

CLIMATE-SMART AGRICULTURE

REBOUNDED FROM THE BRINK OF EXTINCTION:

**Commercial production of milk
amongst pastoralists for climate
change resilience in Uganda**



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REBOUNDED FROM THE BRINK OF EXTINCTION: Commercial production of milk amongst pastoralists for climate change resilience in Uganda

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Acronyms

GDP	Gross Domestic Product
NGO	Non Governmental Organisation
UCCCU	Uganda Crane Creameries Cooperative Union
UHT	Ultra High Temperature
USAID	United States Agency for International Development



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Executive summary

Changes in climate that intensify drought and accelerate the spread of livestock parasites and diseases darken the economic future for sub-Saharan pastoralists. Already stressed, as industrial and urban development narrow their access to pastures and water for their animals, many pastoralists face a bleak choice: abandon their livestock and their cultural heritage or die.

In Uganda, however, the outlook for pastoralists is becoming much brighter. Thousands of pastoralists in Uganda point the way toward a better option: commercial milk production. By settling down on privatised plots of land and crossbreeding their indigenous herds with Friesian cattle, they now produce five times more milk per cow. They earn more from the sale of milk than from the sale of livestock, increasing their ability to buy veterinary medicines, build watering ponds and take other actions that provide insulation from climate-related increases in diseases and droughts. They receive this income on a predictable, weekly basis, increasing their resilience to disease outbreaks and insect infestations. Their increased production, consumption and sale of milk have reduced hunger within their own homes and provided them with the means to broaden their economic base through investments in education, housing, transportation and diversified economic and social activities.

Several interrelated factors promoted the transition to commercial milk production. Changes in governmental policy following a civil war made it clear that privatisation of land would arrest the conventional movements of nomadic pastoralists. Soon after becoming President of Uganda in 1986, Yoweri Museveni warned pastoralists that they must change or die, and urged those with smaller landholdings to reduce their herds and gradually focus on dairy production to increase their income. He reinforced this message by providing essential political leadership. For example, he encouraged government agencies, research institutions, development partners and the private sector to invest in the dairy sub-sector. Government agencies responded by increasing access to veterinary medicines, improving roads to expand access to urban markets and providing incentives for milk production, such as tax incentives on milk coolers. Research institutions documented the costs and benefits of crossbreeding and provided background for understanding steps necessary for accelerating pastoralists' transition to commercial dairy production. Development partners focused on supporting improved animal husbandry and marketing of dairy products to increase national consumption. The private sector developed and helped pastoralists to access new markets for raw and pasteurised milk and new dairy products such as yogurt and ice cream.

Pastoralists in the Southwest Region responded first. The transition began as a few began to crossbreed their herds and demonstrated that they could self-finance the transition by selling two indigenous cattle to yield one crossbreed heifer that would begin producing milk and income within two years. Others followed suit through over-the-fence learning and more structured formal training programmes.

Commercial milk production has several direct and indirect benefits that insulate pastoralists from climate and other risks, and generally improve their standard of living. The most fundamental benefit is an increase in cash incomes experienced by the vast majority of milk producers. The regular flow of income (daily or weekly) from milk sales adds additional benefits. It enables them to understand and monitor market prices (pastoralists who sell only cattle



generally sell cattle infrequently and have little market information that allows them to obtain the highest prices for their cattle). The steady stream of income allows pastoralists to respond quickly to personal and household needs, such as an illness in the family (or to their cattle). It also enables them to make and execute plans – such as those for schooling and investments.

Many milk producers use the higher, steady income specifically to reduce their exposure to climate-related risks.

Examples include:

- Building small dams that hold water from the wet season and diminish their vulnerability to drought.
- Buying water (delivered by tanker truck) from vendors when drought becomes severe.
- Increasing the use of pesticides, e.g., cattle dips, to reduce the cattle's exposure to disease-carrying insects and ticks that are becoming more numerous as temperatures rise, precipitation patterns change and the rangeland becomes covered with more brush.
- Responding quickly when a cow becomes ill, by either buying medicines or calling a vet.
- Diversifying their economic activities so they are not entirely dependent on cattle. Some, for example, invest in property in urban centres.
- Expanding the education and economic activities of women. Some women experience new opportunities directly related to milk, as they control the production, processing and sale of milk. Others use their education to pursue opportunities in other sectors.
- Investing in multiple links of the milk value-chain. Some have bought a pick-up, for example, so they can carry milk (their own and their neighbours') to market.
- Expanding their cooperative activities. Many milk producers belong to cooperatives, which facilitate the dissemination of skills and technologies, increase producers' ability to secure higher prices, and coordinate producers' participation in all components of the value chain.
- Improving rangeland management. Many milk producers are reducing the size of their herds so that they do not exceed the land's carrying capacity and planting alfalfa or new species of pasture grass with higher protein content or ability to withstand drought.
- Diversifying their supplies of cattle-feed; for example some are growing and storing hay for use during dry seasons.

Lessons learned in the Southwest Region are now spreading to the Central Region, demonstrating the potential for scaling-up the transition process. This expansion of the transition within Uganda suggests that similar transitions can occur elsewhere to insulate pastoralists from climate-related and other risks. Although practices that have worked in the Southwest Region of Uganda would have to be adapted to fit the economic, social, ecological and political circumstances of other areas, brief comparisons with nearby countries did not find systemic differences that would necessarily block expanding the transition to other pastoral areas.



Introduction

Pastoralism is a way of life associated with mobile rearing of livestock across large landscapes, primarily rangelands owned and managed through long-standing communal agreements and understandings. It occurs throughout the world's arid and semi-arid lands, which cover about one-third of the world's land area. About 120 million people live in pastoral and agro-pastoral communities worldwide, of whom 50 million live in sub-Saharan Africa (World Bank, 2014). Pastoral practices, which have persisted for centuries, can be a sustainable, efficient utilisation of dryland resources, with livestock (and wildlife) roaming over large landscapes lightly using scarce water and nutrients. Many pastoralists, however, are experiencing pressure from changes in climate, encroachment of urban development on land and water resources, unfavourable changes in their terms of trade with other sectors of the economy, and general disregard for the value of beneficial services pastoralists derive from dryland ecosystems (Niemi and Manyindo, 2010).

This report describes the factors that have enabled some pastoralists in Uganda to adapt to these pressures and achieve sustainable levels of prosperity. The report has these objectives:

- To describe Uganda's pastoralists' transition to becoming successful commercial milk producers.
- To highlight the transition's impacts on pastoralists' resilience to climate-related and other risks in Uganda.
- To describe the factors that facilitated this transition for Uganda pastoralism.
- To draw lessons for and describe the potential for applying these factors for other pastoral communities in Africa.

This section describes the pastoralists of sub-Saharan Africa and their growing vulnerability to climate change and other risks; the potential for and impediments to commercial milk production to strengthen pastoralists' incomes and resilience; and background on successful efforts to increase pastoralists' commercial milk production in Uganda.

1. Pastoralists of sub-Saharan Africa and their growing vulnerability to climate change and other risks

The pastoral families of the hot, semi-arid regions of sub-Saharan Africa are among the world's most vulnerable to climate-related risks (Dong *et al.*, 2011). These risks can materialise through higher temperatures, changes in precipitation, extreme weather (storms, droughts) and ecosystem changes occurring now and anticipated in the future from human-caused emissions of greenhouse gases. When these risks materialise, the pastoral families of these regions have few economic alternatives, the highest incidence of poverty and limited resilience (Oxfam International, 2008). Women and children are especially vulnerable.

Increases in pressure on pastoralists come from multiple directions. Cities appropriate scarce water resources and deprive pastoralists of opportunities to earn incomes from livestock production. Mining and other industrial development displace pastoralists from pasture and rangelands on which they depend to provide forage for their livestock. Market imbalances favour buyers and reduce the prices pastoralists receive for their livestock. The outlook is grim as long as pastoralists remain narrowly dependent on the sale of livestock for the incomes they require to provide improved nutrition and education for their families, support investments to improve herd productivity, and increase their overall resilience to climate-related and other risks, such as avian disease and cattle theft. Many pastoral communities believe that, absent significant change, they will perish within a few years (Niemi and Manyindo, 2010) (Figure 1).



Figure 1: Drought-weathered rangeland typical of Eastern Africa where droughts are occurring more frequently in response to climate change



2. The potential for commercial milk production to strengthen pastoralists' incomes and resilience

Against this backdrop, one of the key options for increasing pastoralists' resilience entails increasing the incomes they earn from their livestock. In some instances, these opportunities will involve giving pastoralists better access to and negotiating power in livestock markets, as well as deeper access to the beef and dairy value chains. These opportunities are limited in scope and scale insofar as most pastoralists lack the organisational, technical and financial resources to prepare for periods when market prices decline. These same limitations inhibit their ability to augment their production of raw milk with investments in other elements of the value chain. Far more powerful are opportunities to develop a second line of income from their herds, through the sale of milk. Pastoralists already produce milk, but they consume all or nearly all of their production. To initiate participation in milk markets, pastoralists must overcome multiple barriers. Some of these are cultural: for centuries, pastoralists have raised cattle for purposes other than milk, e.g., to accumulate wealth and provide resilience against droughts and other disturbances. Others involve communication boundaries, as pastoralists have limited knowledge of milk markets. Still others are logistical – pastoralists typically live away from roads, making it difficult to deliver their milk to market before it spoils – or financial – as they lack access to funding to buy cooling facilities (such as a chiller) and/or means of transport (such as a pick-up truck) for delivering milk quickly to market.

If recent trends continue, demand for milk in sub-Saharan Africa will continue to grow (Knips, 2005). Two factors underlie this growth. One is the growth in population. The other is growth in milk consumption per capita. The two will interact with one another, especially in countries successful in their efforts to raise household incomes. For low-income countries, a 1% increase in income generally correlates with a 0.83% increase in milk consumption (Gerosa and Skoet, 2012: 16). Expected growth in milk consumption will provide opportunities for pastoralists to sell more milk, earn more income from their livestock and use the income to increase their ability to withstand climate-related or other shocks.



3. Potential impediments to pastoralists' commercial milk production

It is important to note, however, that pastoralists must overcome significant obstacles if they are to take advantage of the expected increases in demand and increase their sales of milk. One set of obstacles reflects the harsh natural, economic and security environments in which they live (SOS Sahel, 2013). Obstacles in the natural environment likely will become more severe as anticipated changes in climate materialise, with increased frequency and severity of droughts, floods and disease outbreaks for both humans and livestock. Many obstacles in the economic environment arise from the marginalisation of rural communities and conflict over land and water resources with urban and industrial development.

Pastoralists also must overcome obstacles arising from their management of livestock and from their relationship with milk markets. These obstacles include limited access to markets and limited information and skills essential to milk production and marketing. Many pastoralists in Uganda have demonstrated their ability to surmount these barriers and increase their sales to, and income from, milk markets. The remainder of this report describes their accomplishments and the lessons from them that are applicable for pastoral communities elsewhere.

4. Background on successful efforts to increase pastoralists' commercial milk production in Uganda

Reliable estimates of Uganda's current pastoralist population do not exist. Approximations, though, suggest that, at the turn of the century, about 6.6 million people, or about one-quarter of the nation's total population, inhabited the 84,000 km² of rangelands that make up about 40% of Uganda's land area (REGLAP, 2012). Most of these people practised a pastoral or agro-pastoral lifestyle or, if they lived in urban areas, had extended family who did so. Areas with higher concentration of pastoralists generally exhibit lower levels of life expectancy, education and income (REGLAP, 2010). Many pastoralists in Uganda, though, have substantially improved their economic well-being and reduced their vulnerability to climate-related and other risks by effecting a transition from nomadic cattle-keepers to sedentary commercial milk



producers. Those who successfully produce milk commercially earn sufficient weekly income to:

- eliminate hunger in their families
- acquire medical services when necessary
- support the education of their children
- undertake investments that extend their participation in the dairy industry's value chain and diversify their sources of income
- quickly respond to diseases, droughts and other threats to their herds.

The growth in milk production underlies a transformation of Uganda's dairy industry, which is producing a diversity of products to meet growing domestic demand and enabling Uganda to become an exporter rather an importer of milk products. The primary beneficiaries of commercial milk production are the pastoralist households who have undergone the transition and realised incomes that are larger, more frequent and more reliable than those they had previously.

The transition also benefits other groups:

- Milk consumers, who see a greater variety and volume of milk products available at lower prices than would otherwise exist.
- Milk buyers, processors and vendors, who have greater opportunities to earn income from these elements of the dairy-industry value chain.
- The overall national economy, which benefits as pastoralists' increased milk production enables Uganda to reduce imports and increase exports.

In most, but not all households, men are the primary participants in herd management, the production and sale of milk and other value-chain activities. In some instances, though, new opportunities have materialised for women. Women head some of the households that produce milk, and make decisions and engage in these activities parallel to their male counterparts in other households. In some locations, women sell milk products directly to consumers.

This experience offers lessons that might be useful for other pastoralists in sub-Saharan Africa facing similar threats and seeking to accomplish similar goals, and for other countries seeking to strengthen their dairy industry.

The transition has taken place since the mid-1980s, as the country implemented an economic revival from civil war under the new government of President Museveni. It began in the Southwest Region. This region, President Museveni's home, is a semi-arid area about 3–4 hours' drive from Kampala, the country's capital and largest city. Nomadic pastoralists kept most of the region's indigenous, Ankole cattle, moving them across communal lands seeking forage and water.



They largely aimed to maximize their herd size, relying on the herd for subsistence food and occasionally selling animals for slaughter to obtain cash. Their relationship with the animals also constituted the core of their socio-cultural system.

Several factors, though, doomed the continued existence of this way of life. The greatest threat came from the privatisation of communal lands. With government's encouragement, a few pastoralists staked claim to and began fencing parcels of land. Others, finding their way blocked by the fences, quickly followed in their footsteps. With the privatisation of communal lands, nomadic pastoralism ended for all but those who migrated to areas, inside Uganda or in neighbouring countries, where they were able to gain access to communal lands or unutilised private land.

Sedentary pastoralism replaced nomadic pastoralism for a brief period. During this period, households settled in one location and tried to sustain the same general relationship to the herd that had existed prior to privatisation. The pastoralists sought to maximise herd size, relied on the herd and crops grown around each settlement for subsistence food, and derived cash income from the herd through occasional sales of an animal for slaughter.

Biological, ecological and economic realities, however, quickly imposed limits on this behaviour. For most households and with growing climate-related risks, their land parcel lacked sufficient forage and water to sustain the herd it had assembled when it grazed its cattle on communal lands. The herds began to shrink. As they shrank, they produced less milk and meat for subsistence consumption, and fewer animals for sale. Many households began to spiral out of control, with herds dwindling, hunger and poverty rising with no end in sight. Lacking a new source of income, they faced losing their herds entirely, displacement from their lands and the end of a socio-cultural community that had existed for centuries.

When the Museveni-led government took over in 1986, it recognised the key role that agriculture could play in the country's economic recovery and identified it as a priority sector (Haggblade and Hazell, 2010). Since then, much of the transformation experienced in the dairy sector was driven by the government's deliberate effort to improve livelihoods through agriculture (Mbowa *et al.*, 2012). Thus, the sector benefitted from broad efforts to expand extension services, strengthen agriculture-related finance institutions, replace imported foods with domestic products, and improve infrastructure for transporting agricultural products to urban centres.

In addition, the government took steps specifically intended to promote dairy production and incomes. In 1987, for example, it dedicated revenues from coffee exports to finance the import of 2,000 Friesian heifers for crossbreeding with indigenous cattle to raise the milk production of future herds (Scholten and Dugdill, 2016), and facilitated subsequent private efforts to import more Friesians. The government also distributed milk chillers to some cooperatives, privatised the entity that previously processed milk for the formal market and licensed private milk processors (Mbowa *et al.*, 2012).



Geographical area of the case study

To facilitate research and understanding of milk production in Uganda, analysts distinguish among six milksheds (Figure 2). In Uganda, most milk is produced in the so-called cattle corridor, which extends from the Southwest through the Central to the north-eastern Karamoja Region. The corridor is generally semi-arid, with the degree of aridity increasing from the southwest to Karamoja. The corridor experiences wet and dry seasons each year, with forage availability and milk production rising in the former and dropping in the latter. Residents of the region are subject to risks of frequent drought, which stress human health, livestock and incomes. These risks also underlie the semi-arid ecosystem and create conditions conducive to pastoral survival strategies. About 60% of households in the cattle corridor have livestock but most commercial milk production occurs in the Southwest Region.

The Southwest Region – sometimes called the Ankole Region – has experienced the greatest growth in commercial milk production. The Central Region – sometimes called the Buganda Region – follows, both in terms of the extent of its progress in the transition to commercial milk production and in the amount of milk it produces.

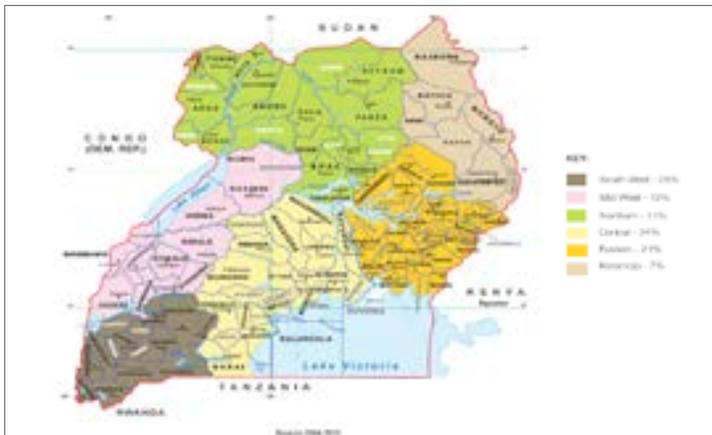


Figure 2: Uganda milkshed regions

Source: Dairy Development Authority (2012)

For this study a cross-section of stakeholders from the Southwest and the Central regions were interviewed. This included producers, buyers, processors, retailers and government representatives. Information was gathered on the reasons for the increase in milk production and the strategies employed to increase milk production over the last two decades. Other information centred on determining the impact of increased milk production on resilience to climate-related risks.



Figure 3. Communal uses of open rangelands have been replaced with leasehold or freehold tenure that encourages individual ownership of land



Development process of the case study

Through key informant interviews of stakeholders and review of relevant documents, we identified several key events, practices and realities that have resulted in increased milk production in these two regions of Uganda:

1. Change in land tenure
2. Presidential leadership (political will)
3. Livestock breeding
4. Availability of essential veterinary drugs
5. Improved rangeland management
6. Adoption of agro-pastoralism
7. Growth of milk markets
8. Expansion of dairy cooperatives
9. Improved infrastructure
10. Availability of extension services
11. Over-the-fence learning
12. Improved levels of education
13. Support from Uganda's development partners

These factors are deeply intertwined. Hence, the order of presentation in the following sections does not imply their relative importance.

1. Change in land tenure

In the Southwest Region, nomadic pastoralism has gradually phased out over the past four decades, as individuals or households changed to sedentary pastoralism and converted land from communal tenure to leasehold and freehold tenure (Figure 3). Households now face increasingly restricted access to water and pasture in a semi-arid region. As a result, they have had to develop innovations in the use and management of land. For example, many have constructed small ponds to extend water supplies available for their livestock from the wet season into the dry season. Over the past 15 years, these changes have spread to the Central Region. The privatisation of land forced pastoralists who previously used the land under communal tenure to look for new ways to survive and sustain at least some of their pastoral way of life. It also made some of them more receptive to consider and implement suggestions for producing and selling more milk.

2. Presidential leadership

His Excellency the President of the Republic of Uganda, Yoweri Kaguta Museveni, has played a critically important role, both in initiating the transition and in seeing it to fruition. Beginning soon after he assumed the Presidency, he helped initiate the transition by speaking in a concerted and consistent manner to advise pastoralists to adopt and expand dairy production. This message resonated powerfully with some pastoralists, especially in the Southwest Region. He also took action that included initiating the import of Friesian heifers to support crossbreeding to yield cows with greater milk-production capabilities, reinforcing incentives in the dairy value chain, encouraging NGOs and donors to promote greater dairy production, and investments in infrastructure to support transportation of milk to markets. He encouraged government agencies, research institutions, development partners and the private sector to invest in the dairy sub-sector. In response, government agencies increased investment in veterinary medicines and milk coolers and improved roads in the cattle corridor. Research institutions invested in developing a better understanding of the impact of crossbreeding and in demonstrating how similar transitions elsewhere could be applied to commercial dairy production by pastoralists. Development partners invested in supporting improved animal husbandry and marketing of dairy products to increase national consumption. The private sector invested in developing new markets for raw and pasteurised milk and new dairy products, such as yogurt and ice cream.

3. Livestock breeding

Commercial milk production generally involves crossbreeding Ankole cattle with Friesians that produce more milk (Figure 4). Ankole-Friesian crosses produce at least 10 litres of milk per day, five times the production of Ankole cows. Pastoralists are also making sure that their Ankole-Friesian crosses do not exceed 75% so that

Figure 4: Ankole cattle (left) and Ankole-Friesian crossbreed cattle (right). Ankole cattle typically produce 2 litres of milk per day, but the crossbreeds can produce at least 10 litres per day



they maximise milk production while maintaining some of the indigenous genetic material that allows for disease resistance. Initially, crossbreeding was promoted through demonstration projects. Some of these were directly supported by the government, with technical assistance from NGOs and donor countries. Others were initiated by private livestock owners. The lessons – both positive and negative – from these efforts gradually spread to others through over-the-fence learning and extension outreach, and crossbreeding became more widespread as owners saw that the benefits could exceed the initial costs.

4. Availability of essential veterinary medicines

With the introduction of Ankole-Friesian crosses, susceptibility to tick- and fly-borne livestock diseases increased. To combat these diseases, pastoralists embarked on prevention methods, such as regular vaccination against some diseases. These practices have led to the establishment – typically by veterinary doctors or assistants – of private-sector drug shops that sell imported veterinary drugs in almost all towns and trading centres in the cattle corridor. The most common drugs sold suggest pastoralists are making more effort to prevent disease than treat it. Most livestock owners say they cannot afford the market prices for all of the recommended drugs and, hence, they prioritise their use of drugs, prefer generic drugs that might be less efficacious and call for governmental intervention to lower prices (Vudriko *et al.*, 2011).

5. Improved rangeland management

Many milk producers have adopted improved rangeland management practices (Figure 5). These practices include clearing brush, moving livestock to avoid over-grazing, building small dams to store water, producing hay to supplement nutrients from pasture feeding and growing grasses especially suited for hay production (Sabiiti and Teka, 2004).



Figure 5. Improved rangeland management includes clearing brush stimulated by climate change and restoring pasture, and building small dams to store water

6. Adoption of agro-pastoralism

The adoption of crop production helped some pastoralists in the transition from nomadic to sedentary pastoralism. Crop production increased the available supply of subsistence food, reduced their own milk consumption and enabled them to sell more milk.

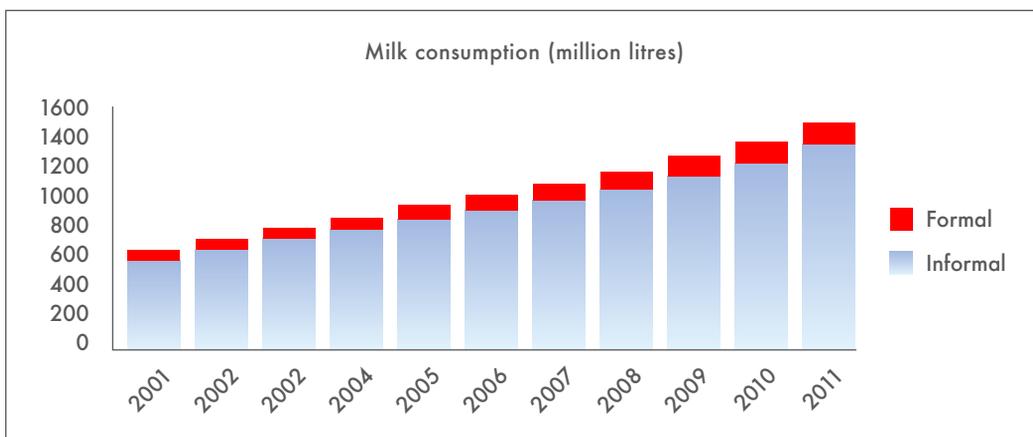
7. Growth of milk markets

Ugandans are drinking more milk (Figure 6). The value of milk and dairy exports also has been increasing in recent years – US\$3.4 million (€2.8 million) in 2011, US\$11.5 million (€9.4 million) in 2012, US\$12.1 million (€9.8 million) in 2013, and US\$28.5 million (€23.2 million) in 2014 (Masinde, 2013; Twaha, 2015).

The expansion in milk consumption resulted from the evolution of both demand and supply. Demand for milk grew as household incomes rose and marketing messages highlighted the nutritional value of milk products. Supply grew through the processes outlined above. Maturation of market institutions, such as extension, finance, milk-collection and handling cooperatives, transportation, processing and distribution, lubricated the growth of both demand and supply.

Both formal and informal markets (Figure 7) play important roles in stimulating and supporting milk production (Nkwasiwe *et al.*, 2015). Formal milk processors stimulate demand by producing a wide range of products such as fresh pasteurised milk, ultra-heat treated (UHT) milk, yoghurt, butter, ghee, instant milk powder and ice cream. They also have facilitated increases in milk production, by increasing the distribution of coolers, generators and testing kits

Figure 6: Annual milk consumption in Uganda, 2001–2011



Source: Agriterria (2012, 2008–2011 extrapolated)

at milk-collection centres (Mwebaze and Kjaer, 2013; Sharma *et al.*, 2013). The informal milk sector provides basic milk products to many consumers at lower prices than those seen in the formal market. The informal market now constitutes at least 75% of all traded milk in Uganda, giving consumers lower prices, but also no guarantee on milk quality.



Figure 7. The formal milk market includes diverse, high-quality products; the informal market includes on-farm sales and bicycle-distributed raw milk

8. Expansion of dairy cooperatives

Three-quarters of the dairy farmers in the Southwest Region belong to cooperatives (Mwebaze and Kjaer, 2013). The establishment of cooperatives has received broad support from the region's economic and political elites and, in return, become a source of economic and political strength. This strength is indicated, for example, by the formation of an umbrella organisation for the south-western cooperatives, the Uganda Crane Creameries Cooperatives Union (UCCCU), which consolidates producers' interests regarding financial issues, regulatory policy, marketing campaigns and other issues. The UCCCU also is seeking to establish and expand its own milk-processing capabilities.

Membership in a local cooperative offers several advantages (Mbowa *et al.*, 2012). Cooperatives secure coolers from the government, operate milk-collection centres and organise shipment of milk to urban centres, sometimes in vehicles owned by the cooperative. They provide an opportunity for member farmers to inform each other and learn best practices, as well as a forum through which milk producers interact with extension workers, buyers and drug retailers. They allow producers to speak with one voice and, therefore, strengthen their bargaining position with other stakeholders. Belonging to a cooperative may enable members to earn a slightly higher price for their milk, but other benefits often are more important, such as generally receiving payment for their milk in a timely manner, having greater access to credit and having opportunities to participate in more training exercises (O'Brien and Cook, 2016).



The one-quarter of Uganda's dairy farmers who do not belong to a cooperative typically sell their milk directly to household consumers or to local retailers, such as restaurants.

9. Improved infrastructure

The Government of Uganda has made major efforts to improve transportation, communication, electrification and other systems of the nation's infrastructure, especially in the Southwest Region (Mwebaze and Kjaer, 2013). These efforts make it easier for rural producers to chill their milk, learn about market conditions and send their milk to urban markets.

10. Availability of extension services

In the 1990s, the central government stopped providing veterinary/extension services and delegated this role to local government and the private sector (World Bank, 2011). In 2001, though, it initiated demand-driven agricultural extension services. This system, which serves the entire agricultural sector, now includes about 4,000 technical extension workers, as well as a larger number of volunteer farmer trainers (Vark, 2014). The technical extension workers provide the volunteer farmer trainers with intensive, short-course training in topics such as growing, storing and utilising livestock feed crops. The trainers then convey what they have learned to their neighbours. Several factors encourage capable individuals to become trainers and provide effective services to others. Social factors often play an important role, as local communities select from within those individuals they want to become trainers. Many trainers also have found that, although they largely assist others on a voluntary basis, they can sometimes earn income from selling information or products to livestock producers outside their immediate community.

In general, though, these services lack the scale and technical expertise necessary to drive substantial advancement in livestock and dairy practices. As a result, pastoralists have developed their own capacity to diagnose and treat common veterinary diseases and seek extension services only during major outbreaks of contagious diseases, such as foot and mouth disease, lumpy skin disease and anthrax. To some extent, some NGOs, research institutions and donors have begun to focus efforts on supplementing this internal capacity through outreach aimed at increasing dairy farmers' capacity to grow and store dry season fodder, grow silage, and artificially inseminate cows.



11. Over-the-fence learning

Many cattle-keepers initiated commercial milk production only after learning from the experience of other farmers. In effect, they learned by looking over the fence to see what their neighbour has done with what results. Especially important was learning about crossbreeding and improving rangeland management practices.

12. Improved levels of education

According to milk producers and government officials, the households that first investigated and took steps to produce milk typically came from families with a long history of educating their children. Many trace their educational experience to the early 20th century Christian movement in Eastern Africa.

13. Support from Uganda's development partners

Bilateral agencies, foundations and NGOs have made significant contributions to the development of Uganda's dairy industry. Their interventions – establishing milk-collection centres, stimulating the development of more diverse and higher quality milk products, and facilitating the development of cooperatives – have directly and indirectly encouraged pastoralists to begin and expand commercial milk production. Some of the entities that have played a prominent role include: Land O'Lakes, Heifer International, SNV Netherlands Development Organisation, Danida, USAID and the French Dairy Project.

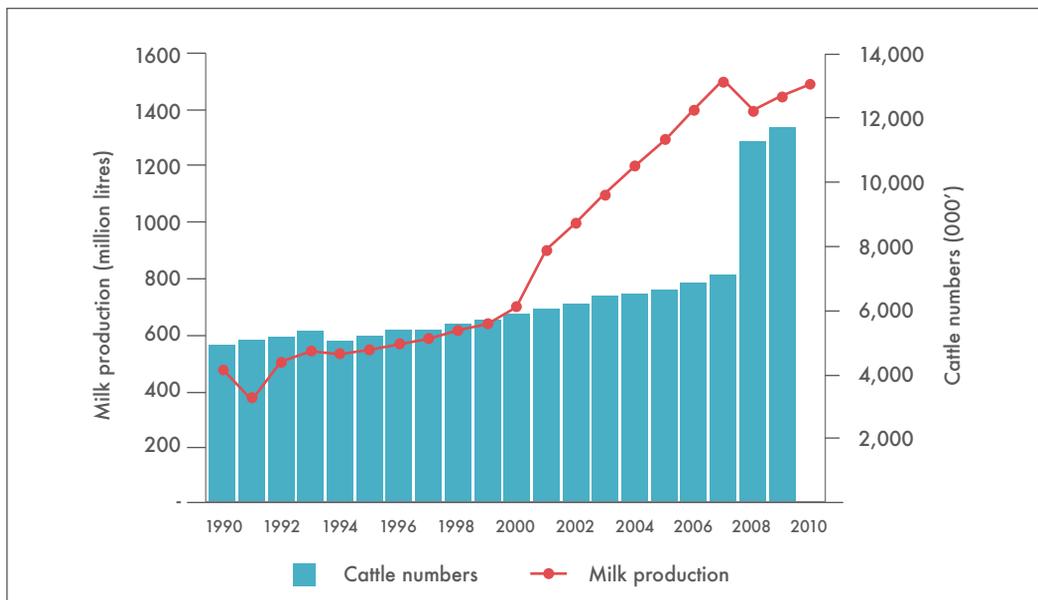
Adoption

This section first discusses the process that pastoralist households in Uganda's Southwest and Central regions have followed to begin and expand commercial milk production. It then looks at some of the factors that might influence the applicability of the process elsewhere.

1. The adoption process in Uganda's Southwest and Central regions

It takes about two years, following the purchase of a Friesian bull for mating with Ankole cows, for the resulting crossbreed offspring to begin producing milk. It generally takes just a small number of crossbreed offspring for the milk production to exceed the household's subsistence requirements so that the excess becomes available for sale. Early adopters say that, as they purchased the first Friesian bull to breed with their Ankole cattle, they initially continued to consider themselves as traditional pastoralists but, after about seven years, they fully considered themselves to be commercial milk producers. Others, those who began milk production based on what they learned from looking over the fence at the first-adopters made this transition much more quickly, often within 2–3 years.

Figure 8: Trends in Uganda's annual milk production and cattle population, 1990–2009



Source: Twinamasike (2001); DDA (2005); EPRC (2009); and UBoS/MAAIF (1990–2010)



Available information does not support a reliable estimate of the number of households or individuals who directly benefit from the transition. Indirect indicators, however, suggest the general scale of the beneficiaries embraces thousands of pastoralist households and others involved in the expanding dairy industry, as well as millions of milk consumers. One review of available statistics (Mbowa *et al.*, 2012) found that the nation's overall annual milk production has increased from about 380 million litres in 1990 to 1.5 billion litres in 2010 (Figure 8). (The dramatic increase shown in cattle population in 2008 and 2009 likely reflects inaccuracies and inconsistencies in the data series for this variable.) Others, however, have concluded that milk production has increased only to about 0.8 billion litres (Makoni *et al.*, 2014). Through the 1990s, the growth in milk production paralleled the growth in cattle population. For most of this century, however, it appears reasonable to conclude that milk production has grown more rapidly, reflecting the expanding presence of exotic crossbreeds that produce more milk per cow.

Apart from the pastoral milk production system, two other distinct milk-production systems have evolved in Uganda: the peri-urban and commercial milk-production systems (Makoni *et al.*, 2014). The pastoral system typically has more than 50 indigenous cattle that obtain feed only from grazing coarse pasture (rangeland). Households emphasise values other than milk production. These include cultural values that associate quality of life with cattle ownership and prize milk, meat, hides and other products derived from cattle for subsistence and cultural uses. Cattle also play major roles in social exchange activities, such as marriage, death, dispute settlement and gift-giving. They also reflect households' desire to build herd size as a primary repository of wealth and source of insurance against economic risk. Increasingly, some pastoral households are recognising the economic opportunities associated with commercial milk production, crossbreeding with exotic breeds that exhibit greater milk production or resilience to changes in climate, and altering their feed systems by grazing cattle on enclosed pastures and providing supplements.

The peri-urban system involves small-scale farms, typically in a village or on the periphery of a town or city. The farmers manage fewer than about 10 cattle, in conjunction with the production of crops. The cattle, which may be indigenous or mixed breeds, are especially important as a source of milk and meat for subsistence use, and as a means for accumulating wealth. Milk sales provide a source of income. Most feed comes from grazing on pastures, but farmers may provide feed supplements, especially during the dry season.



Commercial dairy farms typically manage 20 to 100 pure and crossbreed cows primarily or solely for milk production. They feed the cows on pastures planted with grasses selected for nutritional value and high-energy supplements, such as grain by-products and oilseed cake.

Of the total amount of milk produced by small, family-oriented producers, about 30% is consumed by the producers and their families. Producers sell the other 70% to wholesalers. Of this amount, they divert about 20% to the formal market, where the milk is processed and packaged into products, such as UHT milk and ice cream. The remaining 80% is sold in informal markets, often as raw milk, sometimes as whole milk that has been pasteurised in wood-fuelled, batch pasteurisers. The quality of milk in informal markets can vary considerably. Especially in the dry season when milk production drops, producers and wholesalers sometimes dilute the raw milk with raw water. Most households in Uganda directly participate in the production of agricultural products, at least for subsistence, and often for commercial sale. Livestock-related products contribute about 1% to national GDP, and more than half of this comes from the dairy sector (Balikowa, 2011). Pastoralists' share of this contribution remains unknown. It is clear, though, that in the past two decades many pastoralists have transitioned from having no interest in selling milk to aggressively producing milk for commercial sale.

Fresh milk products from domestic processors now account for most packaged milk products consumed in Uganda. Imports have declined while exports have increased (Mwebaze and Kjaer, 2013). In 2014, Uganda was exporting milk products to Rwanda, South Sudan, Congo, North Africa, India, the Middle East and the United States of America (Kasozi, 2014).

2. Potential adoption elsewhere

Uganda's experience demonstrates that pastoralist households can successfully begin producing milk commercially across large landscapes when:

- Pastoralists face privatisation and fencing of communal rangelands and blocked access to water that effectively terminate nomadic management of livestock herds.
- Households see that they face loss of their livelihoods and their lands unless they can earn income from activities other than raising livestock.
- The demand for milk products is strong enough to support prices for raw milk high enough to cover the costs of informal-market collection, transportation and processing.

- There exist recognisable opportunities for investors to increase their earnings by making a pastoralist-oriented commercial milk industry more efficient:
 - Households must have opportunities to reduce their per-unit production costs.
 - Entrepreneurs must see opportunities to improve the milk collection, transportation and processing systems, or by providing services to milk producers.
 - Government must see opportunities to improve road networks and communication systems that connect pastoral areas to urban centres.
 - Development partners must see opportunities to accomplish their goals by investing in programmes that facilitate development of pastoralists' commercial milk production.
- The costs of learning from the experience of others are low.
- Political and community leaders voice their encouragement and support for pastoralists' commercial milk production. Political and economic support is also required as pastoralists become better organised, e.g., through establishment of dairy cooperatives.

It seems reasonable to expect that adoption of commercial milk production by pastoralists elsewhere will proceed more smoothly to the extent that these conditions apply. Where they are limited, or do not apply at all, there will be barriers to adoption. It may, however, be possible for targeted interventions to lower the barriers, develop a commercial milk system that better fits local conditions, or both.

The actual and potential spread of commercial milk production in Uganda illustrates the possibilities. Pastoralists in the Central Region developed milk production later and to a lesser extent than those in the Southwest Region. Overall, the development of the milk industry in the Central Region seems about a decade behind what has evolved in the Southwest Region. But, by learning from their regional neighbours, it seems likely that they will accelerate and catch-up. Some leaders in the pastoral community have, on their own initiative, travelled to the Southwest Region to observe and learn. NGOs, other development partners and local government have sponsored similar trips. Government and development partners have initiated educational campaigns about the nutritional value of milk, especially for children. There also have been efforts to subsidise the location of milk coolers in the region. The government has improved the major roads connecting the region to Kampala. Some women from milk-producing households have begun selling milk to travellers/road users from booths alongside the major highway.



Circumstances facing pastoralists elsewhere suggest that there are opportunities for adapting and adopting Uganda's experience to promote commercial milk production. This excerpt from an assessment of changes in land management in Ethiopia (Pastoralist Forum Ethiopia et al., 2010: 73–74), for example, describes circumstances similar to those found in Uganda in the 1990s:

“Today, most pastoralist communities find themselves torn between the need to survive and the need to maintain their traditional lifestyles. Increased encroachment from crop cultivation, the rise in private area enclosures and the resulting diminished rangelands have led to fundamental changes in the pastoralist way of life. This chapter highlights the key changes and trends in land use and land tenure that affect pastoralists in Ethiopia and describes their effects.

As we have seen, traditionally pastoralist land was communally owned and pastoralists relied almost exclusively on livestock for their livelihoods. Pastoralists and their animals were able to move freely across vast rangelands in search of water and pasture without restriction. This is no longer practiced. In the last fifty years rangelands have become smaller and those that remain are much less productive. The natural resource base has shrunk because of the allocation of former communal grazing lands to large-scale state and commercial farms, wildlife parks and ranches. There is also a significant increase in the human population per hectare, which has contributed to overgrazing and the destruction of forests. Even though livestock population has increased, the per capita holding has declined. The cumulative effect has been environmental degradation and drought that has further reduced productive rangelands. In many areas, pastoralists have reacted to these changes by enclosing their own land and cultivating it themselves.

Changes in land tenure... have led to the breakdown of traditional natural resource management systems. Land grabbing and individual enclosure for grazing and cultivation have caused many problems. Since 1973 in Yabello, Borana and Oromia, there has been a drastic reduction in grasslands whereas cropland has increased considerably. These new practices disregard traditional and customary practices for managing water and rangeland that have sustained communities for generations. Pastoralism – previously sustainable and productive in arid areas – has been made to look old-fashioned and unproductive because of changes forced upon the land use system by outsiders. In addition, farmland and national parks have expanded into grazing areas. This restricts herd mobility and limits access to pasture and water.

Herds are now confined to smaller areas causing further degradation of fragile lands already constrained by droughts, soil erosion and general land degradation. It has now become common practice to settle in marginal and dry grazing areas, which hinders traditional rangeland management. Dry season grazing areas are particularly badly affected.”

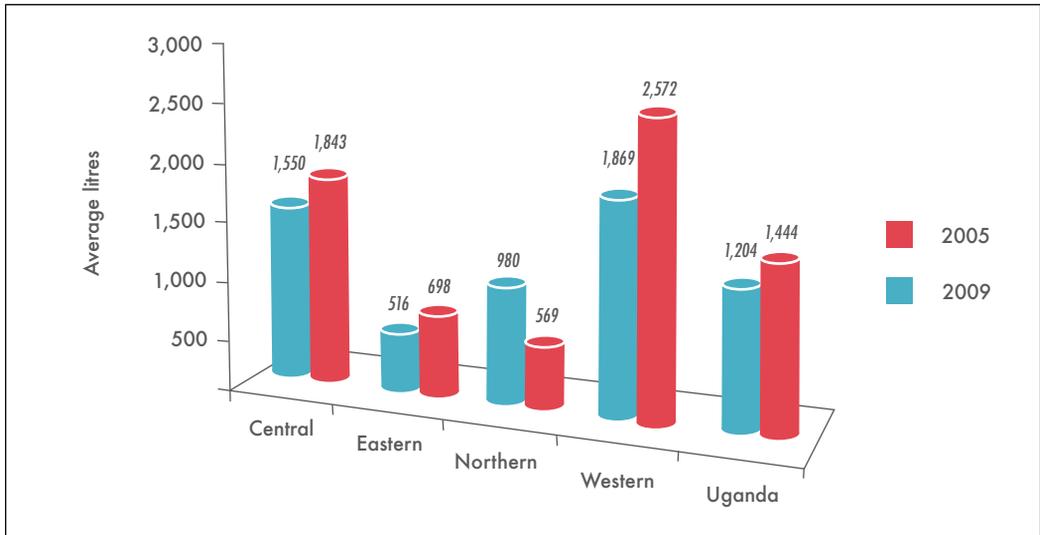
Impacts

One man from the Central Region, who had recently begun re-shaping his herd to include crossbreed cows and selling the milk they produce, offered this succinct summary of the impacts these actions have had on his family:

“Before, there was hunger in my home. Now, there is no hunger. Before, I did not have money to buy medicines when my cows became sick. Now I can buy the medicines and cure my cows immediately. Before, I had to hide from my creditors when I walked through the market. Now, I walk through the market with my head held high.”

The limited available economic data supports this statement. The Western Region (which includes the Southwest) produces the most milk, followed by the Central Region (Figure 9). These regions also exhibited increases in production between 2005 and 2009. Some observers attribute the increases to greater adoption of crossbreeding between indigenous cattle and breeds with greater milk production per cow (Makoni *et al.*, 2014). Growth in production is gradually spreading to other regions.

Figure 9: Average annual milk production per farm, by region



Source: Makoni *et al.* (2014)

For all but the smallest producers, agro-pastoral households can earn more by producing milk than they could by working at other jobs, and income from milk sales can constitute up to 90% of total household income (Garcia *et al.*, 2008). Producers with 40 head of cattle earn about four times the prevailing wage for unskilled workers in the surrounding area.

The transition to commercial milk production also has enhanced the ability of many producers to cope with climate-related risks. In the Southwest Region, for example, some producers earn sufficient income from selling milk that they can buy water during the dry season, increasing the likelihood that their herds will survive future droughts. Nearly all producers have used their income to support the development of small ponds that collect water during the wet season and hold it into the dry season. Income from milk sales gives all producers financial resources they otherwise would not have to respond to anticipated, climate-related intensification of insects, ticks and disease. They can use their income to purchase equipment and pesticides to diminish the herd's vulnerability to the diseases carried by insects and ticks, as well as medicines and veterinary services for those animals that become infected.





Validation

To validate our findings, we met with two groups of stakeholders, one in the Southwest Region and the other in the Central Region. Each meeting included a presentation of the context and objectives of our research and our findings. It was followed by a robust, open discussion, in which stakeholders asked questions about our findings and offered clarifications. We also asked participants targeted questions to clarify ambiguities. In particular, we focused on these issues:

- The role of women in the production and sale of milk and milk products, as well as the impacts on women.
- The costs and benefits of commercial milk production, recognising that few of the producers, even those in cooperatives, keep records on the costs of specific actions, such as the use of veterinary drugs, and the impacts of these actions on the quantity, quality and profitability of milk production.
- The transition process: key actions, duration and outcomes.
- The learning process: by those that were the first to invest in Friesian bulls and by those that learned by looking over the fence.
- Next steps for realising higher, more reliable income from the sale of milk.
- The impact of climate change: on water supplies, heat effects, diseases and milk production.
- Their ability to respond effectively to the effects of climate change.
- Recommendations they would offer to pastoralists elsewhere.

This report fully incorporates what we learned during these meetings, as well as from follow-up phone calls and e-mails with individual participants regarding specific issues that could not be resolved during the meetings.



Drivers of the case study

Our research suggests that 13 factors played key roles in bringing about pastoralists' transition to commercial milk production (Table 1). This conclusion rests on our extensive review of relevant literature and interviews with milk producers, government officials and participants in the milk industry. The discussion in the section above, "Development process of the case study", describes each of these factors and their influence. Where appropriate, we provide quantitative support for our findings. In many instances, however, quantitative information is not available, as most milk producers, and many other stakeholders, do not compile quantitative data. Based on our research, however, we are confident that these same factors will continue to influence the spread of the transition within the Central Region and other regions.

Table 1: Factors that played key roles in pastoralists' transition to commercial milk production

1. Change in land tenure
2. Presidential leadership
3. Livestock breeding
4. Availability of essential veterinary medicines
5. Improved rangeland management
6. Adoption of agro-pastoralism
7. Growth of milk markets
8. Expansion of dairy cooperatives
9. Improved infrastructure
10. Availability of extension services
11. Over-the-fence learning
12. Improved levels of education
13. Support from Uganda's development partners



Potential for scaling-up the case study

Uganda's experience directly demonstrates the potential for expanding pastoralists' commercial milk production. Within the country, production has spread from first-adopters in the Southwest Region to their neighbours, and then from the Southwest Region to the Central Region. The spread of milk production, like that of any innovation, encounters individualised obstacles that reflect differences in circumstances, e.g., a household's proximity to a cooler or the head-of-household's level of education. These obstacles may slow, but likely would not prevent, the spread of milk production.

Our research uncovered no systemic obstacles that cannot, in theory, be overcome in other regions of Uganda or elsewhere. Practices that have worked in the Southwest Region must be adapted to fit the economic, social, ecological and political circumstances of other areas. The most potentially serious obstacles derive from market conditions. Some producers, for example, live a long distance from Kampala and other major market centres. In concept, though, this obstacle can be overcome through the development of better roads that improve access to the centres and the acquisition of refrigerated milk tanker trucks to carry milk over the roads. Alternatively, milk production might focus more on encouraging and then satisfying demand for milk in smaller regional urban centres.



Sustainability

Uganda's experience suggests that pastoralists' transition to commercial milk production will be economically and socially sustainable. If there exists a demand for milk and an industrial structure to deliver products to consumers, producers connected to this structure will continue to produce milk as long as they can earn sufficient income to make it worth their while. Protracted subsidies likely will not be required to sustain them. Pastoral households and communities have embraced commercial milk production, especially once they realised that milk would not just increase their incomes but also provide a reliable income on a daily or weekly basis.

Not every pastoral household has embraced or benefited from this transition. Those who did not want to privatise land and adopt a sedentary lifestyle have been displaced, as have those who may have wanted to take this path but were squeezed out as others privatised all the land before them. To our knowledge, there exists no record of what has happened to these households. Anecdotes, however, suggest that they moved away, to more remote regions of Uganda or to Congo, where they can continue a nomadic pastoral life.

The environmental sustainability of commercial milk production remains unknown. The privatisation and fencing of rangeland, as well as the digging of ponds to collect water, alters the ecosystem, but the consequences have not been quantified. In general, the transition to milk production has induced households to cull their herds to a size that does not exceed the land's carrying capacity. As a consequence, casual observation suggests levels of erosion are declining.



Conclusion

When conducted appropriately and without inefficiencies imposed on it, pastoralism can be a viable social/economic system existing in sustainable harmony with dryland ecosystems (Abkula, 2010). In many parts of sub-Saharan Africa, however, pastoralism is operating in disequilibrium. This outcome results largely from policies and programmes that restrict pastoralists' rights over and access to land and water resources. Where easing of these restrictions has become impossible, pastoralist households face a long spiral toward loss of their livelihood. Anticipated changes in climate, with increases in droughts, disease and extreme heat, will stress households and communities further, threatening the sustainability of pastoral cultures and driving many toward a future of bitter poverty.

Pastoralists in the Southwest and Central regions of Uganda point the way toward a different future. Recognising the imperative to develop new sources of income from their herds, they have become the country's major source of milk for sale. The additional income, received as a steady flow throughout the year, has given households a solid economic foundation. This foundation has reduced their vulnerability to climate and other risks, insofar as it diversifies their food production and income. It also has enabled them to make investments that increase their resilience to future shocks, such as climate-related increases in the incidence of drought and illness. For example, many have dug ponds to carry over water from the wet season to the dry season, developed skills in using medicines to avoid or cure livestock diseases, diversified their activities to include links in the value chain other than the production of raw milk, and sent their children for more schooling than would have occurred otherwise. These developments increase both the short- and long-term resilience of pastoral families, the productivity of their land and water resources, and their ability to sustain a pastoral lifestyle and culture.

Their experience provides proven practices for expanding food production and adapting to climate change. These include:

- Granting pastoralist households tenure over land and access to water.
- Providing solid and credible political leadership in support of the transition to milk production.
- Encouraging crossbreeding of livestock to increase milk yields.
- Making available veterinary medicines essential to milk production.
- Demonstrating and encouraging improved management of rangelands in a manner consistent with milk production.
- Demonstrating and encouraging agro-pastoralism.

- Implementing national policies supporting both formal and informal milk markets.
- Supporting the expansion of dairy cooperatives.
- Improving infrastructure, such as roads, that lower the costs of getting milk to market.
- Improving the availability of milk-related extension services.
- Encouraging over-the-fence learning, both among nearby neighbours and across regions.
- Receiving appropriate support from development partners.

The spread of milk production from Uganda's Southwest Region to the Central Region demonstrates that the concepts embedded in these practices are transferrable. Applying them successfully, however, requires that they be adapted to the particular economic, social, ecological and political circumstances.



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Appendix: Case-study participants

Name	Address/Position
Yonasani Kashaaja	Farmer, Kiruhura District
Jonathan Muhairwe	Farmer, Kiruhura District
George Rwakashugi	Farmer, Kiruhura District
Dan Rukundugu	Farmer, Kiruhura District
Jackson Kanuunu	Farmer, Kiruhura District
Winnie Katushabe	Kanyabuhara Farmers Cooperative Society, Kiruhura District
Dauda Musisi	Private milk vendor, Kiruhura District
Godfrey Karamuzi	Uganda Crane Creameries Cooperative Union (UCCCU)
Elly Gumisiriza	Amos Dairies
Willy Murokozi	Rainbow Industries Limited
Robert Twinamatsiko	Veterinary Assistant, Kiruhura District Local Government
Dr Francis Mugisha	District Veterinary Officer, Kiruhura District Local Government
Ryan Atukwatse	Farmer, Nakasongola District
John Kazoora Kyapaapa	Farmer, Nakasongola District
Beatrice Ntambirwe	Farmer, Nakasongola District
Robert Kasangwa	Farmer, Nakasongola District
Fred Kasumba	Farmer, Nakasongola District
John Michombe	Farmer, Nakasongola District
Willy Karemyingo	Farmer, Nakasongola District
Thomas Buhangara	Farmer, Nakasongola District
Getu Birungi	Private milk/ghee vendor, Nakasongola District
Sicovia Mukanfizi	Private milk/ghee vendor, Nakasongola District
Kezia Kapakisa	Private milk/ghee vendor, Nakasongola District
Esita Kyasimiire	Private milk/ghee vendor, Nakasongola District
David Nsamba	Secretary for Production, Nakasongola District Local Government
Fredrick Byekwaso	Assistant Chief Administrative Officer, Nakasongola District Local Government
Dr Sam Eswagu	District Veterinary Officer, Nakasongola District Local Government

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