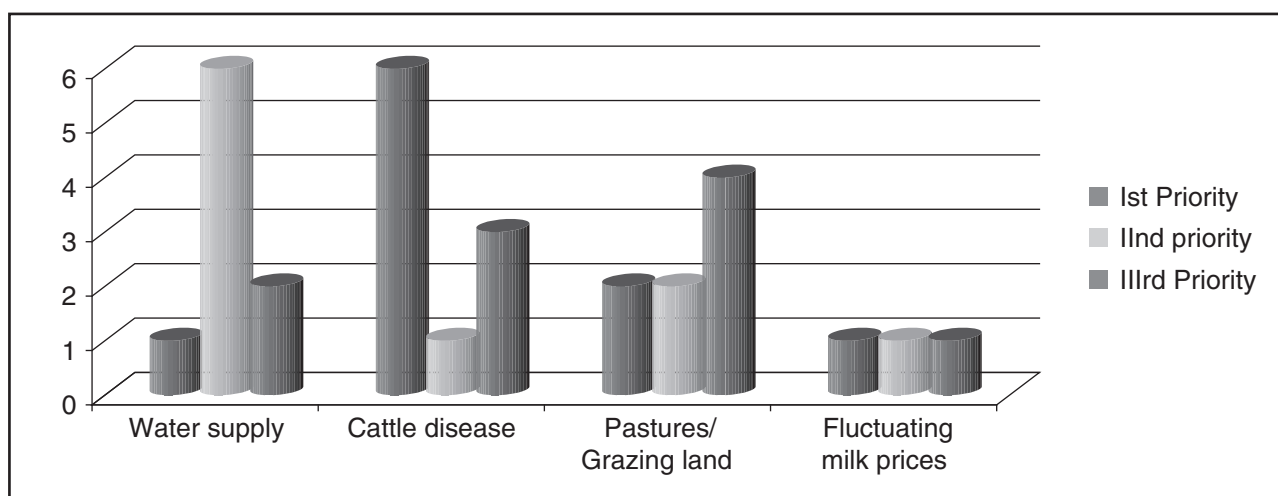
The figure below presents the findings of an exercise that the team conducted during the focus group discussions to find out about the risk prioritization of the farmers, major causes of cattle losses, and basic information about their cattle herds. This exercise is by no means academically rigorous or authoritatively conclusive; it is, however, a good illustration of the farmers' perceptions. Seventeen farmers in two villages participated in this exercise.

### 1. Farmers' Risk Prioritization

#### Nakasongola District—Kinyongoga Dairy Farmers' Cooperative Society (N = 7)



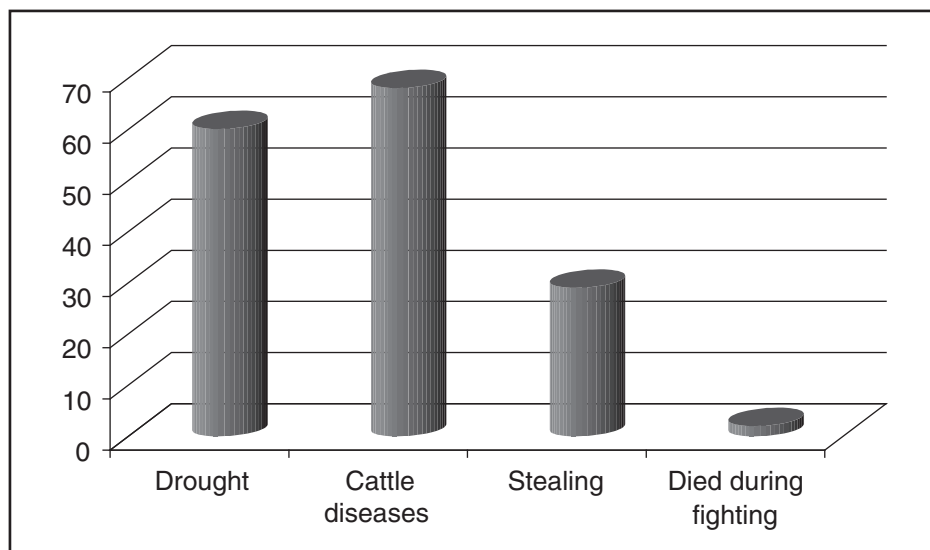
#### Kayunga District—Bugerere Dairy Farmers' Cooperative Society (N = 10)



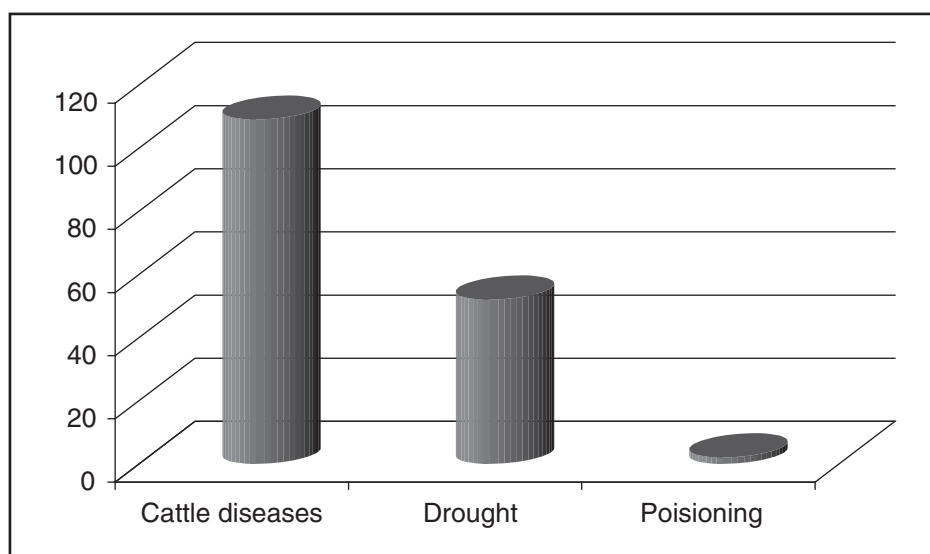
Water supply, cattle disease, limited pastures/grazing land, and fluctuating milk prices were the priority concerns of farmers in both of the focus group discussions. However, while farmers in Kinyongoga were more concerned about water supply, because of their location in a water-scarce area, farmers in Bugerere, close to Lake Kayunga, indicated cattle disease to be their first priority.

## 2. Major Causes of Cattle Loss

### Nakasongla District—Kinyongoga Dairy Farmers' Cooperative Society (N = 7)

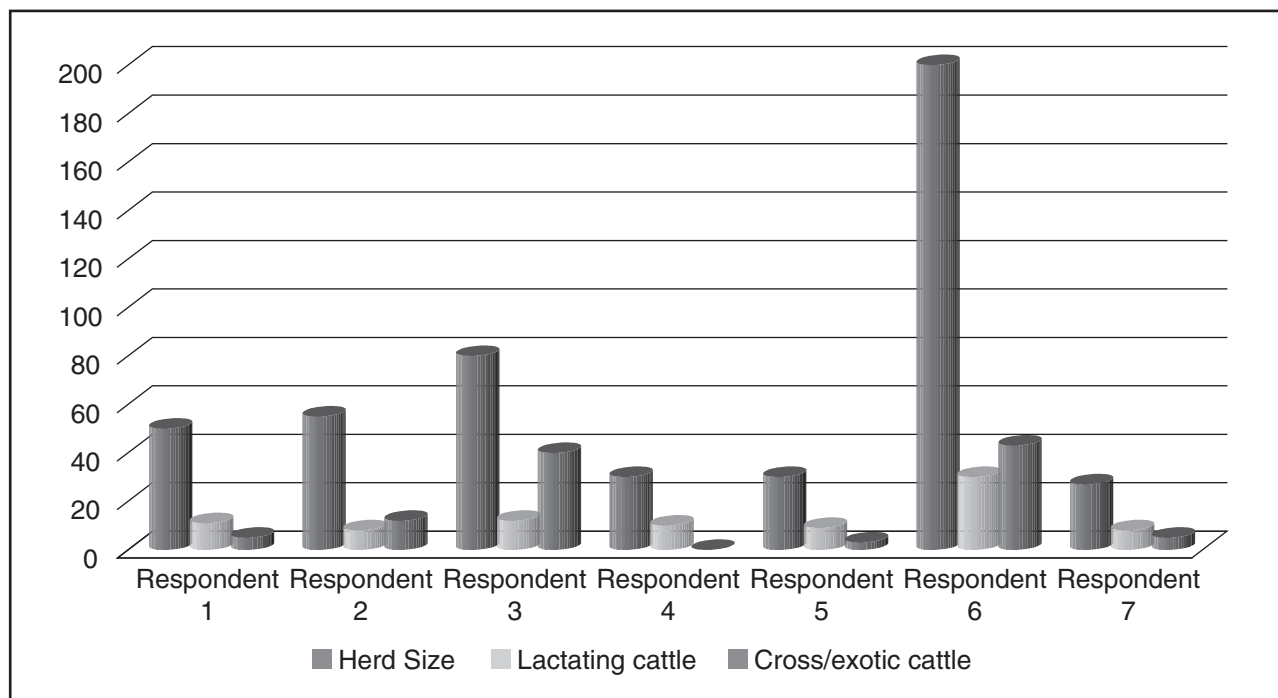


### Kayunga District—Bugerere Dairy Farmers' Cooperative Society (N = 10)

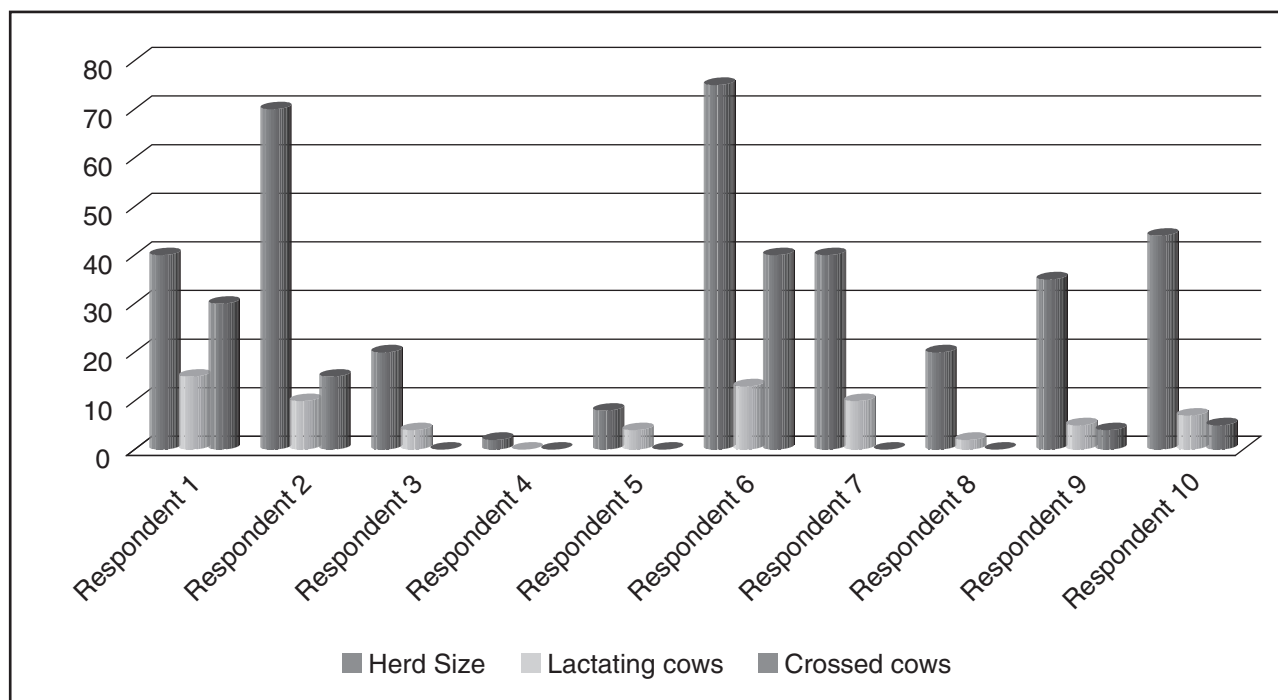


Farmers in both of the focus group discussions were asked to indicate the number of cattle they had lost in the past 10 years and the major causes of cattle loss. Cattle diseases were the biggest cause of cattle loss in both regions. However, in Kinyongoga, drought caused significant loss of cattle, whereas in Bugerere, cattle loss because of drought was much less. Stealing was another major cause of significant losses for some farmers.

### 3. Herd Size and Distribution of Cross/Exotic and Lactating Nakasongla District—Kinyongoga Dairy Cooperative Society (N = 7)



### Kayunga District—Bugerere Dairy Farmers' Cooperative Society (N = 10)



The farmers' focus group illustrated the great variation in cattle ownership. In Kinyongogo, the average herd size was 67; one farmer had 200 cattle head, and 27 was the smallest herd size. The average herd size in Bugerere was 35, the maximum was 75, and the minimum was two.

## Annex 10: Farm Gate Milk Prices (2000–2009)

**Farm Gate Prices (Ush) for Members of the Bushenyi Dairy Cooperative Union (BUDICU) in Southwestern Uganda (2002–2009)**

|                               | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|-------------------------------|------|------|------|------|------|------|------|------|
| Average price per litre (wet) | 168  | 150  | 172  | 175  | 175  | 209  | 221  | 263  |
| Average price per liter (dry) | 233  | 254  | 241  | 262  | 280  | 312  | 384  | 391  |

Source: Elyebu, Secretary Manager, Bushenyi Dairy Farmers' Cooperative Union

**Farm Gate Prices (Ush) for Farmers Supplying the Uganda National Dairy Traders' Association (UNDATA) for the Period 2000–2009**

|                               | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|
| Average price per litre (wet) | 156  | 164  | 172  | 167  | 191  | 182  | 198  | 214  | 284  | 318  |
| Average price per litre (dry) | 220  | 219  | 247  | 262  | 266  | 279  | 314  | 381  | 407  | 446  |

Source: Kalidi Matovu, Executive Secretary, Uganda National Dairy Traders' Association

