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Strengthening smallholder engagement and integration in the Rwandan commercial broiler value chain

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SUMMARY

The emerging broiler value chain in Rwanda has the potential to increase domestic meat supply to meet increasing demand for protein and micronutrients and address the challenge of stunting. Smallholders operate the majority of farm enterprises in Rwanda but have typically been limited to village poultry production. Meanwhile, larger modern enterprises have been the primary suppliers of broilers to the commercial market. However, hybrid, asset-building broiler operations are a third production model that represent a potential avenue for smallholder poultry intensification. The integration of this model into the Rwandan broiler sector provides greater opportunity for domestic producers to meet Rwandan government targets for the supply of animal-sourced foods, while generating livelihood opportunities for smallholders. This paper provides an overview of the commercial broiler value chain and outlines lessons learned from a pilot project that employed this third production model. Challenges to smallholder engagement in the Rwanda commercial broiler value chain cut across input supply, production, post-harvest and marketing, and have been exacerbated by the COVID-19 pandemic. However, multiple opportunities exist to strengthen smallholder engagement and integration into the Rwandan commercial broiler value chain. These include: reducing the recurring costs of production; providing value chain trainings; facilitating microfinancing; reducing post-harvest costs; increasing local demand for broiler meat; and strengthening policies in support of smallholders.

KEYWORDS

Animal sourced foods; poultry; agricultural intensification; small livestock; Africa

Introduction

The poultry sector is an emerging market in Rwanda, driven by rapidly rising demand for poultry products due to increasing populations, rising incomes, changing dietary preferences, and urbanisation. At the same time, the most recent Rwandan health and demographic survey indicated that three in eight children under the age of five are stunted as a result of poor health and nutrition (World Food Programme 2016). The Government of Rwanda (GoR) and the donor community are seeking to address stunting

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by increasing the production of and access to meat-based protein and micronutrients for the whole population (Weatherspoon et al. 2019). Despite Rwanda's recent rapid economic growth, the supply of domestically produced animal-sourced protein and micronutrients is limited, and remains prohibitively expensive for sections of the population.

The GoR national livestock master plan (LMP) outlines a strategy for growth of the livestock sector including a focus on increased production of small livestock for domestic consumption and for export to neighbours such as the Democratic Republic of Congo (ILRI 2017). The small livestock sector has significant potential as a means for sustainably intensifying production of animal sourced protein and micronutrients, particularly in Rwanda which has one of the highest population densities in the world. The best options for Rwanda to sustainably intensify production of meat are those that require limited land and have higher efficiencies. Broiler chickens have a more efficient feed conversion ratio (FCR) than other livestock (except for fish), and the broiler value chain is a target for strengthening by the GoR (ILRI 2017). While chickens (with lower FCRs) require less land area for production of feed ingredients (compared to animals with higher FCRs), the production of grains for livestock feed versus human consumption remains a challenge. Currently, the vast majority of commercial feed ingredients are imported for animal production in Rwanda; however, this could change as animal production increases in Rwanda and feed providers identify lower-cost, local feed ingredient production options.

In Rwanda, there are two primary broiler production methods: village (or 'traditional family') poultry and industrial modern poultry (ILRI 2017). While industrial broiler systems focus on producing large flocks (>2000 birds) for commercial market sale, they exclude smallholders, who constitute the majority of Rwandan agricultural producers. Smallholders keep poultry to aid in poverty alleviation, mitigate risk, consume birds at culturally important festivals, and sell during times of crisis (Mottet and Tempio 2017). However, much of the village poultry farming conducted by Rwandan smallholders is subsistence in nature and may only connect to markets through bartering or trading of single birds in local settings. As such, these two broiler production systems operate independently of each other, and Rwandan smallholders are not integrated into the modernising broiler value chain or growing market opportunities.

Smallholder asset-building broiler production is a third model which is common to many low-income countries, but until recently has been absent from the Rwanda broiler production landscape. The asset-building production model represents small- to medium-sized flocks kept by a household as a means of acquiring assets to increase household wealth, and as a potential avenue of development for smallholder poultry intensification (McLeod, Thieme, and Mack 2009). This model promotes broilers as an economically sensible livestock investment for smallholders due to the quick cycle of returns from the placement of day-old chicks to the sale of product (approximately 42–45 days). The regular, but not extensive, time commitments to managing bird health and growth ensure broiler production is compatible with other smallholder livelihood activities. This third model could help Rwanda move quickly towards LMP targets, which aim for a 149% increase (from 0.97 million to 2.42 million birds produced annually) in specialised broiler production by 2022 (ILRI 2017).

In order to test whether Rwandan smallholders could be efficient and effective producers for the modernising broiler value chain, a hybrid asset-building model of broiler production has been piloted under a public–private partnership since 2017. This

model has sought to integrate smallholders into the broiler value chain through a training and production programme, '*Tworore Inkoko, Twunguke*' (TI), or '*Let's raise chickens and make profit*' (Gill et al. 2020). This TI programme has trained over 500 farmers in efficient broiler production on their homesteads, raising 100 bird flocks in enclosed coops, and resulting in the sale of 200,000 birds into the domestic market since programme inception.

TI has made initial in-roads in integrating the smallholders into the broiler value chain by focusing on internal success factors such as providing training, access to ongoing technical support, reliable input supply, guaranteed sale of birds, and establishing farmers with a microfinance institution to provide recurring loans based on broiler production cycles. However, most of the focus of the TI programme has been assessing whether rural Rwandans could raise modern hybrid birds to industry standard, whether the birds would sell and for what price in the market, and whether participants would consume the birds and/or use any profit from the bird sales to improve their dietary diversity. In order to assess these production efficiencies and impacts, the private sector partner, Zamura Feeds Ltd., has shouldered the risk of both sourcing inputs for broiler production and also aggregating and selling the broilers post-farm-gate. This was done to protect the smallholders from the major external factors that include volatility of input supply and the market, until these external factors could be addressed and/or smallholders could become competitive in the open market.

Two main findings from TI have emerged. First, the pilot project has provided empirical evidence that smallholders are able to efficiently produce broiler chickens close to modern industry standards in rural Rwanda (Gill et al. 2020). This has increased incomes and improved food and nutrition security outcomes for these smallholders. Second, several challenges remain to be addressed if smallholders are to be integrated effectively as competitive producers in the modern broiler value chain in Rwanda. This paper covers four topics: 1) Overview of the commercial broiler value chain in Rwanda; 2) Overview of the TI model, its main findings and impacts; 3) Challenges that remain for smallholder engagement and integration in the Rwandan commercial broiler value chain; and 4) Opportunities for strengthening smallholder engagement and integration in the Rwandan commercial broiler value chain.

Overview of the commercial broiler chicken value chain in Rwanda

The commercial broiler value chain in Rwanda consists of various elements: i) inputs; ii) production; iii) processing, packaging, and storage; and iv) distribution and consumption (Figure 1).

Inputs

Hatchery and day-old chicks

An average of 150,000-day-old chicks (DOCs) are imported into the country from the Netherlands, Belgium, and Uganda every month (Nshimiyimana 2017). Imports account for about half of all DOCs produced for the Rwandan broiler market, with the other half produced by domestic hatcheries. Current prices of DOCs range between 600 and 800

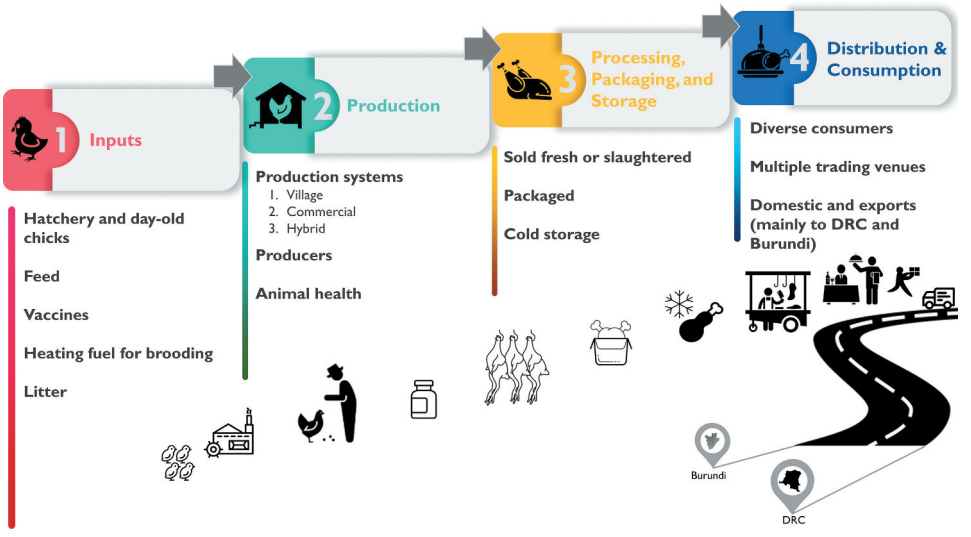

Figure 1. The commercial broiler value chain in Rwanda.

RWF per bird. In late 2020, almost all broiler DOCs were sold by three hatcheries. To reduce imports of day-old chicks and decentralise production, the GoR has encouraged the private sector to invest in hatcheries and the distribution of cross-bred DOCs to meet the rising demand (ILRI 2017). For example, in 2016 EasyHatch became the first private hatchery in Rwanda, and in 2017, the National Hatchery (Rubilizi) was privatised as Uzima Chick, a company owned by an Ethiopian poultry company (EthioChicken) (Nshimiyimana 2017). Currently, Uzima Chick, EasyHatch, and Chief Chick are the biggest hatcheries in Rwanda.

Feed

The ingredients commonly used in Rwandan feeds consist of cereal grains, vegetable proteins, animal proteins, and mineral supplements. The main cereal grain used in poultry feed in Rwanda is maize. Other cereals such as wheat and sorghum are less common in feed mixes. The main vegetable protein sources used in Rwandan poultry feed are cottonseed and soybean meals, both meal by-products from commercial vegetable oil production. Sunflower meal is also used in feed for protein and it has become more common than cottonseed cake. The main animal source protein used in Rwanda is fish meal, particularly for smaller mills. Meat and bone meal usage has increased in the past decade, driven by the emergence of commercial mills. Minerals derived from crushed shells and calcium are also used in feed produced in Rwanda (Republic of Rwanda 2012). Feed mills usually import feed ingredients and then mix them based on desired specifications, such as the type of feed (starter, grower and finisher) and form of feed (pellet, crumble and mash). Many poultry producers also mix feed concentrates on their farms. In 2015, two-thirds of the total demand of poultry feed (25,600 tons) was produced by farmers on their own farms while the remaining one-third (12,810 tons) was supplied by factories and other feed mills (Miklyaev, Afra, and Hashemi 2017). In 2018,

the main companies involved in feed supply in Rwanda included Agrotech Ltd, Premier Animal Feeds Industry Ltd (PAFI[1]), Zamura Feeds, Gorilla feeds, Havuga holding Group Ltd, and MINIMEX Ltd (ProDev group Holding).

Production

The poultry industry in Rwanda is characterised by three systems of production: 1) village poultry production (Mbuza et al. 2016a); 2) commercial poultry production (Kryger et al. 2010; Republic of Rwanda 2012; Nairoukh 2017); and 3) hybrid models that integrate smallholders into modern commercial production (Gill et al. 2020). Village poultry comprises local chicken genetic stock that are raised extensively in small numbers (commonly 5–15 birds). In this production system, chickens are not usually confined and obtain most of their diet from foraging for food and water in a free-range setting. This model requires minimal investment in inputs as most of the inputs, are generated around the home. As a result, these systems are characterised by low intensity production (Ahlers et al. 2009). Comparatively, in commercial production, chickens are provided all of their feed and water and often reared in coops with five to ten chickens per square metre. After the first 14 days, chickens are usually moved to a different coop. When birds are between 42 and 45 days old, they are harvested and processed (Cocchini and Steeg 2019). The TI programme example of a hybrid smallholder commercial broiler model is described later in this paper.

Animal health management

Poultry housing design plays an important role in determining the optimum health conditions for the broilers, as well as their growth and productive performance (Oloyo and Ojerinde 2020; Zhao et al. 2014). Furthermore, hygiene and sanitation of the premises of poultry production contribute to effective disease control (Meroz and Samberg 1995). In Rwanda, both housing and sanitation are among the priorities in the livestock masterplan and the investment plan for poultry (Republic of Rwanda 2012; ILRI 2017). In commercial poultry in Rwanda, producers generally adhere to industry-standard practices and biosecurity measures to avoid health risks, which can be commonplace in free-range enterprises. For example, poultry producers use antibiotics and/or medicines in their farm when needed after confirmed diagnoses by veterinary professionals of treatable infections. Producers also may equip their farms with a handwashing station with soap to allow trained personnel and labourers to wash their hands as frequently as possible (Cocchini and Steeg 2019).

Veterinary services include the prevention, diagnosis, and treatment of health issues, and are central to the production of safe and nutritious poultry products (Schwabenbauer and Rushton 2008; Glisson and Hofacre 2006). In Rwanda, producers access pharmaceutical products from a decentralised network of more than 1,200 agro-dealer outlets. The poultry industry sources essential inputs of pharmaceutical products and equipment from local suppliers. Agrotech Ltd and Sarura Agri-Vet Ltd are the main suppliers of imported pharmaceutical products (Miklyaev, Afra, and Hashemi 2017). Poultry production also benefits from the guidance in veterinary inspection and service from the GoR through the Rwanda Agricultural Board (RAB).

Processing, packaging, and storage

When birds reach maturity at around 45 days, they are slaughtered and the meat is processed, packaged, and stored before it is sold. Most broiler producers process the meat at the farm level before distribution as there are few publicly accessible professional processors in Rwanda. Broiler farms that have processing facilities can also buy live chickens from smaller producers and then process them before they sell them as a value-added product. Processed meat is preserved in a chiller from zero to five degree Celsius before being moved to a freezer for storage, distribution, and/or sale (Cocchini and Steeg 2019; Republic of Rwanda 2012).

Distribution and consumption

Broiler products are mostly purchased by small traders for delivery to outlets in urban centres, including wholesalers, exporters, and retailers. Wholesalers supply retailers with not only domestically produced broiler meat but also imported products. Retailers of broiler meat include small-scale butchers and grocers. Retailers, in turn, distribute broilers to different clients, including hotels, bakeries, street vendors, fast food chains, restaurants, and households throughout the country. Broilers are usually sold directly to consumers in rural areas at weekly markets, although they can also be sold through intermediaries who sell chickens to travellers along the roads to Kigali, and at border crossing points into the Democratic Republic of Congo (DRC) and Burundi. Intermediaries also sell chickens to both outlets and residents in nearby urban areas. In late 2020, a live indigenous bird can be purchased in retail from 3,500 RWF in rural areas to 8,000 RWF in Kigali. The farm gate price of chicken meat from improved birds ranges from 1,800 to 2,200 RWF per kg and reaches 3,000–3,500 RWF per kg once in butchers and/or supermarkets. When sold as a chicken breast, it can cost up to 6,800 RWF per kg (Miklyaev, Afra, and Hashemi 2017; Republic of Rwanda 2012). Prices fluctuate depending on changes in demand, cost of inputs/cost of production, and supply chains. Late 2020 average (mean) price for processed chicken meat from improved breeds was 2,600 RWF/Kg in community markets, and 4,000 RWF/Kg in supermarkets. For cut-up chicken, the price was 4,500 RWF/Kg for drumsticks and 5,000RWF/kg for breast meat.

The main consumers of chicken meat from imported/improved breeds are tourists, middle- and high-income residents, and urban residents. Broilers produced in Rwanda are also exported to neighbouring countries. Most poultry products are exported over land to the DRC via borders in the Rubavu and Rusizi districts of Rwanda. Only a small quantity of poultry is exported to Burundi. The total volume of poultry exports – mainly through informal trading – increased from 665,671 chickens in 2012 to 1,045,835 chickens in 2016 (National Institute of Statistics of Rwanda 2016). This resulted in an increase in revenues from 3.2 M to 5.1 M USD during the same period. With rising population and increasing urbanisation, both domestic and regional markets for poultry products are likely to expand. This expansion can also be attributed to diet changes. The annual per capita consumption of meat – especially chicken meat – in Rwanda increased from 6.4 kg in 2010 to 8.3 kg in 2015 (National Institute of Statistics of Rwanda 2015). This trend is expected to continue as the price of chicken meat decreases, per capita income increases, and dietary preferences are globalised.

The Tworore Inkoko model, findings and impacts

Tworore Inkoko, Twunguke (TI) is a public–private partnership between a Rwandan animal feed company, Zamura Feeds, Ltd., and a U.S. land-grant institution, University of Tennessee Institute of Agriculture. TI uses an intensive, 100-bird model with smallholder farmers, who receive all of the necessary inputs and support services to raise 100 chicks at a time in enclosed coops on their homesteads over a six-week cycle. Gill et al. (2020) provide a full description but a basic outline of the model is provided here.

The TI model

TI operates across five sectors within Musanze district, Rwanda. The majority of the sector is a rolling hills landscape at about 1800masl, surrounded by an arc running from the west to the north along the border of Volcanoes National Park. The population of Musanze district is about 400,000 with the main urban centre in Muhoza sector. TI used a purposive sampling strategy to select sectors from which to recruit households. Households were recruited to participate in TI from the main urban sector (Muhoza), two peri-urban sectors (Cyuve and Kimonyi), and two rural sectors (Gataraga and Kinigi) (Figure 2). TI held information sessions in the various sectors and recruited households at random from lists of those who opted-in by adding their name to a list of interested households in each sector. Eligible households were from Ubedehe 1 and

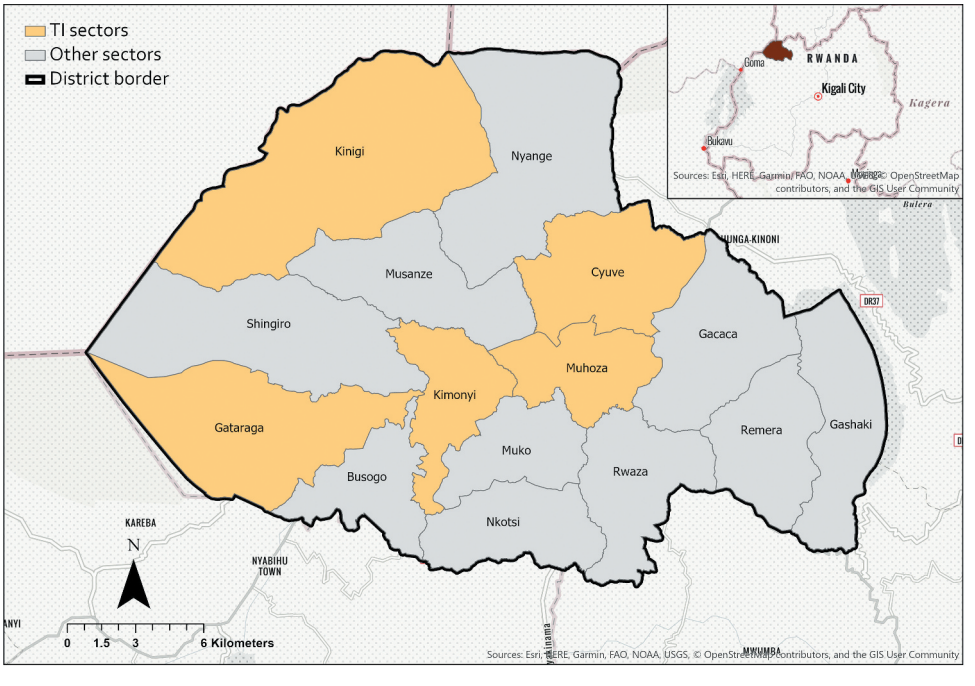

Figure 2. Map of Musanze district, Rwanda, indicating the five sectors from which the Tworore Inkoko, Twunguke programme recruited smallholders to raise broilers.

Ubedehe 2, the lowest-income social classes in Rwanda. Households were recruited in cohorts of about 30 smallholders at a time to streamline training, as well as to efficiently distribute inputs and harvest broilers at maturity.

The TI team worked with U.S. industry experts to develop a culturally appropriate training programme for efficient broiler production for Rwandan smallholders. This training programme was designed and implemented so that it would be accessible and inclusive for smallholders of all ages, abilities, literacy levels, and poultry experience, so that anyone could be profitable in raising broilers. Once producers were recruited, they were enrolled in a three-day hands-on training programme at the TI demonstration farm. The demonstration farm was the first operational production piece under the activity and continues to serve as a fully functioning broiler farm used for testing more efficient practices for TI farmers. Upon completing the training and passing a practical exam, smallholders were enrolled in the programme and provided with everything they needed to be successful at broiler production. Enrolled smallholders received a zero-interest capital loan that covered the instalment of the coop and all one-time equipment such as feeders and drinkers. The nine-square-metre coops were constructed out of locally sourced materials and built by a local construction company, so that all coops were similarly built (Figure 3). For biosecurity, coops were single entry, kept locked at all times, and smallholders were trained to wear coop-only footwear and clothing when inside the coop.

Enrolled farmers were provided access to operating finance through a local micro-finance institution at a competitive 14% per annum interest rate for the recurring costs to raise each flock in their own individual coops, which were built on their own property,

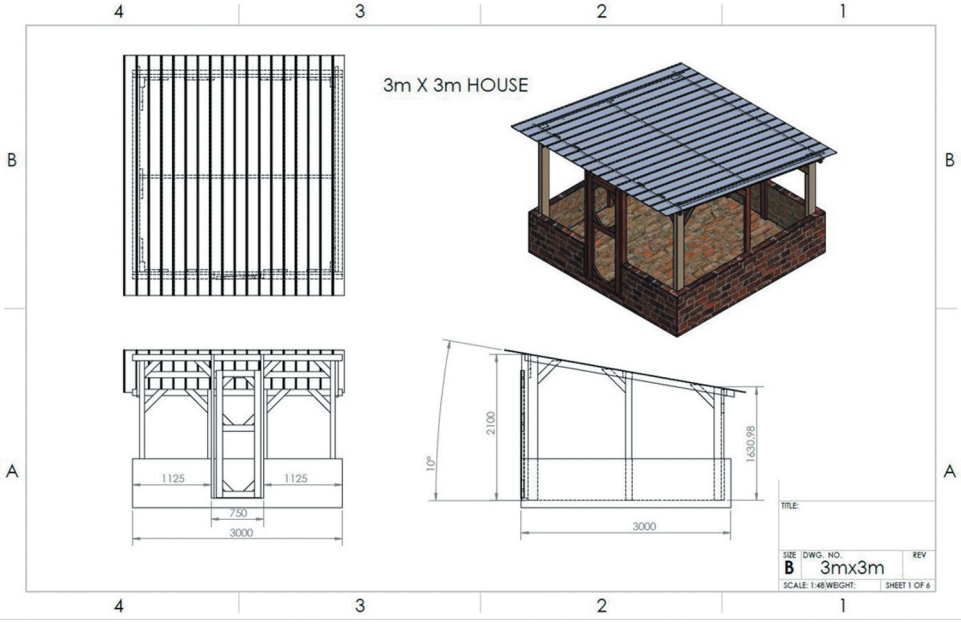

Figure 3. Tworore Inkoko, Twunguke (TI) coop design used for establishing similarly built coops for all TI enrolled broiler producers.

typically near their house. Farmers used the finance to pay for day old chicks, commercial feed, litter, and vaccines. Farmers raised modern broiler breeds, including Ross 308 and Cobb 500. The TI team used a private extension service model, through which a small group of Rwandan technicians were trained in broiler husbandry. These technicians provide support to enrolled smallholders with in-person visits and consultation over text and WhatsApp. TI provides guaranteed purchase of the birds once they reach harvest age and works with the Zamura feed mill as an aggregator which can not only source inputs for broiler production but also has its own sales team who can access better market prices for sale of birds. The TI team works with a local processor for birds to be sold in the dressed market, and birds from the programme have been sold both in live and dressed markets since 2017. The feed mill then returns the profits to smallholders and these farmers pay off their microfinance loan and make a payment towards their capital loan.

By early 2020, prior to a national lockdown in Rwanda due to the COVID-19 pandemic, the TI project had trained 511 smallholders (279 women and 232 men) in efficient broiler production. These households were from the poorest and most vulnerable socio-economic classes in Rwanda, Ubudehe 1 and 2. Almost 200,000 broilers had been sold, mainly in the domestic Rwandan market, between October 2017 and March 2020, with a gross sale of almost 900,000 USD into the local economy. Over this same time period, participating households generated an average (mean) of 85 US cents per day from broiler sales, and consumption of meat by these households increased from 15% to 92%. Households with women who operate as the broiler producer recorded higher profits (98 US cents per day) when compared with households with men who operate as the broiler producer (75 cents per day). Interviews with producers (both men and women) who achieved low FCR (<1.85) revealed that, on average, women were more likely to be present around the homestead (where the coop is located) for more hours per day. Men were more likely to be involved in other livelihood (farm and off-farm) activities away from the homestead. As a result, the gendered division of time spent near the chicken coop led to significant differences in production efficiencies and profit obtained. Average FCR of broilers produced by TI households is 1.9, which is not far from the global modern poultry industry standard FCR of 1.7. Average (mean) mortality of birds produced by TI households is low at 13%, which has helped households attain competitive FCR values. The TI model has become a go-to source of information and current experience on raising broilers in Rwanda through land-efficient practices. As a result, GoR institutions (e.g. Rwanda Agriculture Board, Rwanda Council of Veterinary Doctors) have been trained in efficient broiler production practices by TI technicians.

Challenges for smallholder engagement and integration in the Rwandan commercial broiler value chain

TI has provided empirical evidence that, when provided with the training, production tools and service support, smallholders can produce modern breeds of broilers to close-to global industry standards on their homestead. As a result, these smallholders can benefit from measurable improvements in their income and food and nutrition security. However, challenges remain at key stages of the broiler value chain for integrating smallholders as producers who can absorb risk and maintain profitable broiler enterprises.

Inputs

Cost, quality, and consistency of commercial feed supply

The majority of Rwandan smallholders mix their broiler feeds using locally available ingredients and practices, which often results in a lower nutritional quality feed (ILRI 2017; Vernooij, Masaki, and Meijer-Willems 2018). This lower quality feed can adversely affect bird health and yield. Commercial broiler feed is expensive, as the poultry industry competes with humans for the consumption of important feed inputs such as maize and soy. If smallholders are to raise broilers that meet standards for larger domestic and export markets, they need access to high-quality feed produced by commercial feed mills. However, raising broilers on commercial feed accounts for approximately two-thirds of input supply costs for broiler operations. Consequently, sourcing high quality, affordable feed ingredients are one of the main challenges to the broiler value chain in Rwanda. Domestic soy production only covers one-third of demand in the poultry industry, requiring the rest to be imported from the DRC, Tanzania, Kenya, and Uganda. Minerals from hand-crushed limestone shells vary widely in coarseness, affecting their bio-availability in feed for chickens. The cost of food-grade quality calcium is two times higher than that of lower quality, locally processed calcium. Fish is the primary source of protein in feed mixes but also suffers from an inconsistent supply in Rwanda, so is imported from Uganda and Tanzania. Limited supply and access to some ingredients in Rwanda compel producers to rely on higher-cost imports, driving up the cost of broiler production (Republic of Rwanda 2012).

Supply and quality of day-old chicks

It is difficult for smallholders to maintain a regular supply of high-quality birds, as their individual orders may not be of sufficient volume or frequency for hatcheries to maintain a consistent supply of day-old chicks. For economies of scale, smallholders who are raising small numbers of birds (such as in the TI model) must band together to purchase larger volumes at competitive prices. Historically, chick hatcheries in Rwanda have not produced sufficient and timely numbers of day-old chickens. Consequently, Rwanda has relied on other countries to meet demand, importing from Uganda, the Netherlands, and Belgium. Limited domestic supply of day-old chicks is compounded by demand competition from other countries such as South Sudan and the DRC (Nairoukh 2017). However, since 2017, local hatcheries have increased their production capacity. As such, the main challenges that remain include inconsistent hatching schedules and chick quality.

Charcoal

Charcoal is often used in smallholder broiler production as a fuel supply for heating chicken coops, especially during the first 14 days of brooding (Gill et al. 2020). Charcoal brooding is labour-intensive in these first two weeks of production, which has a particular burden on women, who do the majority of fire tending. In addition, the overall use of charcoal in agricultural and domestic activities is a risk to forest conservation. To protect forests, the GoR has introduced a series of policy measures to accelerate the transition from charcoal to other fuel sources. In May 2020, the GoR announced that it would ban the use of charcoal in Kigali city as part of the effort to protect the environment (Nkurunziza 2020). While this is a positive

step forward for environmental protection, it constitutes a challenge to broiler production as it compels producers to look for alternative heating options, such as propane gas. Currently, the supply chains for propane gas and equipment do not extend to rural Rwanda. In addition, propane gas is more expensive than charcoal, and there is no brooding equipment designed to use propane gas on the Rwandan market.

Production

Knowledge and training

Smallholders lack adequate knowledge and training to raise broilers efficiently. Smallholders typically lack exposure to modern poultry industry methods and are instead familiar with the backyard village method of production. The majority of smallholders may also have limited formal agricultural education, as well as limited opportunities for informal training in efficient broiler production. This may result from the lack of institutions specialising in poultry husbandry training and support services (Vernooij, Masaki, and Meijer-Willems 2018). Smallholders also lack access to regular extension support to provide production assistance, hindering smallholders from entering into broiler production as a new livelihood activity.

Access to credit

Poor access to credit hinders the ability of smallholders to improve their broiler production (Mbuza et al. 2016b). Microfinance loans are difficult for smallholders to obtain, and even if they are successful in obtaining a loan, available interest rates are very high (24%/year or higher). Smallholders often lack collateral and guarantees that are required to qualify for loans. This limits the ability of producers to make investments in their broiler enterprises (Cocchini and Steeg 2019).

Animal health management

Newcastle disease and parasites (e.g. nematodes and tapeworms) are the main causes of broiler morbidity and mortality in Rwanda (Mazimpaka et al. 2017). Smallholders do not tend to seek modern approaches to disease management, such as employing vaccines or consulting veterinarians in case of disease outbreaks, but instead rely on traditional, unproven treatments (such as vein piercing and de-feathering) (Mazimpaka et al. 2020). The combination and proximity of informal and commercial livestock production in Rwanda poses biosecurity risks. The outbreak of disease in one chicken flock can rapidly spread to other populations without safeguards to identify and contain the outbreak. Also, poor quality bird housing and poor sanitation practices negatively impact the health and productivity of birds (ILRI 2017). The reliance on traditional methods of animal care is partly due to the lack of access to and high cost of formal veterinary services. A study done in the eastern province reported that 83% of respondents were not receiving technical and veterinary assistance (Mazimpaka et al. 2017). Vaccine shortages in district-level veterinary pharmacies requires farmers to travel to Kigali for such products (Miklyaev, Afra, and Hashemi 2017). Low rates of vaccinations in the country increase the risk of the outbreak and spread of disease among chicken populations (World Organisation for Animal Health 2019).

Processing, packaging, and storage

Processing facilities

In Rwanda, there is a lack of meat processing facilities and limited expertise at existing facilities for value-added processing, such as producing cuts of chicken. Dressed chickens are primarily sold by the entire bird. These dressed birds typically include the gizzard and neck, and may also include liver, heart and feet. As chickens are typically sold as a whole bird package, chicken meat remains more expensive (per kilogram) than beef in Rwanda. This contributes to lower demand for chicken meat among the general population.

Cold chain

Smallholders frequently lack the expertise and equipment to process large quantities of birds. This leaves Rwandan smallholders dependent on commercial processors to sell dressed birds. However, most processors do not have access to a reliable cold chain to store and transport dressed birds. Small-scale processors rely on limited cold storage space on power grids that may suffer from interruptions, contributing to spoilage and loss of product. As small-scale producers often cannot invest in cold storage, they benefit from selling to larger producers with more reliable cold storage facilities (Cocchini and Steeg 2019). However, this puts pressure on producers to identify buyers and negotiate terms for selling their highly perishable product. For example, during the government-imposed COVID-19 lockdown in Rwanda, broiler producers experienced widespread losses, as a result of poor access to cold storage (Rwibasira 2020).

Quality standards

Rwandan smallholders lack the resources and connections to engage with processing units or poultry companies who have been certified to guarantee quality standards, such as Hazard Analysis Critical Control Point (HACCP). Maintaining a consistent, high-quality product is critical to building trust and growing the client base. Many supermarkets and hotels in Rwanda prefer broiler meat sourced from South Africa and Kenya (Miklyaev, Afra, and Hashemi 2017). This is partly because producers and suppliers in these countries have a strong track record of meeting specifications.

Distribution and consumption

Market access and trade

Rwandan smallholders frequently operate independently and therefore lack the collective organisation to aggregate sales of broilers and secure higher prices. In addition, these smallholders have limited access to markets due to the distance from markets, poor infrastructure, and cost of transportation options. Almost half of the Rwanda broiler producers surveyed by Mbuza et al. (2016b) reported limited access to markets. While the cost of broiler meat remains high, available markets for broiler meat are concentrated in the high-end hospitality industry. Furthermore, political tensions and non-tariff barriers (NTBs) that regulate market access and/or restrict imports/exports can inhibit regional trade of broilers (Orio, Owino and Mendez-Parra 2017). In particular, border markets can

be fluid and uncertain due to changing policies and border closures. The costs of market volatility are felt more acutely by smallholders who rely on cross-border trade to move perishable products, such as broilers.

Consumers

An increase in the purchasing power of consumers contributes to the growth of the poultry industry (Mbuza et al. 2016b). The average gross national income per capita (constant 2017 PPP$) in Rwanda is USD 2,250 (World Bank 2019). This makes purchasing and consuming chicken on a regular basis a challenge for many Rwandan families at current market prices. Consumers also show a low preference for imported chicken breeds (Miklyaev, Afra, and Hashemi 2017). This poses challenges for marketing modern broiler breeds that can be produced more efficiently at scale.

The coronavirus pandemic

Smallholders have low capacity for absorbing risk due to a range of factors, such as lack of capital, assets, and market linkages. Smallholder producers will therefore likely take longer to recover than large-scale enterprises from the disruptions caused by the coronavirus pandemic (COVID-19), due to various reasons including (but not limited to), difficulty accessing credit to re-start production, shifting labour back to broiler production, and competing with larger producers for scarce inputs. COVID-19 has presented production challenges and driven down consumer demand for broilers in Rwanda. In particular, the hospitality industry has been one of the hardest-hit sectors of the Rwandan economy. This resulted from the disruptions to international travel, which led to a drastic reduction in tourism, which drives much of the current demand for broiler meat. Furthermore, measures to stay home during the pandemic have reduced the purchase of poultry at hotels, restaurants, and grocery stores. This reduction in chicken consumption is exacerbated by limited operation of the border with the DRC, thus further reducing live chicken sales. At the same time, the pandemic has disrupted supply chains for inputs used to produce broiler chickens. These factors have contributed to decreased supply and demand of broiler chickens in Rwanda. The broiler value chain appears to be recovering, as evidenced by new placements of chicks among producers, and exceptionally high prices for broiler meat in the market.

Opportunities for strengthening smallholder engagement and integration in the Rwandan commercial broiler value chain

Many emerging economies are grappling with rising demands for animal-sourced protein juxtaposed with large proportions of their populations engaged in smallholder agricultural production. While the following recommendations are written with reference to the Rwandan context, it is likely that these recommendations are applicable to other nascent commercial broiler sectors in emerging economies. We present six opportunities for strengthened engagement and integration of smallholders in the commercial broiler value chain in Rwanda. These recommendations provide options for both public and private sector organisations and institutions to support smallholders to be consistent and important actors in the commercial broiler sector in Rwanda.

Reduce recurring costs of production

Targeted investment to increase the reliability and consistency of inputs will help reduce smallholder broiler production costs and improve their net profitability. Therefore, special attention should be put on developing the animal feed industry in Rwanda so that affordable, high-quality commercial feed is readily available to smallholder producers (Mbuza et al. 2016b). Allocating more land to increase the supply of key feed ingredients such as maize and soy may be only one strategy, as land is a limited resource in Rwanda. Introducing and scaling up alternative feed ingredients, such as insect protein from black soldier fly (*Hermetia illucens*), may be another opportunity to meet demand. Promoting investment in agri-businesses, including grain aggregators and transporters, feed processors and distributors would also strengthen the domestic supply chain for feed and feed ingredients. Supporting the establishment of new hatcheries and the professionalisation of existing hatcheries in Rwanda would help reduce costs, by providing more competition with imports from Uganda or Europe in terms of both volume and quality. Costs could also be reduced through the use of efficient broiler housing heating sources, and the development of zero-waste systems by using litter as fertiliser.

Provide broiler value-chain trainings for stakeholders

Training a range of different stakeholders in the broiler value chain would serve to improve the supply and affordability of broiler products across Rwanda. Three stakeholder groups in particular could benefit from training programmes: i) existing smallholders who are producing broilers; ii) small-scale processors could be trained in HACCP so that they can meet national and international certification standards; iii) veterinary professionals to provide broiler health services. Existing medium- and large-scale broiler producers in Rwanda could be incentivised to provide training and support to smallholders so that they will adhere to best practices that protect the overall broiler population (World Organisation for Animal Health 2019).

Facilitate microfinance provision to smallholders

Expanding the opportunities for smallholders to access credit facilities will enhance development of the broiler value chain. Value chain finance products can work in Rwanda and there is evidence that microfinance institutions can play an important role in providing access to credit for smallholders (Kopparthi and Kagabo 2012). Opportunities could include encouraging organisation of smallholders into groups so that they can negotiate better terms, and so that microfinance institutions can expand their client base. This would help to develop stronger, longer-term linkages between smallholders and microfinance institutions, which can build trust (Taremwa, Macharia, and Bett 2021). Furthermore, with increased mobile technology adoption, this could also include increasing mobile financial services to facilitate loan access and repayment.

Reduce post-harvest costs

Post-farm gate costs can be reduced through establishing processing facilities, increasing cold storage and reducing the costs of transportation of harvested birds. Improved processing facilities must be put in place if Rwanda is to satisfy a growing and diverse market for chicken meat. The establishment of modern chicken processing plants that can slaughter birds at high and consistent volumes, and that are accessible to smallholder individual or cooperative producers, would reduce the post-harvest costs associated with broiler production. Expanding numbers and capacity of cold storage facilities in Rwanda would ensure that chicken meat can safely reach consumers. Improved freezer capacity would allow producers to plan better for seasonal demand: storing surplus during periods of low demand and selling that surplus during periods of higher demand. Subsidising cold storage facilities would help extend access to smallholders, particularly during the current market volatility associated with the coronavirus pandemic. Organising smallholder producers to aggregate their harvests could result in reduced overall transportation costs. The recent expansion of electric and renewable energy vehicles could be integrated into the nascent commercial broiler value chain in Rwanda, aligning smallholder production with the sustainable development of Rwanda's poultry industry (Vaarst, Steenfeldt, and Horsted 2015).

Stoke demand for locally produced broiler meat

While market demand for chicken meat is currently dominated by high-end restaurants and hotels, there is potential for it to expand both domestically and for export. Efforts towards increasing national and regional demand for Rwandan-produced broiler meat products would facilitate smallholder engagement in the broiler value chain. This could be achieved through three methods. First, promotion and strengthening of chicken trader associations, coupled with eliminating intermediaries and selling directly to consumers would likely make chicken meat more affordable to Rwandan households. This, of course, would need to be done carefully to support any stakeholders disenfranchised by market reforms to transition to alternative livelihood opportunities. Secondly, promotion of the consumption of chicken meat in Rwandan households, particularly of improved breeds raised by commercial operations, could take place through targeted marketing and nutrition messaging campaigns. Thirdly, improved consumer awareness of food safety through educational campaigns would support increased consumer willingness to pay for safe and nutritious poultry products.

Strengthen policies in support of smallholders

We recommend five policy options in support of smallholders. First, a national poultry policy for Rwanda would facilitate sustainable development of the commercial broiler value chain, which would help meet the targets outlined in the LMP (Mbuza et al. 2016b). This could involve updating the national biosafety guidelines for vaccination, disease monitoring, and control. The Rwanda LMP could also be aligned with Rwanda's One Health approach to ensure human, animal, and environmental health concerns are all considered when integrating smallholders into the commercial broiler value chain

(Nyatanyi et al. 2017). Secondly, energy policies could be updated to promote green technologies appropriate for coop heating, and both the public and private sector could be incentivised to facilitate smallholder producers' access to these technologies. The government's charcoal policy could be revisited to lessen potential negative impacts of the charcoal ban in Kigali on rural smallholder producers, who heavily depend on charcoal to affordably raise chickens and represent only a fraction of overall charcoal consumption. Thirdly, the government could encourage open market competition between hatcheries by ending subsidies for public and semi-public hatcheries. This would contribute to more competitive pricing and quality of chicks. Fourth, the government could remove trade barriers for regional input supply and final broiler products by maintaining favourable bilateral trade relations with East African Community countries. This will reduce unnecessary non-tariff barriers that hinder the broiler value chain by disrupting markets, feed imports and product exports. Finally, microfinance access support, insurance schemes and other risk-sharing services could be instituted to protect broiler producers in case of unforeseen circumstances (e.g. political instability or pandemics). These services will be instrumental to producers planning to resume operations and invest resources in an uncertain market.

Note

1. PAFI is now African Solutions Limited (AfriSol), a Zimbabwean firm which has been investing in Rwanda since 2018.

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