



Kingdom of the Netherlands



TRAIDE

Investment Opportunities in the Rwandan Dairy Sector

TRAIDE Rwanda



*Emily ter Steeg with support of John Bonnier
October–November 2019*

Contents

FACT SHEET RWANDAN DAIRY SECTOR	3
INTRODUCTION	4
1.1 Rwandan context	5
1.2 Sustainable growth of the dairy sector	5
1.3 Stakeholders in the dairy sector	6
MAJOR TRENDS IN THE RWANDAN DAIRY SECTOR	7
2.1 Production and farm systems	8
2.2 Processing	11
2.3 Inputs and services	12
2.4 Value chain structure	15
2.5 Domestic market	17
2.6 Imports and exports	19
INVESTMENT OPPORTUNITIES	20
3.1 Challenges in dairy sector	21
3.2 Opportunities in dairy production	23
Commercial feed and fodder production	23
AI services and genetics	23
Health	24
Barn design	24
Farm equipment	24
3.3 Opportunities in dairy processing	25
Processing plants	25
Processing machinery, cold chain logistics and storage	25
Product packaging	25
Dairy technology and product development	25
3.4 Opportunities in business development	26
Growing market: milk zones	26
Milk for school children	26
Premium product market	26
Export market	26
REFERENCE LIST	27



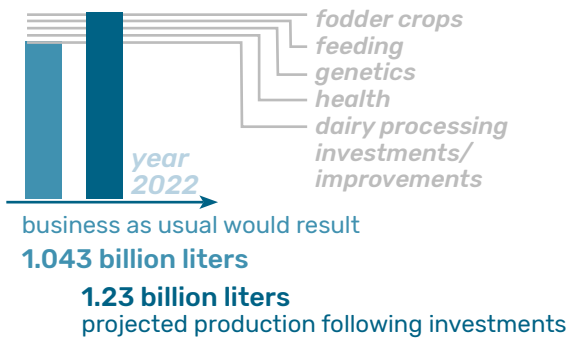
Fact sheet Rwandan Dairy sector



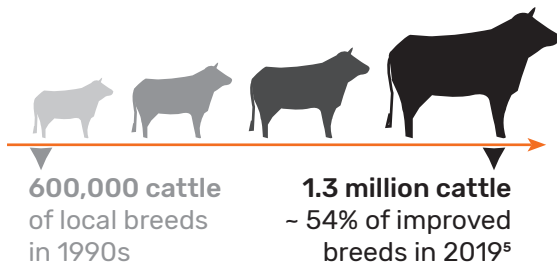
816,000 MT in 2019²
731,000 MT in 2015¹
⋮
50,000 MT in 2000¹

MILK PRODUCTION IN RWANDA

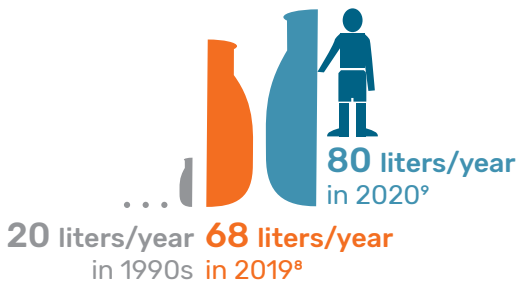
GOVERNMENT OBJECTIVE FOR 2022⁶



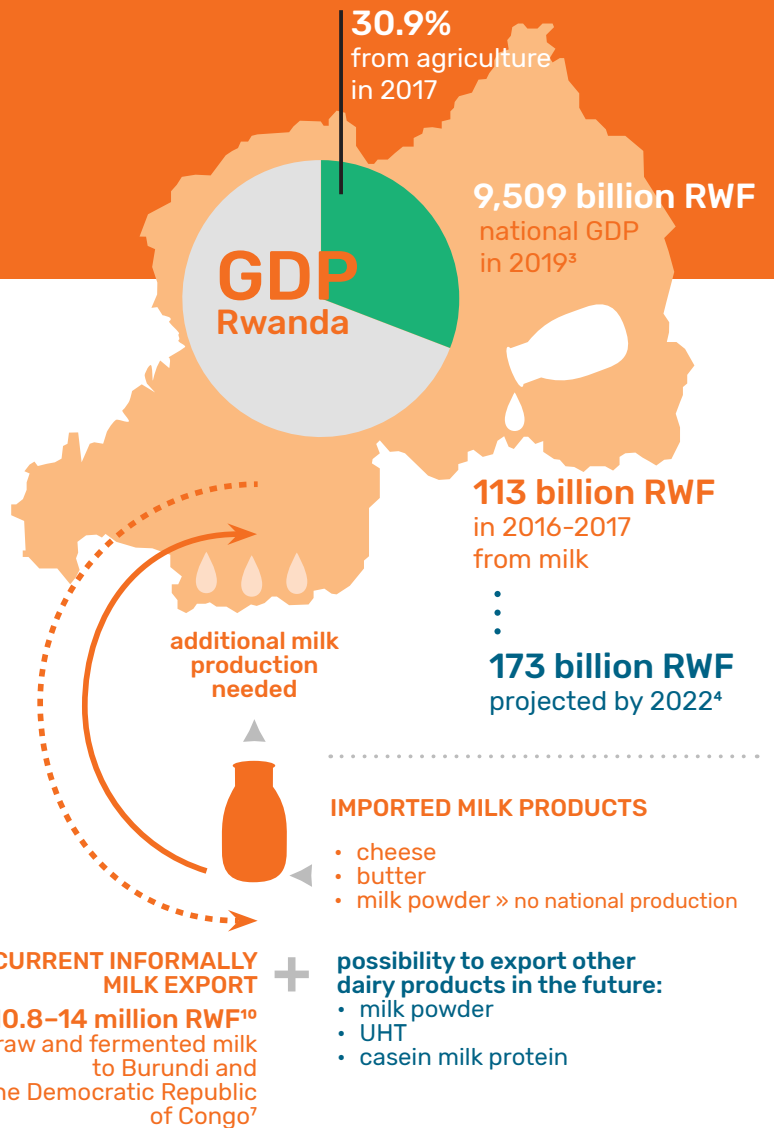
THE NATIONAL HERD



MILK CONSUMPTION



- mostly consumed dairy products:
- raw milk
 - pasteurized milk or fermented milk (Ikivuguto)
 - yoghurt⁹
 - cheese
 - (fruit) yoghurt
 - cream
 - butter



¹ FAO 2017; IFAD 2016; MinBuza 2016.

² Bonnier 2019; FAO (2019) reports 747 million liters of milk produced in 2016-2017. The NISR Household Survey (2017) shows an enormous difference between national average daily production during the low and high season: 909,329 liters in low season versus 2,007,803 liters in high season.

³ CIA 2017; World Bank 2019.

⁴ ILRI, MinAgri and RAB 2017.

⁵ IFAD 2016.

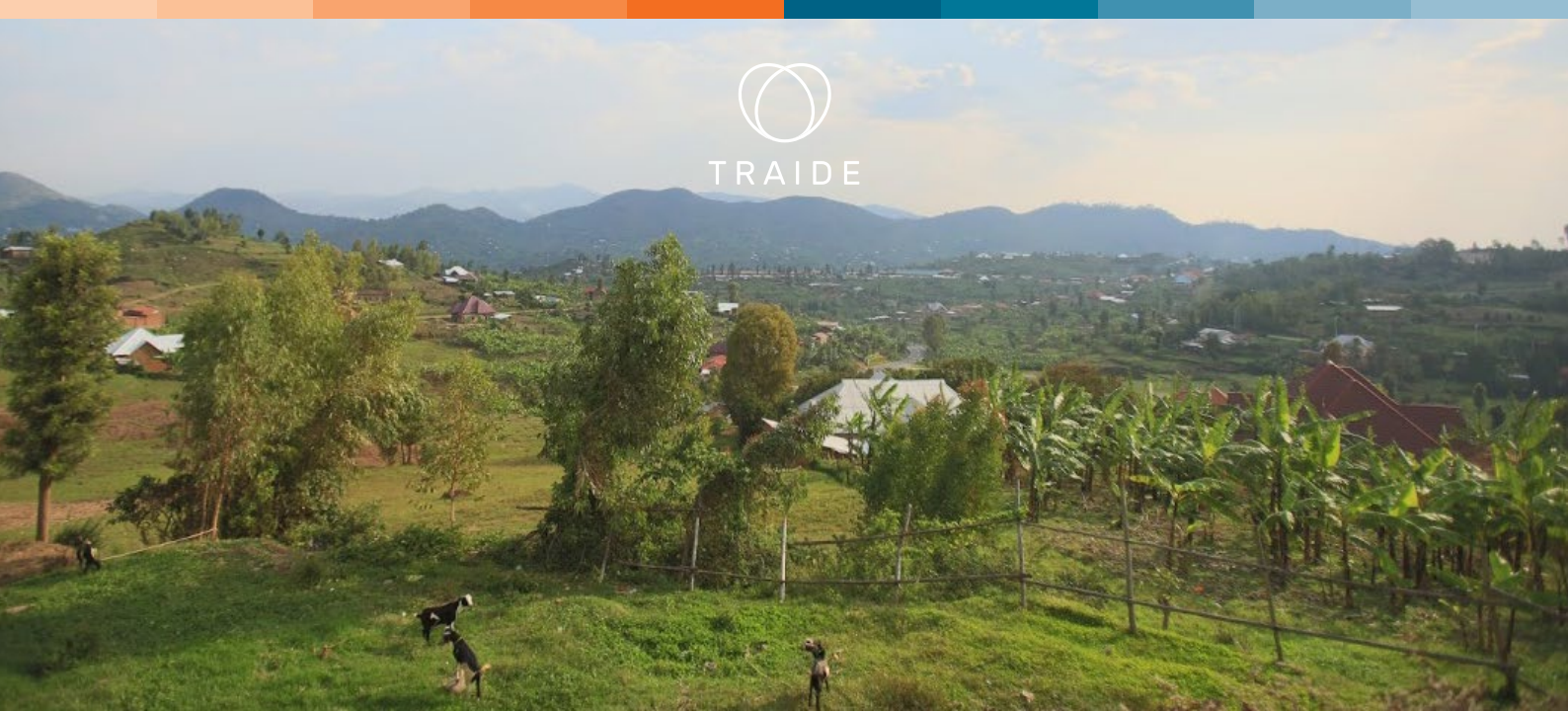
⁶ ILRI, RAB and MinAgri 2017.

⁷ IFAD, 2016; USAID & Land O'Lakes 2016.

⁸ FAO 2019.

⁹ Ngarambe 2019.

¹⁰ 1000 RWF is approximately equal to 1 EURO and 1.07 USD



01.

Introduction



This report will explore the possibilities for investment opportunities for Dutch and other local or foreign businesses in the dairy sector. Rwanda is moving through a phase of transition. The country seeks to develop equitable relationships with other countries moving from aid to trade. Sustainable and inclusive growth of the dairy sector can also contribute to this process.

1.1 RWANDAN CONTEXT

Rwanda still has a predominantly rural, agrarian economy. The livelihoods of 70% of the labor force depends on the agricultural sector and this percentage is even higher amongst the female half of the population for whom it is about 80%. The agricultural sector accounted for 30.9% of the Rwandan Gross Domestic Product (GDP) in 2017, which was 9,509 billion RWF in 2019.¹¹ Agricultural products account for 63% of export earnings with coffee and tea as the major crops for export. New sectors besides agriculture will need to provide the growing labor force with employment opportunities: the Rwandan population growth rate of 2.3% and almost 41% of the population is under the age of 14.¹²

The National Agricultural Policy published in 2018 outlines the development objectives of the Rwandan government. It aims to transform the agricultural sector from 'a subsistence sector to a knowledge-based value creating' sector. Modernization of the agricultural sector will be realized via implementation of policies promoting technological upgrading, crop intensification, high-value commodities, land registration, organisation in farmer cooperatives and decentralization. Private sector-led development and foreign investments are also major components of the government strategy.

1.2 SUSTAINABLE GROWTH OF THE DAIRY SECTOR

The dairy sector has major strategic importance when it comes to Rwanda's realisation of sustainable development goals. Sustainable growth of the sector can contribute to poverty reduction and strengthen local food and nutrition security.¹³ For this reason, the government of Rwanda has made significant investments in the sector. It seeks to move beyond subsistence farming towards a business-oriented, modern dairy sector. In the future, the dairy sector must become capable of meeting local demand for dairy products and producing surpluses for the regional market.

The contribution of milk to the national GDP was 113 billion in 2016–2017, the contribution of milk to the national GDP is projected to be 173 billion by 2022.¹⁴ The dairy subsector is the largest segment of the livestock sector in Rwanda, which accounts for 10.5% of agricultural GDP and is the fastest growing sub-sector within agriculture. The current 'farm gate' value of annual milk production is approximately RWF 117.0 billion (USD 162.4 million).

¹¹ CIA 2017 and World Bank 2019.

¹² CIA 2017.

¹³ IFAD, 2016 and MinBuza 2016.

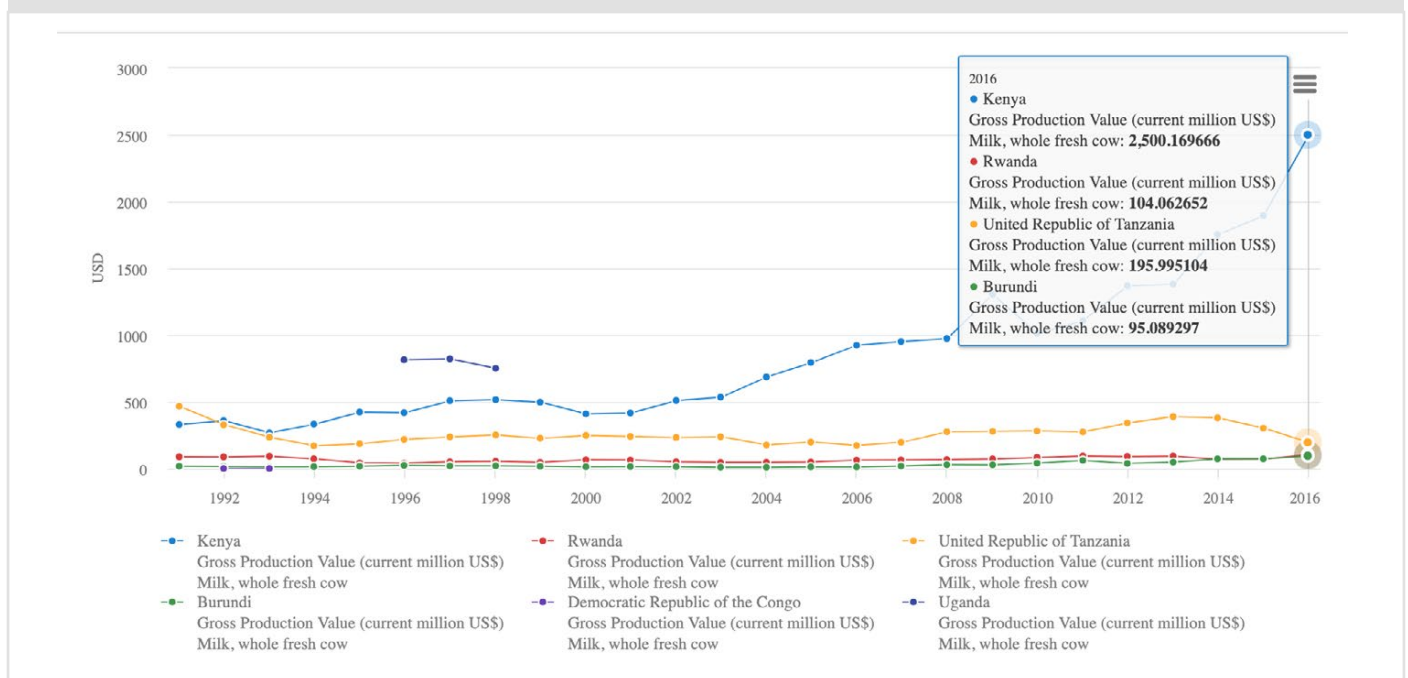
¹⁴ ILRI, MinAgri and RAB 2017.

Growth rates of the Rwandan dairy sector have been impressive. Historically, livestock and dairy cattle in particular have been an integral part of livelihoods in Rwanda. During the genocide against the Tutsi in 1994, approximately 80% of all cattle were decimated. The national herd has been rebuilt and is steadily growing. Nowadays, Rwanda is considered a considerable player in the regional dairy industry. There are informal exports of raw and fermented milk to neighbouring countries Burundi and the Democratic Republic of Congo (DRC). Nonetheless, the level of productivity and quality is still low in comparison to the most competitive dairy producer and exporter in the region: Kenya. There are no significant improvements in the gross production value of milk (see Figure 1 below).

1.3 STAKEHOLDERS IN THE DAIRY SECTOR

The major stakeholders in the Rwandan dairy industry are the dairy farmers and consumers. The most influential organizations in the Rwandan dairy sector are: Ministry of Agriculture and Animal Resources (MinAgri) and development organization International Fund For Agricultural Development (IFAD). Furthermore, Inyange Industries, SNV, Rwanda Cooperative Agency (RCA) and Send a Cow are also important players.¹⁵ Banks and Saccos play an important role when it comes to access to finance for dairy processing companies and cooperatives. Land O'Lakes used to be very influential player during the implementation of a large-scale project together with USAID. However, they have left Rwanda after the completion of the project in 2017. During this project, a platform was founded called 'the Rwanda National Dairy Platform (RNDP)' but this platform is now facing financial constraints.

Figure 1. TIME SERIES ON SELECTED DATA: GROSS PRODUCTION VALUE MILK IN USD (SOURCE: FAOSTAT, 2019)



¹⁵ Hulst, 2015.

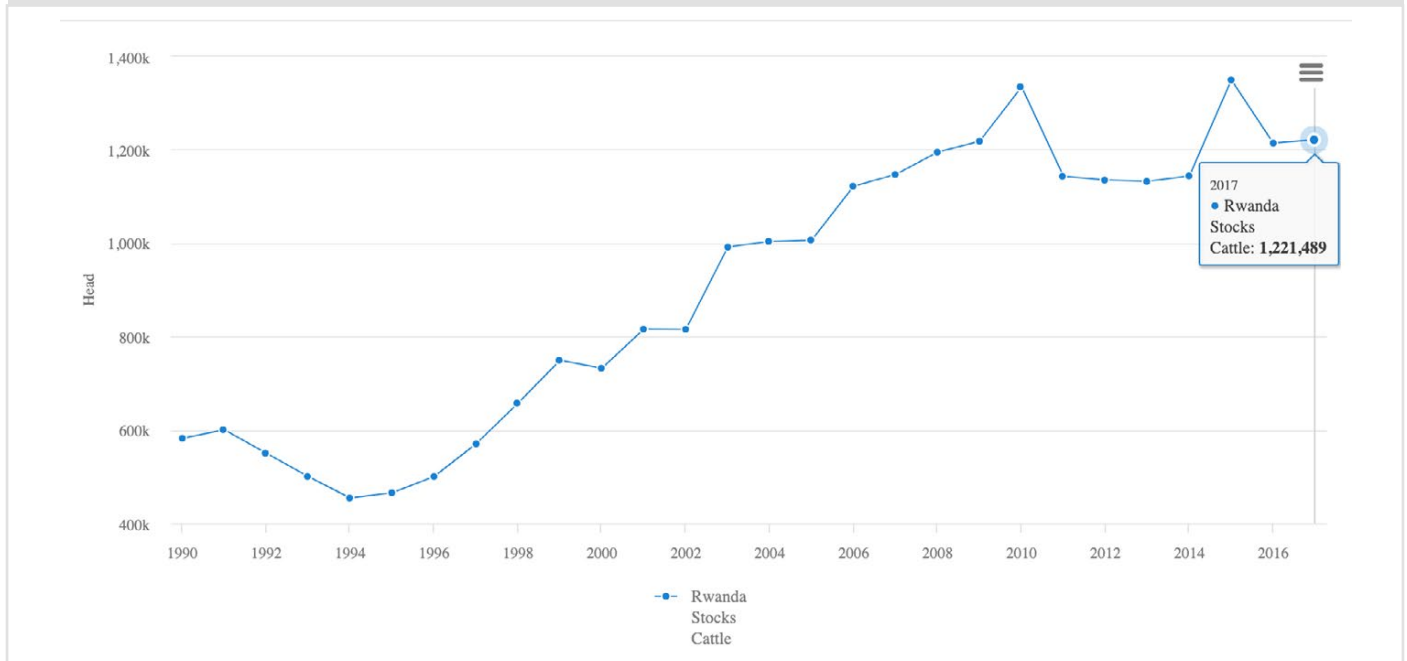


02.

Major trends in the Rwandan dairy sector

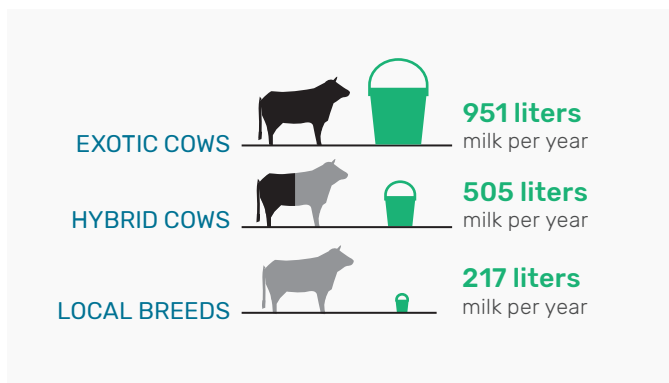


Figure 2. NUMBER OF CATTLE IN RWANDA 1990–2017 (SOURCE: FAOSTAT, 2019)



2.1 PRODUCTION AND FARM SYSTEMS

Currently, Rwanda is producing approximately 816,000 MT of milk.¹⁶ The total volume of milk produced in Rwanda has increased significantly from approximately 50,000 MT in 2000 and 445,000 MT in 2016.¹⁷ The national cattle herd now counts 1.3 million cows of which more than half are genetically improved dairy breeds (about 54%). Hybrid cows have become the main breed as a result of artificial insemination services. In 2017, the average annual milk production per cow was approximately 909 liters.¹⁸ Average daily production varies from 2 liters/day up to a maximum of 15 liters/day.¹⁹ There is a large difference between yields of exotic cows (951 liter/year), hybrid cows (505 liter/year) and local breeds (217 liter/year). It must be stressed that all yields are below the genetic potential of the cows.



Family versus commercial system

In the Dairy Master Plan, a distinction is made between two objectives for two types of dairy systems: Improved Family Dairy (IFD) and Commercial Specialized Dairy (CSD).²⁰ The government wants to strengthen both systems to achieve the ambitious growth in milk production. Firstly, 'Improved Family Dairy' is a system in which a family keeps 1–2 milking cows. Family Dairy is practiced by farmers in all provinces in mixed crop-livestock production systems. It requires few inputs but the level of milk production is moderate. The cattle are improved with genetics of crossbreds or exotics. Families also use improved feed and health services.

Secondly, 'Commercial Specialized Dairy' refers to dairy production systems with high inputs and high milk productivity. It includes grazing, zero grazing or stall-fed systems practiced at a commercial scale. The Family Dairy system is the dominant system in Rwanda. Most milk is produced by local smallholder farmers for own consumption or the local market. In 2016–2017, only 3% of the total volume of milk produced in Rwanda was produced by the Commercial Specialized Dairy system whilst 97% of milk was produced by the Family Dairy system.²¹

¹⁶ RAB 2019.

¹⁷ MinBuza 2016.

¹⁸ ILRI, MinAgri and RAB 2017:24.

¹⁹ NISR, 2017 and Hulst, 2015.

²⁰ ILRI, MinAgri and RAB, 2017.

²¹ ILRI, MinAgri and RAB, 2017:26.

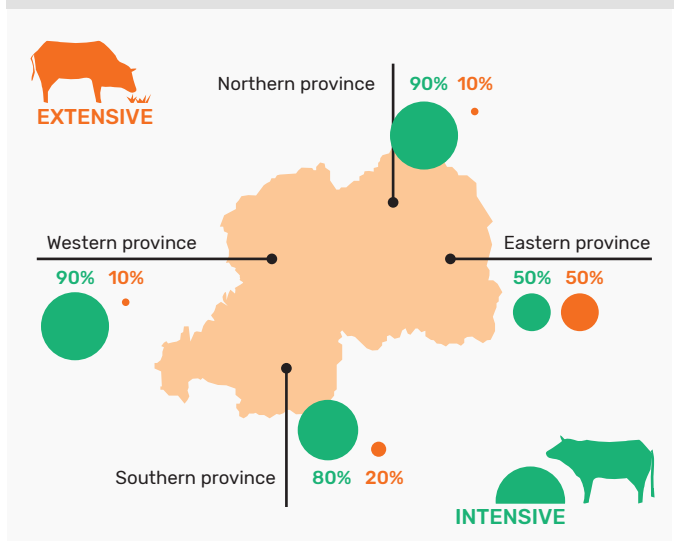
Semi-intensive versus extensive system

It is possible to distinguish between the intensive, semi-intensive and extensive dairy system. In intensive dairy systems, there is a confinement of animals (zero-grazing), a high level of management and optimum feed resource planning. In the semi-intensive system (semi-grazing), animals are partly confined: they are allowed to graze freely while being enclosed in the evening when feed supplementation is provided. In Rwanda, farms part of the semi-intensive system rely on so-called 'cut-and-carry practices' for feed provision: they harvest grasses and fodder crops including in off-farm locations. The extensive system (grazing) is a pasture based production system. In Rwanda, it is practiced in marginal and communal grazing lands (uncontrolled grazing), where few animals are kept. Average farm size is estimated at seven cows in the extensive system with an average of two cows lactating.²² In the semi-intensive system, households on average keep 2.6 cows of which 1.7 cows are lactating. The reported percentage of extensive versus intensive farming is shown in Figure 3.

Geography

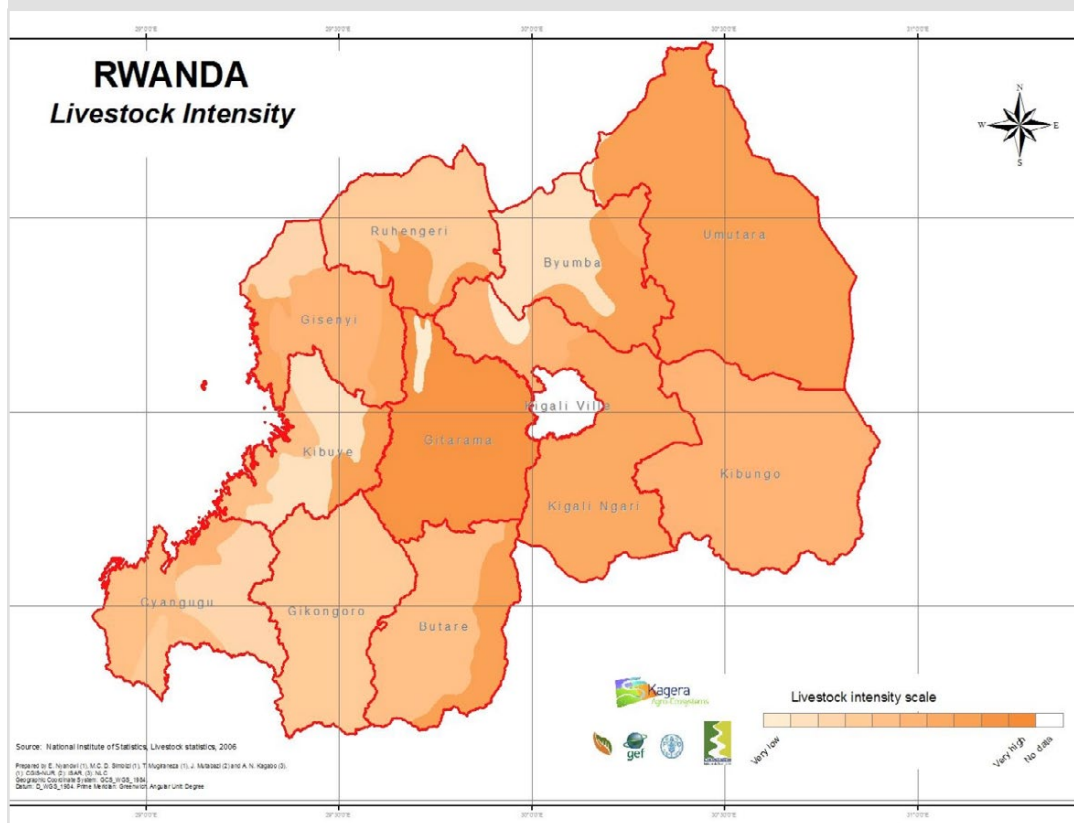
Dairy production is mostly based in the Southern and Northern Province of Rwanda. In the Southern province, 71.6 percent of households raise cattle and this percentage equals 70.9 percent in the Northern province.²³ The extensive system is mostly applied in the Eastern and Northern parts of the country whereas the semi-intensive system is applied in the Northeast and Southern provinces, as well as Kigali.²⁴ Seasonality has the greatest impact in the Eastern

Figure 3. REPORTED DIVISION FARM SYSTEMS (SOURCE: MUTONI, 2019)



province.²⁵ Dairy farming is practiced in open, deteriorated range areas. There is overgrazing and inadequate dry matter intake due to a lack of grazing management and observance of the land carrying capacity. In the Northern and Western province, the high altitude range and rugged topography favour kikuyu grass planted pastures fortified with clover legumes.²⁶ A sustainable dairy farming system can be built on these crops if rotational grazing systems are implemented.

Figure 4. LIVESTOCK INTENSITY IN RWANDA (SOURCE: FAO, 2010, <http://www.fao.org/3/a-au280e.pdf>)



²² USAID et al., 2016.
²³ NISR 2017:47.
²⁴ USAID et al., 2016.
²⁵ IFAD, 2016.
²⁶ IFAD, 2016.

Feed, fodder and water

At this point, the growth of the Rwandan dairy sector is constrained by lack of feed, fodder and water. The quantity and quality of inputs holds back the expansion of dairy farms and production per cow. Firstly, feed is scarce and expensive due to the low availability of raw materials such as maize. The lack of animal feed supply is a major constraint for all livestock industries in Rwanda. In Rwanda, napier grass and banana pseudo-stem are the most common feed items followed by weeds and cereal straws.²⁷ Many cows depend on grazing for feed and hence, they often receive too little.²⁸ In a zero-grazing system, average daily rations on dairy farms are estimated to contain a ratio of napier grass (7kg/day), sweet potato vines (1kg/day) and maize bran (0.5 kg/day).²⁹ The usage of concentrates or feed additives are not widespread because the market price of concentrate is higher than the price of milk. Hence, farmers are reluctant to invest in concentrate unless the extra feed results in a significant increase in milk yields.

Secondly, farmers need to provide their cattle with a sufficient amount of (clean) drinking water. Farmers can try to save money by cutting back on water expenses.³⁰ Seasonal influences play a big role in the dairy sector. The wet season is the period with the highest milk production because there is more feed (grass) and water available for the animals.³¹ During the dry season running from June till September, there is often a shortage of feed and water. Cattle is provided with less water, less nutritious feed and consequently, milk production drops.³² Especially in the Eastern Province, dairy farmers experience severe feed shortages and cattle mortalities shoot up.³³ Fluctuations in milk production are enormous: the manager of the Inyange processing plant in Nyagatare District, reported that they receive about 50,000 litres per day during the rainy season whilst they only receive about 3,000 litres per day during a drought.³⁴

Figure 5. FEED, FODDER AND WATER



Collection of milk

Milk is consumed by the household and excess milk is delivered to a Milk Collection Centers (MCCs) or directly to a dairy processor. In 2019, RAB reported that the number of MCCs in Rwanda had increased to 126 from 100 MCCs in 2016.³⁵ MCCs are either open all day or twice a day because they need to facilitate farmers with different milking times. Transportation of milk from smallholder farms to MCCs or any market outlet is done mainly by farmers themselves or household members walking or using bicycles and motorcycles. Some individuals rent or own trucks to transport milk from farms to milk shops, cafes, restaurants and milk-processing centers. Commercial dairy farmers and cooperatives also use trucks with the capacity to carry 10- to 50-liter milk cans from their farms to markets. A challenge is posed by the limited capacity of MCC tanks and sometimes it is not possible to store all milk delivered by farmers.³⁶ The government seeks to strengthen the decentralised milk collection infrastructure through the establishment of more MCCs.³⁷

The government seeks to enhance the commercialization of MCC operations. In 2015, a bill was passed into law by the Ministry of Agriculture to regulate the trading and handling of raw milk. The Rwandan dairy industry was growing fast but it was also facing challenges in terms of 'production of sub-standard dairy products, specifically milk'.³⁸ The unregulated informal dairy sector was causing market distortion.³⁹ People were buying and selling poor quality milk including milk that had been rejected on the basis of quality checks by MCCs and processors. The law of 2015 requires the presence of a qualified technician at each MCCs in order to maintain good quality and safety.

In 2018, a minimum milk price of 200 RWF (paid for one liter of milk) was introduced by the Ministry of Trade and Industry in order to protect farmers from a limited number of buyers.⁴⁰ In the past, farmers sometimes received 170 RWF per liter from MCCs; a price which did not cover production costs. MCCs or farmers who are able to deliver their milk to processors themselves receive 240 RWF per litre of milk. However, when MCCs or farmers rely on the processing company for transport, they will only be able to sell milk for 220 RWF per liter. Issues arise both during the wet and dry season. During the dry season, the supply of milk drops and there is a struggle to meet demand. During the wet season, there is overproduction and prices fall. Both MCCs and dairy processing companies receive more milk than they are able to process and/or sell.

²⁷ Mutimura *et al.*, 2015.

²⁸ Bonnier, 2019; Hulst, 2015.

²⁹ Bonnier, 2019.

³⁰ Bonnier, 2019.

³¹ Hulst, 2015.

³² AgriProFocus, 2016.

³³ IFAD, 2016.

³⁴ Ntirenganya, 2018.

³⁵ Bonnier, 2019 and IFAD, 2016.

³⁶ Bonnier, 2019.

³⁷ IFAD, 2016.

³⁸ African Farming and Processing, 2015.

³⁹ SNV, 2015.

⁴⁰ Ntirenganya, 2018.

2.2 PROCESSING

Dairy processing companies obtain raw milk from dairy farmers, private milk collectors (traders) and cooperatives. As explained above, raw milk is usually collected at the MCCs by the processor and transported to the processing plant. Cooperatives struggle to pay for the transportation of milk and are unable to invest in required means of transportation. Hence, they remain dependent on the processor to come and collect the milk. Some cooperatives and farmers are able to deliver milk directly to the plant and as a result, they get a better price. In Rwanda, the raw milk is processed into pasteurized milk, fermented milk (Ikivuguto), yoghurt, cheese, cream and butter. Processed dairy products are distributed through retail shops, supermarkets, schools, restaurants, cafes and hotels located in major urban centres.

The Rwandan dairy industry is still young and hence, the market for processed dairy is still developing. At the moment, the country has six processing plants with a capacity exceeding 10 MT per day. Many processors are small and process less than one MT per day. Triumph Africa, a South African investor, is planning on building a new processing plant for the local production of milk powder in Gicumbi. The main player in milk processing is Inyange Industries with a processing capacity of about 100 MT/day. Inyange has a market share exceeding 75% of processed milk and dairy products in Rwanda.⁴¹ The company is owned by Crystal Ventures, the holding company of the Rwandan Patriotic Front (RPF). The second largest dairy processor is Nyanza Milk Industries with a 5% market share.⁴² Additionally, Rwanda has about 25–30 small and medium-size processors of cheese and other dairy products.⁴³



Table 1.

Processor	Installed capacity (MT/day)	Used capacity (MT/day)	Milk intake wet season (MT/day)	Milk intake dry season (MT/day)	Product range
Inyange	150	40–100	40–100	40–100	Whole range, including UHT
Mukamira	40	16 (40%)	16	20	Mainly yoghurt
Blessed Dairies	30	6.5–7.5	5–7	5–7	Range of products, limited volumes
Nyanza Milk Industries	20	15–11	15	11	Mainly pasteurized and fermented milk
Gishwati Mountain Farms	10	5 (50%)	20	10	Cheese and fermented milk
Giheke	10		1-2		Fermented milk
Ingabo Dairy	5	5	35	5	Milk and cheese
Masaka Dairy	7	7–6	7–6	7–6	Range of products, limited volumes
Zirakamwa Meza	5–4.5	5–4.5	5	5–4	
Muhe Farm	5	2	2	2	
Indatwa-Fumbwe	2	2	1.5	2	
Haji Dairy	2		2		Fermented milk
WMPC	1.2	1.2	1	0.8–0.9	
Gishwati Farms	1	0.7–0.8 (70–80%)	1	0.7–0.8	
Fromagerie Urugero	1	0.5–0.7	0.4	1	
La Caves de l'Abondance	1	0.3 (30%)	0.3	0.3	
Uruhongore	0.4	0.4	0.5	0.4	

* Information could not be gathered regarding: Burera, Imanzi Gouda Cheese, Fromagerie La Reine, Ubumwe farming company, Royal cheese dairies, Karisimbi Ghee Processors Ltd and FNICO. Crystal Industries has been closed and is no longer operational.

⁴¹ IFAD, 2016.

⁴² Bonnier, 2019.

⁴³ IFAD, 2016.



The total processing capacity in Rwanda is currently estimated at 290 MT/day. However, the capacity of processing companies is underutilized: only approximately 35–40% of the processing capacity is being used.⁴⁴ Many of the processing plants attain volumes that are significantly below their capacity: only about 20% of all milk reaches the formal processing industry.⁴⁵ Underutilization of capacity can be explained by a lack of market demand for processed products. The processors refuse to buy more milk when supply threatens to exceed market demand for processed dairy products.

There is low market penetration in local and regional markets as processors continue to compete with the large informal market.⁴⁶ Consumers buy dairy on the informal market because products are cheaper. However, quality is unregulated and hence, sub-optimal. Meanwhile, costs of processing and packaging remain high due to capacity underutilization and a lack of economies of scale, cost of imported packaging materials, cost of electricity and inefficient processing technologies.

The dairy processing industry used to face severe challenges due to the low quality of raw milk. Inyange used to reject 60 percent of milk coming from MCCs across the country limiting its ability to both increase milk volumes and create value-added dairy products.⁴⁷ Nowadays, rejection rates at some MCCs are close to zero ranging from 0–1%. Other MCCs still face severe challenges and rejection rates can reach up to 52%.⁴⁸ These large differences show potential impact of government investments and development projects. Farmer cooperatives also train farmers to mitigate the risk of rejection.

The quality of raw milk is affected along the value chain. First, hygiene is poor during the milking process. Second, there are no cooled storage facilities on the farms and there is no chilled transportation to the MCCs. Thirdly, power cuts at MCCs can also degrade the milk quality.⁴⁹ Concerns expressed frequently by chain actors include: milk diluted with water, high bacterial count, milk containing antibiotics or aflatoxins, and sour (spoiled) milk in the supermarket. Some consumers and premium hotels have switched to imported products following their concerns about the quality of local dairy products.

Finally, there is no quality-based payment systems to incentivise farmers to further improve their farm management. Few processing plants pay MCCs for the quality of the bulk whilst most plants do not pay for quality at all. Individual farmers are not paid a higher price for milk with elevated levels of protein and fat, which would improve the quality of dairy products. Some consumers and premium hotels are concerned about the quality of local dairy products leading them to switch to imported products. Quality based payment linked to the milk supply of individual farmers can change this. Moreover, cooperatives like IAKIB are currently running a pilot with a mobile phone application of Heifer to collect information on MCCs. The app enables cooperatives to send updates regarding the quality of milk and to make payments via mobile money to individual farmers. Therefore, there are already some technological tools available to support the implementation of such a system.

2.3 INPUTS AND SERVICES

Animal feed

Feed supply has already been identified as a weak and critical link for the Rwandan dairy sector. The use of premixes or fortified animal feed is limited. No import duty or VAT is levied on production inputs or feed components.⁵⁰ However, there is a foreign exchange premium which causes market distortion. Nonetheless, other obstacles remain to the access of farmers to high-quality animal feed.

Firstly, awareness regarding the balanced rations required to keep cows productive and healthy is low. In collaboration with RAB and cooperatives, feed mills and feed dealers could contribute to feed quality and feeding by giving more information about the quality of the feed and the use of feed in rations. It should be strongly emphasized that roughage will keep cows healthy and productive while reducing feed costs. Secondly, costs of animal feed are too high for most farmers: forage is scarce and concentrates are expensive. Production of fodder and fodder conservation are constrained by a lack of land. At the moment, many dairy farmers can simply not afford to buy concentrate or fortified feed for their cattle. Agriterro has collected data during field visits to farmer cooperatives in 2019. The results have been summarized in Table 2.

⁴⁴ IFAD, 2016.

⁴⁵ MinBuza, 2016.

⁴⁶ SNV, 2015 and IFAD 2016.

⁴⁷ USAID adn Land O'Lakes 2016.

⁴⁸ IFAD, 2016.

⁴⁹ Hulst, 2015.

⁵⁰ Miklyaev *et al.*, 2017.



Table 2. DATA COLLECTED DURING FIELD VISIT VIA FARMER COOPERATIVES
(SOURCE: AGRITERRA, 2019)

Prices used in calculations	Unit	RWF	Euro
Concentrate for mature and lactating cows	Price/kg	267.03	0.26
Concentrate for young stock	Price/kg	275.00	0.27
Additives (salt licks) 5 kg block = 5000 RWF	Price/kg	1,000.00	0.99
Napier grass (500 kg = ±5500)	Price/kg DM	43.52	0.04
Sweet potato vines (100 kg = 4000 RWF)	Price/kg DM	131.87	0.13
Maize bran	Price/kg DM	197.80	0.20

Thirdly, farmers are suspicious of the quality of concentrates available on the market. The quality of concentrates is generally poor due to lack of quality control regulation of the feed industry.⁵¹

Animal health

In Rwanda, veterinary services are organised by RAB through district and sector veterinary officers. Veterinary equipment is available in veterinary pharmacies and drugs as well as vaccinations can be imported duty and tax free.⁵² In the past years, a privatization strategy has been implemented by the government to improve access of farmers to animal health services. Public veterinary officers still provide services at district offices and in the field. Meanwhile, they also supervise private veterinary officers who report to them on their activities.⁵³ All private vets need a license to operate and are trained by RAB. They also receive their equipment via the government. Some cooperatives employ their own veterinary technician and members do not have to pay for their services. MCCs are considered a service hub for farmers where

they can access vets, paravets, medicines or feed.⁵⁴ There is a pharmacy at most MCCs. Increased participation of the private sector has had a positive impact on the access of farmers to animal health services. However, the system is still overstretched and more needs to be done in terms of training, policy and regulation.⁵⁵ The service area of a single veterinary officer on average covers about 3,200 cattle in addition to all other animal species.⁵⁶

Breeding and genetics

The Rwandan government seeks to improve access of farmers to Artificial Insemination (AI) services. Since 2000, it has implemented several projects to improve farmer access to AI. A local production unit of semen and liquid nitrogen production equipment have been purchased and established at the Masaka bull station.⁵⁷ AI inseminators have been trained and equipped. Moreover, the price of normal semen is not expensive thanks to subsidy policies.⁵⁸ Nonetheless, the use of AI continues to be constrained by the limited coverage and quality of veterinary services. The success rate of inseminations is unknown but is likely low: RAB reports a success rate of 40–45% but this number does not take into account the number of repetitions.⁵⁹ Rwanda has a low adoption rate of AI: farmers' preference for AI varied between 3 and 28%.

At this point, there are still too few AI technicians in Rwanda and these para-vets lack practical knowledge and experience.⁶⁰ The ongoing process of privatization has a positive impact on the access of farmers to animal health services. The adoption rate of AI depends on the general system for animal health services because AI as an isolated activity implemented by AI technicians cannot generate enough revenue to survive. Limited skills in heat detection seems to be the main reason for low success rates. In the future, the government seeks to further privatize the sector commercializing the delivery of AI services.

In terms of pricing, RAB used to be the only provider and implemented a fixed price of 13,000 RWF: 5,000 RWF for semen, 5,000 RWF for veterinary service and 3,000 RWF for transport. Nowadays, RAB is still the only provider of semen but veterinary practices are being privatized. Unions and cooperatives can hire their own inseminators providing the service themselves reducing costs. Many unions and cooperatives subsidize the price of AI for its members to raise productivity of breeds. The USAID and Land O'Lakes projects—running from 2012–2017 – even enabled certain unions and cooperatives to provide AI services to their members for free. It is considered an important investment in the cooperative.

⁵¹ IFAD, 2016.

⁵² Miklyaev *et al.*, 2017.

⁵³ Bonnier, 2019.

⁵⁴ Hulst, 2015.

⁵⁵ IFAD, 2016.

⁵⁶ IFAD, 2016.

⁵⁷ IFAD, 2016.

⁵⁸ Bonnier, 2019.

⁵⁹ IFAD, 2016:4.

⁶⁰ Hulst, 2015.

Finally, low reproductive performance also results in low milk productivity. Farmers tend to wait with the insemination of cows. The Household Survey showed that about half of the adult females are not in milk: lactation periods are short ranging from 125 to 180 days whilst calving intervals are too long.⁶¹ On average dairy farmers face long calving intervals of approximately 480 days. Please note that these numbers are slightly contradictory: a fifty-fifty divide of productive and unproductive cows would indicate a lactation period of approximately 150 days and calving intervals of about 380 days.⁶² A calving interval of 480 days would mean less than half of the cows is in milk.

Machinery and equipment

Investments in cooling, processing and harvesting machinery are required to increase productivity and quality of the dairy industry. At this point, almost every cow in Rwanda is milked by hand and this practice will likely remain. Two main reasons can be identified for the low mechanization. Firstly, the average land size of a dairy farm is 0.6 ha: this scale does not allow for nor does it require mechanisation. The use of machinery is only feasible when farmland and machines are used collectively. Secondly, Rwandan farmers generally do not have financial resources to invest in durable assets.

Cooperatives and medium- and large-scale farms will benefit from low-cost and basic machinery and equipment. Also, new and existing processing plants create demand for dairy-processing equipment. Nonetheless, the scale of dairy machinery and equipment is too large even if they are purchased and used by a cooperative. It is necessary to look at the niche market for small- and medium-size processing. An example of such a niche product is a mini-dairy for batches of 500 liters.

The price-quality ratio offered by Indian and Chinese companies is usually more appealing in comparison to European products. European manufacturers do tend to provide better services and warranties. Potentially, basic second-hand equipment from Europe could prove a good fit as new, high-tech equipment is likely unnecessary. Public or donor funding is usually required for the purchasing of milking equipment, cooling tanks, tractors and machines. RAB uses tenders to purchase machinery from international manufacturers. Cooperatives can enable farmers to also make investments in such equipment together.

Access to finance

Access to finance continues to be a struggle for farmers. Commercial banks consider them risky clients because they cannot provide collateral and do not have a financial track record.⁶³ In 2016 IFAD listed the following required investments at the production level: acquisition of improved breeds; construction of zero-grazing units; pasture development; dairy farming inputs and equipment. Moreover, investments are also required moving up the value chain to fund: milk collectors (containers); transportation machinery (trucks); new milk collection centres; processing machinery and milk traders.

It is possible to distinguish between three different mechanisms through which farmers have access to finance. Firstly, dairy cooperatives often have a Savings and Credit Cooperatives (SACCOs) wing that provides savings and loans. The SACCOs are important institutions in rural Rwanda offering financial services to people with limited access to commercial banking services. It must be noted that it remains a challenge to improve the professionalism of these institutions and to reduce their interest charges.

Secondly, farmers can obtain advance payments by the dairy cooperative, which will be deducted from their total milk sales at the end of the month. Thirdly, farmers can sometimes gain access to 'formal' commercial banks where the dairy cooperative has its accounts. Members can get security loans from the bank when the cooperative acts as a guarantee.⁶⁴ Two other examples of mechanisms enabling dairy farmers to access financial services are self-help mechanisms of Accumulated Savings and Credit Associations and Table Banking initiatives. The members of dairy cooperatives generally have improved access to finance thanks to various services offered by the cooperatives. However, only about 2–7% of dairy farmers are members of dairy cooperatives.⁶⁵

In 2016 USAID and Land O'Lakes have worked with financial service providers to develop new financial products for dairy farmers. The adaptation of new underwriting methodologies enabled them to target opportunities in dairy taking into account high potential. Their program also supported banks to develop completely new products that would better meet the needs of a growing base of dairy farmers and entrepreneurs.

⁶¹ NISR, 2017.

⁶² Bonnier, 2019.

⁶³ USAID and Land O'Lakes, 2016.

⁶⁴ Hulst, 2015.

⁶⁵ IFAD, 2016.



2.4 VALUE CHAIN STRUCTURE

Informal market

The value chain of Rwanda is characterized by fragmentation and dominant informal sector. Dairy farming is unorganized and widespread: most farmers consume raw milk at home and sell excess milk for low prices locally. Farmers remain disconnected from processors or the market and they struggle to earn an income. In the informal sector, milk handling and trading is done through a system which does not guarantee quality and food safety.

Milk is generally collected from farmers without any testing, is transported in plastic containers which are not easy to maintain required hygiene standards, and the entire handling and trading environment is open to deliberate or opportunistic adulteration/contamination of the milk.⁶⁶

Approximately 75–80% of all milk produced in Rwanda is handled by informal traders.⁶⁷ There are three categories of informal traders. The first category of traders are called milk collectors: they buy milk directly from farmers, transport it, and sell it to intermediate buyers (traders or processors). The second category of traders are called hawkers: they sell milk to final consumers through door-to-door deliveries. The third category of traders collect and retail through designated sales point for raw milk. These points are interchangeably called milk kiosks, bars or zones.

Formal market

By contrast, the quality of milk and food safety are guaranteed in the formal system. In 2015, a Ministerial Order on milk collection, transportation and marketing was passed into law seeking to formalize the dairy sector in Rwanda. It aimed to improve quality of milk ensuring minimum standards are implemented. The regulation defines food safety standards for milk handling and trading. Moreover, it requires all traders to get a license and adhere to these food safety standards. The traders are only allowed to sell milk which has been tested and certified. In 2016, it was estimated by IFAD that only 10–15% of traders were complying with the new law.

Processors are struggling as the value chain can squeeze them from both sides. On the one hand, processors need to buy milk from a dispersed network of farmers who oversupply during the wet season and under-supply during the dry season. On the other hand, consumer demand for processed products on the formal market remains low because purchasing power is still low. Therefore, the informal market continues to be the number one competitor for processors and it is difficult to develop



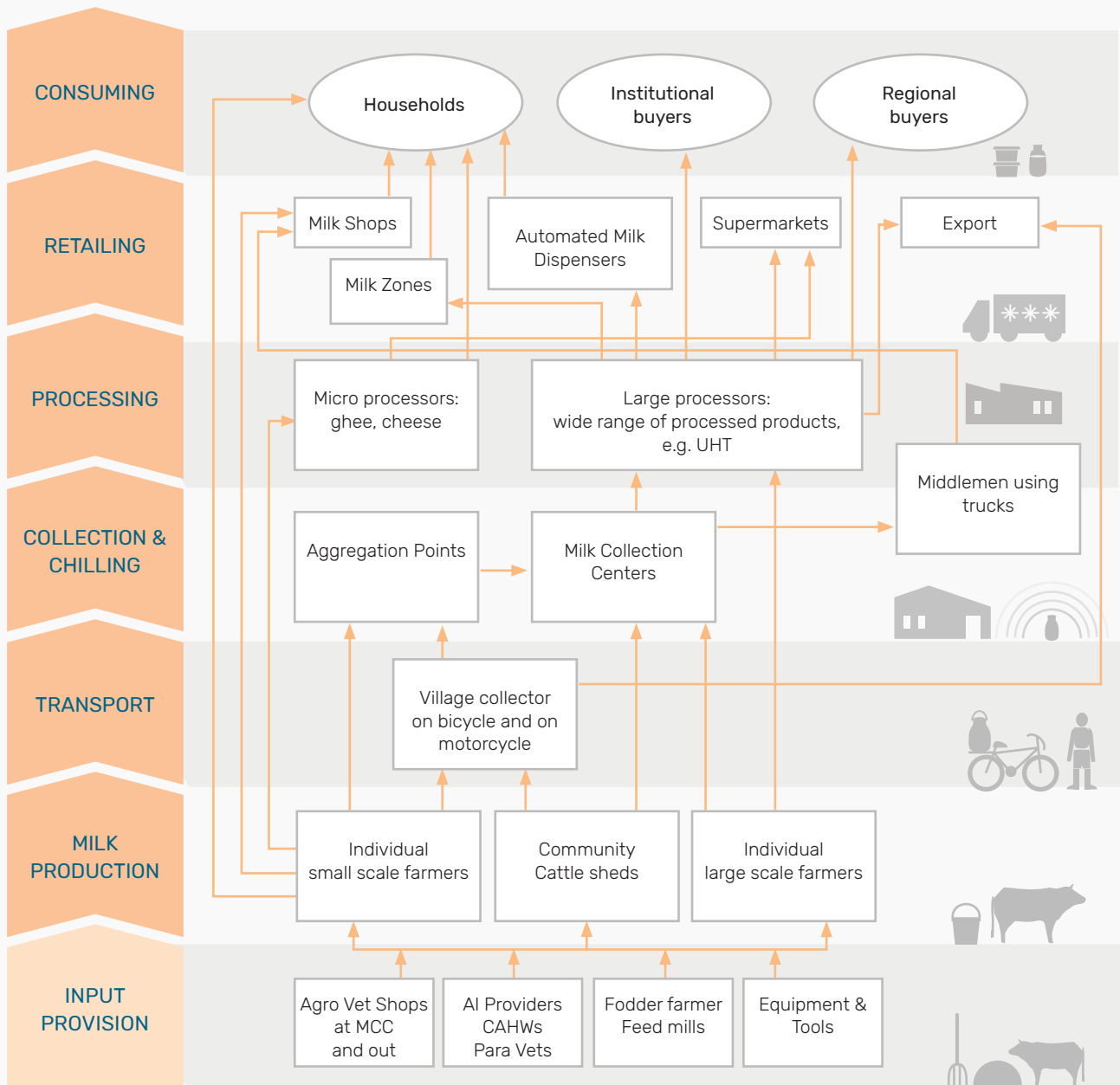
economies of scale. As a result, IFAD concluded that farm-gate prices paid to dairy farmers are the lowest in the region, while the Rwandan consumer pays the highest prices for processed milk and other dairy products.

In the dairy value chain map below, there are three types of sales points: supermarkets, milk shops and milk zones. Supermarkets are only present in the large cities and only sell processed milk products. Milk shops are small local supermarkets (also called alimentation) in which raw milk is the main product sold but other products are also available. They are owned by private individuals. Milk zones are owned by a processor and they sell raw, fermented and pasteurized milk as well as other dairy products under their own brand. The bulk milk kept in a cooler; it has been pasteurized so customers no longer have to boil it. It is possible to buy any quantity of milk and people can also drink a glass of milk. In the past, milk bars were a widespread phenomenon in Rwanda. Their sign boards used to state: *Amata na Fanta Bikonje* meaning *Milk and Fanta*. Nowadays, most milk bars have been transformed into ordinary cafes.

⁶⁶ IFAD, 2016.

⁶⁷ IFAD, 2016: 9 and 24.

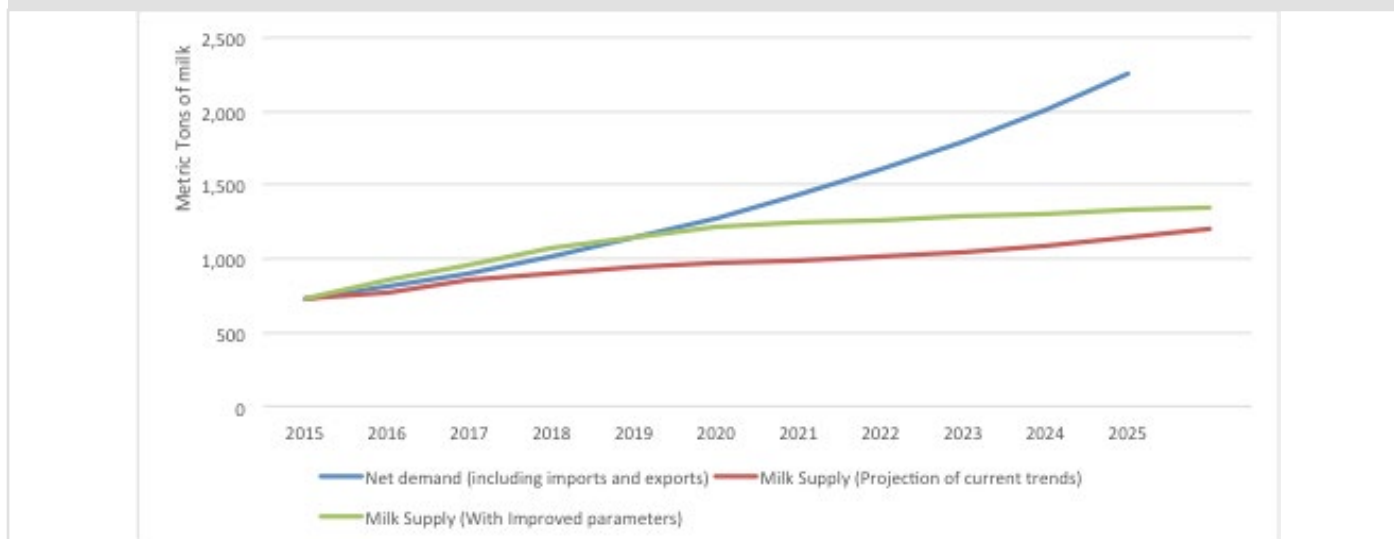
Figure 6. DAIRY VALUE CHAIN MAP (SOURCE: HEIFER PROJECT INTERNATIONAL, 2016)



Generally, retailers report they have no difficulty to get the desired supply of dairy products. They can order via email or phone and the local distributor of the processing company will take care of the delivery. Inyange has distributors in every zone. The order process is easy and the risk of running out of stock seems low. Retailers report zero/minimal losses of products following a failure to sell a product before the expiration date. Usually, retailers have contractual agreements with processors that they can return dairy products, which are about to expire. At this time, milk can still be made into yoghurt. However, it must be noted that food waste is deemed a controversial issue in Rwanda and these statements might not be fully accurate. This statement indicates that retailers always seek to have minimal stock to minimize their risk.

The MCCs are the strong links in the Rwandan dairy chain. They are key to the development of a strong and widespread decentralised network of milk collection and processing for dairy products. MCCs need to develop a reliable and profitable market for the collected milk. Farmers can organise themselves around a MCC and build an economy of scale and build partnerships with buyers. The cooperatives play a key role in expanding the MCC network. They can organize logistics and connect farmers to MCCs and MCCs to processors or buyer. When farmers are connected to the formal market via MCCs, the quality and quantity of local milk can be increased and farmers can also earn higher incomes.

Figure 7. MILK DEMAND PROJECTION (SOURCE: IFAD, 2016:10)



2.5 DOMESTIC MARKET

On the domestic market, milk can offer an affordable source of animal protein. About 20% of the Rwandan population is considered to be food insecure and 38% lives below the poverty line.⁶⁸ Meanwhile, the Rwandan population is growing fast with an annual growth rate of 2.3%.⁶⁹ Demand for milk is growing along with the population. Moreover, demand is also rising thanks to increased awareness regarding the benefits of milk consumption. The deficit between milk demand and supply projected is worrisome (see Figure 7 above). However, a report written by a USAID and Manage from 2016 shows demand might not rise as fast and predicts there will be no real gap between supply and demand. This conclusion is supported by the available data on milk production and consumption of RAB from 2000–2019.

It is possible to distinguish between three categories of Rwandan dairy consumers on the basis of household income. Firstly, low-income households generally buy locally produced (raw) milk directly from farmers. In rural areas, households usually prepare fermented milk (ikivuguto) themselves according to a traditional recipe rather than buying. Some households may buy pasteurized or fermented milk from MCCs. Secondly, middle-income households buy in milk shops (alimentation), milk zones and at MCCs. In a few instances they buy dairy products in the large supermarkets. Thirdly, high-income households will generally buy all dairy products in large supermarkets. Unless, they want unprocessed milk in which case they will also visit the local milk zone or milk shop.

Milk is popular and consumed by all three categories of consumers. Fermented milk (ikivuguto) is also consumed amongst all three categories but sometimes too expensive for low-income households. Consumption of other dairy products like yoghurt, butter and cheese is not common. Butter and cheese are historically not very popular in Rwanda and consumption rates

remain low. Moreover, these products are still considered luxury products. The large price differences make this apparent: one litre of unprocessed bulk milk is sold at 400–500 RWF in a local milk shop or milk zone whilst the price of one litre of processed milk is 1000–1200 RWF in the supermarket. One 250 ml cup of yoghurt costs 350 RWF in the supermarket.

Fifteen supermarket visits showed that pasteurized milk, fermented milk (ikivuguto), yoghurt and butter are widely available. Inyange milk is sold in every (main) supermarket in Kigali. The large supermarkets also sell Masaka and Ingabo milk. The pricing of different brands in supermarkets seems similar. Milk powder is expensive because of importation costs and it can also be difficult to find. NIDO milk powder is sold at 38,000 RWF (38 euros) for 2.5 kg or 9,000 RWF for 400 grams (9 euros).



⁶⁸ WFP, 2019.
⁶⁹ CIA, 2018.

Table 3.

Milk	Products	Retail price	Sold where?
Inyange industries	Whole	1l / 1000 RWF	Simba, SawaCiti,
	Low fat	1l / 1100 RWF	Ndoli, Horebu,
	Fermented	5l / 2500–4000 RWF	La Championne,
	Raw	500 ml / 500–600 RWF	Carrefour, Patel, Kime Ltd and la Galette
Nyanza Milk Industries	Fermented	5l / 3500–4000 RWF	Kime, Horebu and Carrefour
Zirakamwa meza	Fermented	5l / 3500 RWF 1l / 500 RWF	Carrefour
Masaka dairy farm	Fermented	5l / 5000 RWF	SawaCiti
Blessed dairy	Fermented	5l / 3600 RWF	Kime Ltd
	Pasteurized	Price unknown	
	Low fat Pasteurized	Price unknown	
Mukamira	UHT flavored	250ml / 250 RWF	La Championne, Kime Ltd and Simba
	Pasteurized	5l / 2500 RWF	
	Fat reduced	Price unknown	
	UHT Fermented	3l / 2600 RWF	
Gishwati farms	Fermented	5l / 2500–4000 RWF	Ndoli
Imena	Fermented	5l / 2500 RWF	Horebu and Carrefour

Cheese and cream are also not as easily found. Gouda cheese produced by Gishwati or Ingabo is generally available in larger supermarkets but sometimes retailers run out of stock. Speciality cheeses like parmesan and mozzarella are usually not available. Dairy processing companies report to produce these products on the basis of special orders of hotels and restaurants. Large differences exist in cheese sales in supermarkets located in different neighbourhoods. The supervisor of Kime Ltd. located in Kiyovu reports sales of 100–200 cheeses per week. Two of the largest supermarkets in Kigali report to sell approximately 40–50 cheeses per week. SawaCiti in Kimihurura sells 40 pieces of cheese per week while the Simba branch in Kicukiro reports to sell 7 cheeses per day. They sometimes run out of stock for small-size cheeses of 200 grams as processors produce more large size cheese of 1 kilo because the production costs are lower.

There are many more small cheese producers such as Muhe farm, Fromagerie le Reine, Gishwati Mountain Farm, Urugyero, Royal Dairies, Blessed Dairy, Les Cavabon and Masaka Dairy Farm. These cheese brands were not available in the larger supermarkets in Kigali. Likely, the processors sell directly to consumers and hotels or restaurants.

Table 4.

Cheese	Products	Retail price	Sold where?
Gishwati farms	Gouda	1 kg / 4000–4700 RWF 500 gr / 2500 RWF	La Championne, Simba, Carrefour, la Galette, Kime Ltd, Patel, Ndoli, Horebu
	Mozzarella	500 gr / 4300 RWF	
Ingabo dairies	Gouda cheese	200 gr / 1600 RWF 1 kg / 4000–4500 RWF	

Table 5.

Yoghurt	Products	Retail price	Sold where?
Inyange	Plain	250 ml / 500 RWF	Simba, SawaCiti, Ndoli and La Championne, La Galette, Carrefour, Horebu, Kime Ltd, Patel and T2000
		500 ml / 600 RWF	
Masaka	Plain	250 ml / 400–450 RWF	La Championne, Ndoli, SawaCiti, Carrefour, Horebu, Kime Ltd, La Galette, Patel and Simba
Ingabo	Vanilla and strawberry flavour	150 ml / 350 RWF	Ndoli, Carrefour, Horebu, Kime Ltd, La Galette, Patel and Simba
		250 ml / 350 RWF 500 ml / 700 RWF	
Blessed	Brand “Fruity” strawberry and mango flavour	150 ml / 750 RWF	La championne, Horebu, Carrefour, and Kime Ltd
		250 ml / 1150 RWF 500 ml / 2250 RWF	
Blessed	Vanilla, strawberry and plain	250 ml / 400–450 RWF	Horebu, Carrefour, Kime Ltd and Patel
Mukamira	Vanilla and strawberry flavour	150 ml / 350 RWF	Kime Ltd, Carrefour and Patel
		250 ml / 400 RWF	
Gishwati	Plain	500 ml / 700 RWF	Simba, Kime Ltd, Carrefour, Horebu, La Galette and Patel





2.6 IMPORTS AND EXPORTS

Imports

Rwanda imports dairy products formally from neighbouring countries and Europe. Rwanda mainly imports dairy products from Belgium, France, Italy, Kenya, Netherlands and Uganda. Rwanda is an importer of cheese, butter, cream and milk powder. Some products are not produced locally like milk powder. Other products, like cheese and butter, are produced locally but the quality of local products is deemed insufficient. One premium hotel has reported to import cheese from Europe because their clientele has a strong preference for imported cheese. Furthermore, imported products can sometimes be cheaper than local products. Butter from Belgium is sold for 4800 RWF whilst locally produced butter of Inyange costs 5200 RWF. It remains a challenge for local processors to compete with imported products due to (varying) quality of milk, processing machinery and equipment, packaging material and storing procedures. Additional milk production could substitute imported milk products and can also be exported (milk powder, UHT or casein milk protein) to increase foreign exchange earnings.

Exports

Rwanda also exports some dairy products and the majority of these exports are informal. Annually, Rwanda informally exports \$11.5–15 million of raw and fermented milk to its neighbouring countries Burundi and the Democratic Republic of Congo.⁷⁰ The prices paid by cross-border traders are not good so farmers and processors prefer to sell locally.⁷¹ Additionally, Rwanda formally exports some pasteurised milk and fermented milk products from Inyange and Mukamira to Burundi, DRC, South Sudan, Mali, Central Africa and Kenya. In the future, Rwanda might not be able to export dairy products to neighbouring markets as domestic demand will exceed domestic supply. Demand grows along with the population and local demand for dairy products. All non-processed agricultural and livestock products including locally processed milk are VAT exempt. There is only one market distortion for milk: the foreign exchange premium.

⁷⁰ IFAD, 2016; USAID & Land O'Lakes, 2016.

⁷¹ Bonnier, 2019.



TRAIDE

03.

Investment opportunities



AHAGORIRWA AKAWUNGA

**COOPERATIVE I.A.KI.B
MILK COLLECTION CENTER RUKOMO**





The strategy of RAB is aimed at the strengthening of the formal dairy system. Growing local demand offers opportunities when affordability is ensured. Also, Rwanda has a strong reputation in the region when it comes to quality assurance. Hence, there are also some export opportunities for processors.

3.1 CHALLENGES IN DAIRY SECTOR

The challenges listed below can be considered opportunities for investors and traders. The list shows the gaps, which can be filled by making use

of new technologies or perhaps foreign funding. Looking at the complete list, it becomes apparent that the Rwandan dairy sector is young and in the early stages of development. Nevertheless, the sector seems to be at a turning point where the private sector is increasingly participating in the development of the sector. Simultaneously, the government can facilitate the sustainable and inclusive growth of the dairy sector by taking a stronger role in setting standards and enforcing regulation on themes like milk quality and feed quality. Government promotion of *'farming as a business'*, professionalization of cooperatives and increasing privatization of certain services will also contribute to overcoming these challenges.

1. THERE IS LOW MILK PRODUCTION PER COW AT FARM LEVEL.

Challenge	Intervention needed
Poor animal nutrition, shortage of feed and poor ration formulation are the biggest constraints for productivity in Rwanda ⁷²	<ul style="list-style-type: none"> • Increase and diversify local production of forage: grass, maize and other fodder crops • Increase local production of maize for corn • Optimize use of by-products and crop-residues • Lower price of concentrate or increased price of raw milk, which is 350 RWF/kg at the farm level: almost twice the price of milk • Improve quality control on compound feed to prevent the sales of low quality concentrates to farmers
Shortage of land and fodder	<ul style="list-style-type: none"> • Focus on crossbreeding to reduce the number of low productive, indigenous cow breeds in a country with scarce land • Enhance production of fodder crops, including irrigation and conservation
Low awareness of farmers regarding needs of improved cow breeds	<ul style="list-style-type: none"> • Training for farmers regarding cow management: feeding, health and housing
Seasonal fluctuations in milk production resulting in surpluses and shortages ⁷³	<ul style="list-style-type: none"> • Increase UHT processing of milk to meet demand during the dry season with processed surplus milk from the wet season • Improved feeding practices during dry season with concentrates and fodder to mitigate fluctuations • Allow milk prices to rise during the dry season to cover increased production costs of farmers

2. QUALITY OF THE RAW MILK IS POOR

Challenge	Intervention needed
Toxic/antibiotic levels in milk	<ul style="list-style-type: none"> • Bring down aflatoxin levels in cow feed by improvement of post-harvest handling of maize • Increase testing of individual milk batches • Test on antibiotics and combine penalty system with advice on the use of antibiotics
Poor milk handling at the farm	<ul style="list-style-type: none"> • More hygiene during milking, storage and transport • Use of stainless steel buckets for milking and cans for transport (or acceptable alternatives!) • Stimulate use of filters and chilling • Continue with Farmer Field School approach
Duration of period between milking and cooling	<ul style="list-style-type: none"> • Promote use of cooling equipment and transport facilities in reliable and affordable way • Increase the number of Milk Collection Centres (MCCs) creating a decentralised network • Increase the availability of small cooling equipment on dairy farms • Improve electricity provision at MCCs: milk cannot be cooled properly during power cuts affecting milk quality or use alternatives that require a more flexible approach
Lacking awareness and incentives to improve quality	<ul style="list-style-type: none"> • Implement quality-based payment system on the basis of factors such as fat and protein content, biological quality • Promote the use of extra laboratory quality checks • Provide trainings to farmers to improve quality

⁷² ILRI, MinAgri and RAB, 2017; IFAD, 2016.

⁷³ Hulst, 2015 and IFAD, 2016.

3. ONLY 30% OF FARMER HOUSEHOLDS HAVE ACCESS TO EXTENSION SERVICES, AND FAR LESS HAVE ACCESS TO EXTENSION SERVICES RELATED TO DAIRY FARMING, REQUIRED TO MAINTAIN AND IMPROVE THE HEALTH AND PRODUCTION OF THEIR CATTLE

Challenge	Intervention needed
Limited access to extension services: on a yearly basis a dairy farmer is reached 2.5 times by a public or private extension agent	<ul style="list-style-type: none"> Strengthen knowledge and technical expertise of farm advisors Increase coverage of extension services through private actors or public-private partnerships Improve the low extension agent to dairy farmer ratio to enable vets to do more farm visits and enhance the access of farmers
Limited access to animal health services resulting in high young and adult stock mortality	<ul style="list-style-type: none"> Proceed with privatization of veterinary services Develop and enforce quality requirements for veterinary services Improved training of vets and para-vets to meet quality requirements Raise awareness regarding diseases and utilization of drugs but also regarding potential resistance of diseases to drugs (drug resistance)
Limited access to Artificial Insemination (AI) services.	<ul style="list-style-type: none"> Improve access to input supply (semen and liquid nitrogen) and increase the number of AI technicians Assess the feasibility of providing high-quality exotic semen with estrus synchronization in dairy production Develop a breeding policy consistent with farm management conditions Monitor performance for public and private AI services Continue to privatize the market for AI services

4. LACK OF ORGANIZATIONAL STRUCTURES FOR FARMERS DOES NOT ENABLE THEM TO EFFECTIVELY MARKET MILK AND ACCESS TO INPUTS/SERVICES

Challenge	Intervention needed
There is an unfair sharing of gross margins as the farm-gate price is about 16% of the consumer price ⁷⁴	<ul style="list-style-type: none"> Establish direct links between cooperatives or farmers and distributors/markets Increase the number of MCCs so farmers do not have to rely on traders for transportation who currently collect most milk for direct sales or delivery to MCCs Create networks, sector-platforms and/or umbrella organisations for better exchange of interests and to build mutual trust Make cost-price calculation for raw milk production and processed products to assess price structures, margins and efficiency problems in the dairy chain
Dairy cooperatives do not have business expertise	<ul style="list-style-type: none"> Create economies of scale by collaboration between smallholders through coops for sales, inputs and service provision Training in entrepreneurship and making business plans for farms
Limited number of coops provides inputs and services	<ul style="list-style-type: none"> Stimulate collaboration between cooperatives for investment in (chilled) transport Assess the viability for cooperatives to invest in feed production, to ensure quality and supply for their members Strengthen the advisory, AI and health services to suppliers of the cooperative MCCs Raise awareness on alternative finance models for inputs and services provided by cooperatives to their members

5. LACK OF PROCESSING AND UNDERDEVELOPED MARKET FOR DAIRY PRODUCTS: LESS THAN 20% OF ALL MILK REACHES THE FORMAL PROCESSING INDUSTRY (MinBuza, 2016)

Challenge	Intervention needed	Challenge	Intervention needed
There is a large informal market for milk	<ul style="list-style-type: none"> Strengthen the bargaining power of farmers cooperatives by increasing the number of dairy processing companies so they can obtain better prices Increase the number of MCCs and enable unions and cooperatives to process milk by providing financial support for small-scale processing 	Premium dairy products are often imported because quality of local products is lacking	<ul style="list-style-type: none"> Build links between processors, hotels and restaurants to clarify quality requirements for premium product market Training in milk processing and product development!
Price of dairy products is too high for a large part of the population	<ul style="list-style-type: none"> Increase awareness regarding the importance of food safety and certification Build economies of scale to optimize use of processing capacity and lower prices of processed dairy products 	Access to export markets is limited by the lack of quality of dairy products and high production costs	<ul style="list-style-type: none"> Training of staff of processor companies in processing and product development to reach international standards of quality Active marketing approach in neighbouring countries (own marketing network of processors)
Processing capacity is underutilized: total capacity has been estimated at 280 MT/day, of which 35–40% is used	<ul style="list-style-type: none"> Stimulate collaboration between cooperatives and (new) investors to avoid investments in overcapacity Stimulate collaboration with raw-milk suppliers to increase and assure supply for processors Underutilization partly caused by low milk supply in the dry season: address the problem of seasonal variation in milk supply 	There is limited access to finance for dairy farmers	<ul style="list-style-type: none"> Training of financial specialists to evaluate dairy farm business plans and entrepreneurship Facilitate access to finance for farmers through cooperatives enabling them to make larger investments

⁷⁴ MinBuza, 2016.

3.2 OPPORTUNITIES IN DAIRY PRODUCTION

The most significant challenges for Rwanda is the low productivity per cow and high seasonal fluctuations in productivity. The problem should be addressed through effective interventions, which improve yield per cow rather than increasing the number of animals producing milk. Increasing the number of cattle in Rwanda will inevitably result in shortages in terms of land availability and animal feed.

Commercial feed and fodder production

Raise awareness and supply concentrates

Lack of awareness regarding concentrates, uncertain quality and high prices in relation to the price of raw milk have resulted in the limited use of concentrates. Consequently, many cows are not reaching their potential in terms of productivity due to a lack of nutrients. Hence, there is a need for more use of concentrates, but this should be commercially viable. A higher demand will lead to higher production by feedmills. Good advice about animal nutrition is an important prerequisite for profitable use of concentrates.

Introduce new fodder crops or grass varieties and improve cultivation, harvesting and conservation techniques

Considering land shortages and high population density in Rwanda, it is very important to optimize use of available land. Current yields can be increased by using highly productive fodder crops and grass varieties. The usable yields per hectare can increase significantly with better crop management, irrigation, more cuts per year from grass, and silage making. Adaptation trials for data collection and demonstration plots for farmers are important and should be supported.

Provide support for post-harvest management of maize

Cows need concentrates, such as corn, wheat- and maize bran and other by-products from food processing. A ration based on fodder crops does not provide sufficient protein and energy. However, maize in Rwanda is often contaminated with aflatoxin following poor post-harvest management. Maize is not sufficiently dry allowing mould to develop: the fungi produce toxins. Aflatoxin in cow feed leads to aflatoxin in milk. Cows will metabolise aflatoxin B1 in contaminated feeds to give aflatoxin M1, which is found in milk.

AI services and genetics

Support in optimizing (private) AI services

AI services need to be optimized and privatised further to improve the quality of services provided and the access of farmers to these services. Training of technicians, improving the logistics of transporting semen, introducing recording schemes and selection programs, will improve performance and access. Both government and private AI services have to meet high standards of quality. Close monitoring of the performance of the AI technicians is important, with refresher training and guidance at regular intervals.

Develop and implement a national or regional breeding strategy

A national or regional breeding strategy needs to be developed that is consistent with farm management conditions and a clear vision on the trends in markets for dairy products and/or beef.





TRAIDE



Establish breeding farms

Reliable sources of young stock and/or pregnant heifers from genetically superior dams and sires will be needed to develop the dairy sector. Breeding farms should be able to show production records and pedigrees that assure the genetic merit of their cattle.

Import of suitable exotic genetic material

High-quality semen for AI services is expensive and scarce. It is important to consider the Rwandan climatological and managerial circumstances when selecting exotic semen. In Brazil, the development of the Girolando breed, crossing the *Bos Taurus* and *Bos Indicus*, was very successful. A similar option could be considered for Rwanda.

Health

Increase testing frequency for increased number of diseases

Increased farm visits by vets or para-vets can lead to increased testing for diseases. Often farmers only report disease. Farmers are sometimes not testing for diseases but this does not mean that the disease does not exist or there is no threat.

Establish mobile veterinary clinical services

Mobile veterinary clinic services can become part of the process of privatization of veterinary services. Also, these mobile services can be linked to MCCs as service hubs for dairy farmers.

Support government in disease control programs

Importers of meat will need assurance that the live animals or meat is free of any disease. An efficient system for health monitoring and control programs are important and should be carried out by the government health services and veterinary inspection.

Improve access to drugs and vaccinations

Many farmers cannot afford to pay for antibiotics and hence, cows do not get the medicine. The limited financial access to medicine leads to low incidence of elevated levels of antibiotics in milk. Meanwhile, farmers who do use antibiotics often do not know the right treatment of antibiotics and other drugs. Consequently, antibiotics will likely end up in the milk. IAKIB cooperative reported antibiotics to be found in the milk approximately once per month. It is important improved access is still monitored by cooperatives and vets.

Technical support in controlling animal diseases

Dutch experts in the fields of animal identification and surveillance systems, vaccination programs and bio-security systems, can provide support to improve the health of livestock. Government programs, with financial support from donor organisations.

Barn design

Zero grazing is a common and effective way to improve dairy production in Rwanda. Diseases can more easily be controlled whereas free ranging cows pose a greater risk. Barns should meet basic requirements for animal welfare (e.g. clean and comfortable resting places, good ventilation, free access to feed and water, space for exercise). Also, the barns should be easy to construct and maintain as well as affordable.

Farm equipment

Machinery and equipment are usually too expensive and large-scale for Rwandan dairy farmers. Small-scale and second-hand European equipment is popular: it has a strong reputation and is perceived as high quality. Small milking machines, stainless steel milk cans and buckets are highly appreciated by dairy farmers, while for field work small tools and equipment can increase production efficiency.

3.3 OPPORTUNITIES IN DAIRY PROCESSING

A low percentage of total milk production in Rwanda is being processed. Mostly in the wet season there is plenty of milk, which cannot be processed. Meanwhile, some processing companies are not making use of their full capacity because market demand is insufficient. The three main challenges related to dairy processing are: firstly, finding sufficient market for dairy products, secondly, offering quality products to retail partners and thirdly, assuring the supply of raw milk meets quality standards.

Processing plants

Milk processing is increasing and investments are being made. Most investments are made by Inyange, the government-affiliated company. International investors can either establish their own company or collaborate with existing Rwandan processing companies. The latest project is the milk powder processing plant of Triumph a South African company. It should be noted that (large) donors are also actively supporting existing Rwandan processing companies. Last year, Masaka Dairy in Gasabo District received a 234 million RWF grant from USAID to grow its processing capacity.

Processing machinery, cold chain logistics and storage

European companies need to adapt their equipment to the needs of the Rwandan market (size, second-hand, appropriate quality standards and less high-tech) to enable themselves to compete with Chinese or Indian

suppliers. An example of niche products are mini-dairies for batches of 500 liters or flow pasteurizers with high energy efficiency. Furthermore, companies can improve cold chain logistics and provide storage equipment:

- offer bulk milk tanker transport equipment
- offer milk chilling equipment for MCCs
- offer milk chilling tanks for the processing industry
- offer cooled cabinets and cold storage for retail shops and milk zones.

Product packaging

Rwanda intends to implement a ban on all single-use plastic. This ambitious law has major environmental benefits but it also poses a major challenge for the dairy sector. It means processors will no longer be able to use the plastic cups as 250 ml packaging. Investors can help introduce or develop innovative solutions, which enable processors to meet new environmental requirements while also continue to offer affordable products.

Dairy technology and product development

Services can also be provided regarding dairy technology and product development. Many new processing plants lack experience and know-how about how to operate and repair equipment. Also, processors need to learn how to carry out (more advanced) laboratory analyses and how to develop new products. Companies can set up a service organization for maintenance of dairy equipment to serve dairy processors.



3.4 OPPORTUNITIES IN BUSINESS DEVELOPMENT

Business development is a major opportunity as limited market demand remains a challenge in Rwanda. Marketing efforts of the government and private sector have been very limited. Awareness needs to be raised with regard to the health benefits offered by dairy products. Moreover, marketing must stimulate milk consumption within the formal system and stress the importance of quality and food safety.

Growing market: milk zones

There is a growing market for milk sold in milk zones (Bonnier, 2019). The price of pasteurized milk sold in bulk at milk zones is fixed by the government and ranges from 400–500 RWF per litre. Milk zones offer processors the opportunity to increase distribution of safe milk within the formal system at an affordable price.

Milk for school children

Milk programs for schools are considered an opportunity for the improved local distribution and consumption of milk. RAB started the 'One Cup of Milk per Child Program' in May 2010. The program is still being scaled up considering success in achieving fighting malnutrition amongst children. Currently, the program reaches between 83,575 school children from 112 schools in 15 districts. School children receive one litre of milk per week through a government program. They receive two portions of 0.5 litre twice a week and costs are covered by the Rwandan government. The allocated budget for the program per child in 2019 is 28,800 RWF (approximately 29 euros). There are 3 processors participating in the program; Inyange provides UHT milk, while Nyanza Milk Industries and Agro Processing Industries (API) provide fermented milk.

Nyanza Milk Industries reports to distribute 5 MT/day of fermented milk to schools per day. They supply two portions of 0.5 litre twice a week. The government pays Nyanza Milk Industries a fixed price of 400–450 RWF per carton of 500 gr of fermented milk. The distribution of five times 0.2 litres of milk per week would be preferable but the logistics and packaging are more expensive. School milk programs are financially attractive for the processing companies. It provides them with a guaranteed market secured by a government contract. The number of beneficiary schools is still increasing. The school milk program aims to target children from disadvantaged households exclusively. Current processors do not want new processors to take a market share.

Premium product market

Premium products can offer opportunities for increased import substitution. Dutch investors can assist with product development and improvement to meet the high standards of the international market and international consumers. Yoghurt variety and quality could be improved with new probiotic starters. Cheese variety and quality could be improved with new production techniques: only Gouda cheese is widely available and consumed. Speciality cheeses need to be promoted to increase consumer demand. Hotels and restaurants will not provide sufficient demand.

Export market

There are export opportunities for investors in the Rwandan dairy industry. Whilst local production levels remain low, demand for dairy products is rapidly increasing in its neighbouring country DRC. Rwandan processors can tap into rising demand exporting UHT or milk powder. In this way, they can optimize the use of their processing capacity and develop the economies of scale to bring down the prices of dairy products on the Rwandan market. It must be noted that there is always a risk when processors become depend on markets across the border.

REFERENCE LIST

- Bonnier, J. (2019) Notes Mission July: Report on Field Visits in Southern Province.
- Central Intelligence Agency (2017). Rwanda: The World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/rw.html>
- Food and Agriculture Organization (2019). Modernizing Rwanda's livestock to attract investment and enhance food security. <http://www.fao.org/rwanda/news/detail-events/en/c/1185157/>
- Hulst, J. (2015) Consultancy Assignment. Agriterra.
- International Fund For Agricultural Development (2016). Rwanda Dairy Development Project (RDDP): Detailed design report. <https://webapps.ifad.org/members/eb/118/docs/EB-2016-118-R-19-Project-design-report.pdf>
- International Livestock Research Institute, MinAgri (Rwandan Ministry of Agriculture and Animal Resources) and Rwanda Agriculture Board (2017). Rwanda Livestock Master Plan. <http://extwprlegs1.fao.org/docs/pdf/rwa172923.pdf>
- Manzi, M., Rydhmer, L., Ntawubizi, M., Karege, C. and Strandberg, E. (2019). Reproductive performance of Ankole cattle and its crossbreds in Rwanda. *Tropical Animal Health and Production*, 51:49–54.
- MinAgri (Rwandan Ministry of Agriculture and Animal Resources) (2013). National Dairy Strategy.
- MiniCom (Rwandan Ministry of Trade and Industry) (2017). Dairy farmers welcome milk price regulation. http://minicom.gov.rw/fileadmin/minicom_publications/documents/TRADE___INDUSTRY_E-NEWSLETTER_VOL_1_IS-SUE_006_-FEB-MARCH_2018.pdf
- Ministry of Foreign Affairs (BZ) (2016). Factsheet Dairy Sector.
- Miklyaev, M., Afra, S., and Schultz, M. (2017). Cost-Benefit Analysis of Rwanda's Dairy Value Chains. Cambridge Resources International. https://cri-world.com/publications/qed_dp_299.pdf
- Mutimura, M., Ebong, C., Madhusudana Rao, I., and Nsahlai, I. (2015). Nutritional values of available ruminant feed resources in smallholder dairy farms in Rwanda. Rwanda Agriculture Board. http://rab.gov.rw/fileadmin/user_upload/Publications/Reports/ResearchPublication/Mutimura_et_al_2015.pdf
- Mutoni, H. (2019). Interview on Dairy sector.
- National Institute of Statistics of Rwanda (2017). Agricultural Household Survey 2017. <http://www.statistics.gov.rw/publication/agricultural-household-survey-2017>
- Ntirenganya, E. (2018). Dairy farmers welcome milk price regulation. <https://www.newtimes.co.rw/section/read/229708>
- Rwanda Agriculture Board. One Cup of Milk per Child Program. http://rab.gov.rw/fileadmin/user_upload/Animal_Production/One_Cup_of_Milk_per_Child_Program_.pdf
- SNV (2015). Feasibility study for the quality based milk payment system in Rwanda. https://images.agri-profocus.nl/upload/post/Advert_Consultant_Ag-ric_sector_Dairy_dd_03_08_20151438618447.pdf
- Sygenta Foundation (2012). Crop and Livestock Insurance Feasibility Study: Final Report. http://www.minecofin.gov.rw/fileadmin/templates/documents/AFR_Agri_Feasibility_Study_FINAL_Agric_insurance.pdf
- United States Agency for International Development, Food and Agriculture Organization, CGIAR and Council on Food and Agriculture (2016). Rwanda Dairy Competitiveness Program II: Efficiency gains in dairy production systems decrease GHG emission intensity. <http://www.fao.org/3/a-i6532e.pdf>
- United States Agency for International Development and Institute for Food and Agricultural Standards (2016). Rwanda: Animal Source Foods Production and Marketing Brief. Feed the Future.
- United States Agency for International Development and Manage (2016). Demand Analysis Report – Republic of Rwanda.
- United States Agency for International Development and Land O'Lakes (2016). Rwanda dairy Competitiveness program II: Impact Report. <https://www.agrilinks.org/sites/default/files/resource/files/RDCP%20II%20Impact%20Report.pdf>
- World Food Program (2019). Country Profile Rwanda. <https://www.wfp.org/countries/rwanda>
- World Bank (2019). Overview Rwanda.



TRAIDE