



## Dairy Drives Development in Kenya

**E**ster is a successful dairy farmer in Nandi County in the Northern Rift region of western Kenya, home to 47 percent of the country's dairy production.<sup>1</sup> Through a local women's dairy co-operative, she was inspired to develop her own dairy business. She has 15 head of cattle (one bull, 10 cows and four calves) producing a total of 105 liters (28 gallons) of milk per day; 10 liters are kept for consumption and calving and she sells the rest through her co-operative.

Ester has invested in the productivity of her farm by building a better cowshed with dedicated milking and feeding stations. She upgraded to high-grade dairy cattle that are more productive and can digest feed more efficiently. Increasing her milk output enabled her to hire three full-time employees and pay for veterinary and insemination services. To protect herself from risk, Ester purchases livestock insurance, grows her own fodder and saves a portion of her income in a personal bank account.

Ester has moved out of poverty and has attained financial independence. Yet for all her success, Ester knows she is vulnerable, particularly to illness and old age. She fears that someday she will be unable manage the farm, even with the help of her employees, and she will have to sell some of her cows or land to survive. Her savings will not be enough to live on if she becomes chronically ill or disabled.



### A DAUGHTER'S INSPIRATION

**Dalmani, Ester's daughter,** admires her mother and wants to help other women have the same opportunities to improve their lives. She is studying agriculture and seed science at the university, focusing on dryland crops.

The drylands of northeastern Kenya have the highest rates of rural poverty in the country along with the highest incidence of hunger and malnutrition. The lack of water and the short cropping season restrict farmers to fast-growing, heat-tolerant crops such as sorghum and millet.

Dalmani is studying how sorghum and millet can be improved to increase their resistance to heat and disease, and how these crops can be biofortified with essential nutrients like vitamin A, zinc and iron to help reduce the incidence of micronutrient deficiency.

She sees great potential in these improved crops, but knows from her mother's experience that widespread adoption of new technologies by farmers requires training and support. She hopes to be an educator as well as a scientist and thereby help bridge the gap between the researchers developing new technologies and the people who use them.



*The East African Dairy Development Project (EADD) aims to provide sustainable livelihoods and food security for one million dairy farmers in Kenya, Uganda and Tanzania by 2018. Heifer International leads the project, which helps farmers establish producer organizations (PO) so they can access inputs, credit, training and a market for their milk. They also learn preventative health practices and receive veterinary medicine. Photo credit: Russell Powell, courtesy of Heifer International*

## AFRICA'S DAIRY HUB<sup>2</sup>

Kenya's dairy farmers produce more than five billion tons of milk per year, the most in Africa. The dairy industry accounts for six to eight percent of Kenya's GDP and provides income for two million households. Consumers also benefit from Kenya's dairy productivity; per capita milk consumption is 100 liters (26 gallons) per year, more than any other developing country.

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**Annual milk output in Kenya grew from 66.3 million tons in 1963 to 5 billion tons in 2014.<sup>3</sup>**

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Kenya has two distinct dairy value chains. The **formal value chain** consists of highly-productive medium and large-scale farms (more than three hectares, with at least 10 cows)

focused on commercial production. Milk yield is at least 10 liters (2.6 gallons) per cow per day. Farmers in the formal value chain have cross-bred and high-grade dairy stock, make on-farm investments and have access to credit. They have access to an extensive cold-chain network with large-scale pasteurization capacity capable of processing 3.5 million liters (920,000 gallons) of milk per day. Compliance with quality and safety standards in the formal value chain is high, making it the principal source of milk for urban consumers and value-added dairy products.

The **informal value chain** accounts for 70 percent of the milk that is sold in Kenya. Small-scale producers with one to three cows and a farm size of less than three hectares produce milk primarily for their consumption and local sale. Input and technology use is low and milk yields average seven liters (1.8 gallons) per cow

per day. Raw milk is sold directly to consumers through an extensive network of informal traders. The cold-chain network is limited and adherence to quality and safety standards is minimal.

## WOMEN IN DAIRY — ESTER'S STORY<sup>4</sup>

With 15 cows, Ester is considered a medium-scale farmer and part of the formal value chain. She sends her milk to the co-operative where it is tested for safety and quality, chilled and sold in bulk to commercial buyers.

Membership in the co-operative is critical to Ester's success. She receives training in animal health practices, business management and product handling. Through the co-operative, Ester obtains veterinary

and insemination services, loans to improve her farm and purchase equipment and livestock index insurance which reduces the risk to her income from cattle accident, death and disease.

The fees for the co-operative services and financing are deducted from the payments she receives for her milk. The payments go directly into her **M-PESA account**, a phone-based mobile payment system used by two-thirds of adults in Kenya. Ester has a bank account for her savings, but she uses M-PESA for daily money management, including payroll.

The payment system is efficient, but Ester's co-operative often waits until the milk is sold before paying its farmers.<sup>7</sup> As a result, she is sometime short of cash, making it difficult for her to pay her workers on time.

To improve her cash flow and reduce costs, Ester grows two hectares of *brachiaria* grass as the principal source of feed for her cattle and to sell in the rapidly growing fodder market. The nutritious grasses are easy for cattle to digest, which improves their milk productivity and reduces the amount of methane they produce during the digestive process.

Demand for improved grass and legume fodder from small and medium-scale farmers is skyrocketing. Ester sells her *brachiaria* at the local "fodder store," which purchases and sells fodder for farmers in the area.



*The International Center for Tropical Agriculture (CIAT) has developed brachiaria grass varieties that are drought-resistant and increase milk productivity in dairy cows by 40 percent. Photo credit: Georgina Smith/CIAT*

## A SHARED-VALUE INVESTMENT IN ANIMAL HEALTH<sup>5</sup>

Africa is home to 20 percent of the global dairy cattle population, but produces only five percent of the global milk supply. This inefficiency in milk production has implications for Africa's efforts to reduce hunger and malnutrition and to reduce the environmental footprint of livestock production. It also indicates the widespread need for improvement in animal health practices and expanded access to veterinary medicines and knowledge.

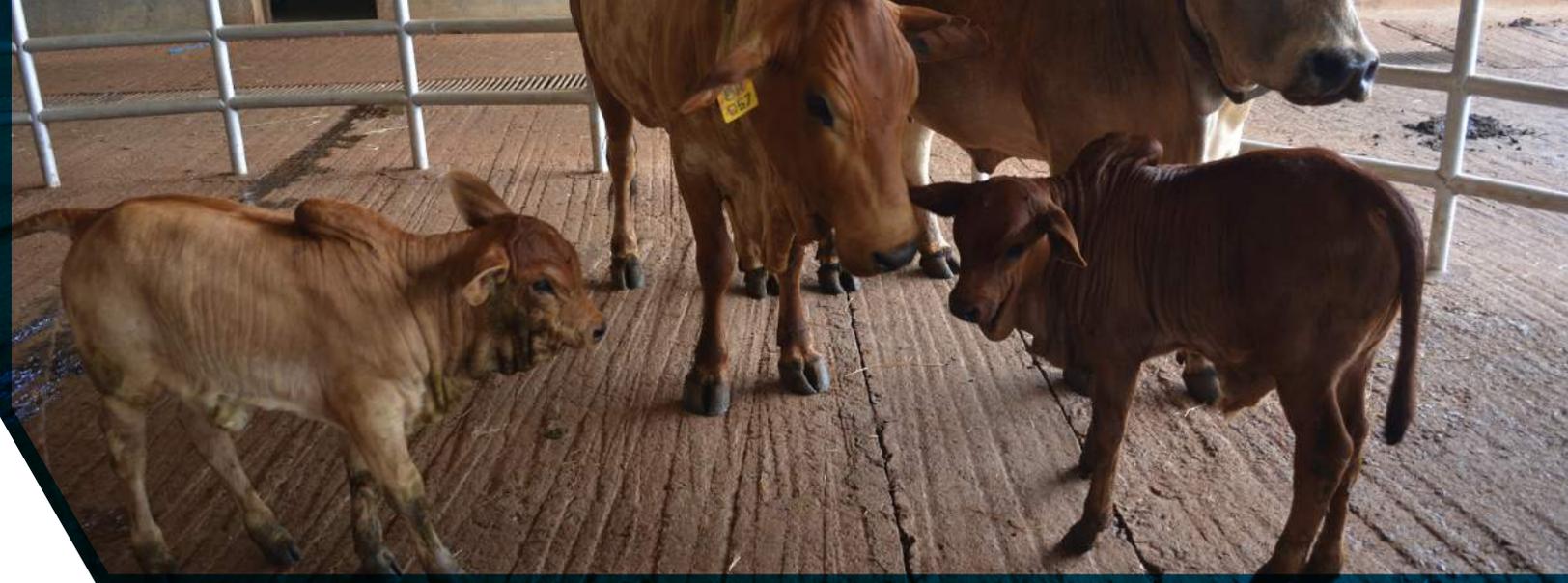
In Kenya, 80 percent of milk output comes from small-scale producers. Farmers with smaller herds and fewer resources are less likely to have access to veterinary care. **Elanco Animal Health**, with support from the **Bill and Melinda Gates Foundation**, is launching the **East African Growth Accelerator (EAGA)**, an initiative to help small-scale farmers in Kenya, Tanzania and Uganda improve the health and productivity of their dairy herds and poultry.

To ensure a sustainable livelihood and earn sufficient incomes to invest for the future, small-scale dairy farmers need consistently healthy, productive herds. Good animal care and feeding practices promote productivity and prevent disease, but access to affordable, quality animal health care products is also essential. EAGA will use a shared-value approach, providing farmers with affordable access to the products they need.

## CONSTRAINTS FOR PRODUCTIVE GROWTH<sup>6</sup>

Milk production is labor-intensive. In addition to the daily feeding and milking of the cows, dairy farmers must constantly manage manure, monitor the health of the animals and maintain milk safety and quality standards established by the co-operative. Ester finds it difficult to retain skilled workers. Her employees require constant supervision, which makes it difficult for Ester to attend to other activities. To reduce labor time and costs, Ester plans to purchase milking equipment and milk testing technologies. She hopes this will attract reliable employees interested in working with the new technologies.

Ester is also concerned about the health of her cattle and their exposure to diseases. Part of her county is infested with tsetse fly, the biological vector of *trypanosomiasis* (sometimes called sleeping sickness), a parasitical disease that causes anemia and emaciation in cattle. The condition is chronic and if left untreated, it is often fatal. If a cow survives the infection, its milk productivity can drop by



*Boran cattle are well-suited to the dryland areas of East Africa, but produce very little milk and meat compared to cross-bred and high-grade varieties. The International Livestock Research Institute (ILRI) farm in Nairobi is breeding Boran cattle that efficiently digest the low-quality grasses and silages that are common to the drylands. This will decrease methane emissions and improve milk and meat productivity. Photo credit: International Livestock Research Institute (ILRI)*

30 to 40 percent. Trypanosomiasis is a zoonotic disease that is passed between animals and humans via the tsetse fly, although the number of human cases in Africa has dropped substantially due to sustained public health efforts.

## KENYA'S CLIMATE CHALLENGE<sup>7</sup>

Kenya's leadership in Africa's dairy industry is endangered by climate change. A substantial increase in mean temperature is predicted for East Africa and could lead to a reduction in fodder output and grazing land capacity.

Increasing temperatures threaten the health and productivity of livestock. As droughts lengthen and intensify, large-scale cattle losses are likely. Small-scale farmers will be forced to sell cows or land to cope with the loss of income, making it difficult for them to recover financially when the drought is over.

As part of its climate change adaption and mitigation strategy, **Kenya's dairy sector needs to increase the productivity of its dairy cattle and reduce the GHG emission intensity of milk production.** Sub-Saharan Africa's milk production has the highest emission intensity in the world, three times greater than the global average, and almost double that of South Asia.

**Kenya is home to 75 percent of the dairy cattle in Southern and Eastern Africa; 80 percent of Kenya's milk output is produced by small-scale farmers.** By improving cattle productivity and reducing emission intensity, the dairy sector in Kenya can significantly mitigate greenhouse gases while increasing small-scale farmer income.

More than half of the emission intensity of milk production in sub-Saharan Africa comes from methane produced during a cow's digestive process. One strategy for reducing these emissions is to add legume silages to a cow's diet. Legumes are digested more efficiently, so a cow produces less methane and more milk.

Improving the genetics of dairy cattle is another way to reduce methane emissions and increase milk productivity. Kenya has already made strides in this direction; the country is home to more than 70 percent of the cross-bred and high-grade dairy cows in Africa. Sixty percent of the milk produced in Kenya (three billion liters) comes from high-grade cattle and cross-breeds. But high-grade dairy cattle are more susceptible to disease than local cattle varieties, so breeding for disease resistance is a top priority.

The drylands of northeastern Kenya are particularly vulnerable to climate change. This region receives less than 500 millimeters (20 inches) of rain per year and has fewer than 90 plant growth days. Many of the people in this region are pastoralists, moving regularly to find forage for their livestock

The **U.S. Agency for International Development (USAID)** funded the **Resilience and Economic Growth in Arid Lands-Accelerated Growth (REGAL-AG)** program to accelerate sustainable growth in the drylands by strengthening market linkages and developing livestock service and input markets. The program implementer, **ACDI/VOCA**, has constructed or renovated 12 livestock markets. The Merille Market in Marsabit County is close to the main road and easily accessed by livestock producers, traders and services providers. It has a large sale yard, animal pens, an animal health center, hay store and retail selling area. It serves as the economic hub for the 5,000 families who live in the area.



*DuPont's Africa Regional Technology Center in Delmas, South Africa. This is one of the facilities in DuPont's Africa Research Hub that produces an industry-leading multi-crop product portfolio for the continent. Photo credit: DuPont/Barbra Muzata*

## SEED SOLUTIONS TO MEET AFRICAN FARMERS' NEEDS

Farmers around the world need seeds that give them better yields, adapt to changing weather and soil conditions and provide protection against pests and disease. **DuPont** has a network of research facilities that develops varieties and traits to improve yield, weather tolerance and disease resistance.

In 2017, **DuPont opened the Africa Regional Technology Hub** to accelerate the development of seed products that meet the specific needs of African farmers and comply with government regulations in the region. The Hub will focus on maize, sunflower, soybean and drybean crops.

The Hub is comprised of several research facilities, including the Delmas Technology Center, which focuses on research activities in Eastern Africa, a multi-crop drought research center in Hoogekraal working on drought tolerance and Africa's biggest private Insectary, where the DNA of crop pests can be studied and stored. DuPont also has a biotechnology partnership focusing on the development of biofortified sorghum, which improves Vitamin A, zinc and iron content of the crop in popular local varieties.

The Insectary will be critical to the development of traits to combat local yield-robbing pests, some of which are unique to the continent. The DNA and dispersal patterns of pests can vary across geographies, so seed traits that effectively combat the pest in one region may not work in another. For example, the fall armyworm, which has destroyed the crops and livelihoods of millions of maize farmers in Africa, has a different genetic code than its relatives in other parts of the world. At the Insectary, researchers will have the resources to develop traits specific to African pests, which may help protect crop yields in the future.

### Taking It to the Farmer

In addition to developing targeted seed varieties, DuPont is working with international donors and African partners to provide small-scale maize farmers with seeds, agronomic training, postharvest storage and access to markets. In Ethiopia, the **Advanced Maize Seed Adoption Program (AMSAP)** has reached 250,000 farmers in just four years, more than double the original five-year projection. Farmers have experienced productivity increases of 300 percent.

To help farmers process and store their increased maize output, AMSAP has installed shellers and storage units in 16 villages and built new grain warehouses that have reduced postharvest losses.



*The AMSAP program is being replicated in other countries, including the Zambia Advanced Maize Seed Adoption Program (ZAMSAP), which launched in 2015. In Solwezi, Zambia, farmers compare maize grown from hybrid seeds to maize grown from open pollinated varieties. Photo credit: Ann Steensland/GHI*



## Policy Priorities for Improving Productivity and Sustainability in Kenya

### Invest in Public R&D and Extension<sup>8</sup>

Kenya has made significant investments and structural improvements in its national agricultural research system. In 2014, Kenya invested \$274 million (in 2011 dollars) in public agricultural research and development, a 36 percent increase from 2004. While the creation of the Kenya Agricultural and Livestock Research Organization (KALRO) in 2014 consolidated several commodity-focused research institutions into a single, coordinated research system, it faces funding and capacity shortfalls that threaten to reduce its effectiveness. Government funding for agricultural research flatlined in 2011 and donor investment levels are diminishing. With many of the country's agricultural scientists retiring in the coming decade, developing and retaining the next generation of researchers needs to be a top investment priority.

### Embrace Science-Based and Information Technologies<sup>9</sup>

At current rates of TFP growth, Kenya will meet only 11 percent of its food demand in 2030 through productivity growth. The economic, environmental and human consequences of low productivity are evident in Kenya's maize yield which is just 30 percent of the global average. To increase their output, Kenyan farmers are opening new lands for agricultural production, but prolonged drought and a widespread infestation of armyworm have reduced maize output by 50 percent, putting millions at risk for hunger. An open, science-based policy dialogue is needed to ensure that Kenya's farmers can access a range of tools and technologies, including traditional hybrid and genetically modified seeds that are drought-tolerant and pest-resistant, to meet the productivity and sustainability challenges they face.

### Enhance Private-Sector Involvement in Infrastructure and Agricultural Development<sup>10</sup>

Farmer co-operatives and producer organizations play a critical role in Kenya's dairy sector, creating economies of scale and supporting the development of a dairy value chain that produces more milk than any other country in

Africa. Policies that encourage private-sector investment in the transportation infrastructure and the nationwide network of milk cooling centers would reduce milk losses and increase farmer incomes. Reforms are also needed to support the efficient and fair management of the co-operative system and to incentivize co-operatives to increase leadership opportunities and training for women, who comprise 50 to 75 percent of dairy co-operative membership but hold less than one third of the leadership positions.

### Cultivate Partnerships for Sustainable Agriculture and Improved Nutrition

Partnerships between the public sector, private companies and producers are needed to help integrate Kenya's small-scale agricultural producers, traders and retailers into the national value chain, which is essential to meeting the country's goals for reducing hunger, malnutrition and poverty. Several examples from the livestock sector illustrate how this can be achieved, including the East African Dairy Development project (see page 49) and the work of ACDI/VOCA to construct livestock markets in the drylands (page 51). But the scale of these programs is small when compared to the scope of the challenge. Scaling-up and replicating successful efforts is essential, along with sustained financial commitment to support it.

### Foster Capacity for Regional and Global Trade<sup>11</sup>

In a regional analysis of trade capacity in East Africa, Kenya had high marks for trade facilitation and transparency. Kenya scored well for the extent of automation and external agency cooperation, as well as for the availability of regulatory information and documentation requirements and the presence of an appeals process to dispute customs decisions. But the country's primary contribution to the global agricultural value chain is raw materials such as coffee, tea, fruits and vegetables. Increasing Kenya's capacity for value-added agricultural production would boost export opportunities and help meet in-country demand for high-value agricultural products.