

Rwanda: Desk Study of Extension and Advisory Services

Developing Local Extension Capacity (DLEC) Project
March 2018

Acknowledgements

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ACRONYMS

ADB	African Development Bank
AFAAS	African Forum for Agricultural Advisory Services
AMIS	Agriculture Market Pricing Information System
ASIP	Agricultural Support Investment Program
ASTI	Agricultural Science and Technology Indicators
BTC	Belgian Development Agency
CAHP	Community Animal Health Provider
CAHW	Community Animal Health Worker
CDI	Clinton Development Initiative
CFSVA	Crop and Food Security Vulnerability Assessment
CIAT	International Center for Tropical Agriculture
CICA	Agriculture Communication and Information Center
CIK	Catholic Institute of Kabgayi
CNFA	Cultivating New Frontiers in Agriculture
COAMVU	Maize-Producers Cooperative in Rwanda
COMESA	Common Market of East and Southern Africa
DG	Digital Green
DLEC	Developing Local Extension Capacity
EAC	East African Community
EAS	Extension and Advisory Services
EDPRS	Economic Development and Poverty Reduction Strategy
FAAS-R	Rwanda Forum for Agricultural Advisory Services
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FFS	Farmer Field School

FP	Farmer Promoter
FTE	Full-Time Equivalent
GAP	Good Agronomic Practices
GDP	Gross Domestic Product
GFRAS	Global Forum for Rural Advisory Services
GoR	Government of Rwanda
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
ICT4RAG	Information and Communication Technology for Research in Agriculture
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Corporation
IFPRI	International Food Policy Research Institute
IRG	International Resources Group
ISAR	Rwandan Institute for Agronomic Sciences
LWA	Leader with Associates
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Government
NAEB	National Agricultural Export Board
NGO	Non-Governmental Organization
NISR	National Institute of Statistics-Rwanda
OAF	One Acre Fund
OCIR CAFÉ	Rwanda Coffee Authority
OCIR THE	Rwanda Tea Authority
OFSP	Orange Fleshed Sweet Potato
PREFER	Private Fertilizer Import and Distribution for Rwanda
PSDAG	Private-Sector Driven Agricultural Growth
RAB	Rwanda Agricultural Board

RHODA	Rwanda Horticulture
RPF	Rwandan Patriotic Front
RTI	Research Triangle Institute
SEDO	Socio-economic Development Officer
SMS	Short Message Service
SPAT II	Strategic Plan for Agricultural Transformation
TM	Twigire Muhinzi
UK	FARD
UN	United Nations
UR-CAASVM	University of Rwanda-College of Agriculture, Animal Sciences and Veterinary Medicine
USAID	United States Agency for International Development
VFT	Volunteer Farmer Trainer
WVI	World Vision International
ZOI	Zone of Influence

INTRODUCTION

Rwanda is a unique African country with a unique history. Like many other sub-Saharan African countries, agriculture is the key livelihood for the majority of the nation's people. Rwanda is also one of the most densely-populated countries in the world, and there are many challenges for rural agriculture: access to land, access and high cost of agricultural inputs, small average landholdings, soil erosion and an undercapitalized private sector. Despite these barriers, Rwanda's agricultural sector has produced significant agricultural growth since the 1994 genocide, taking advantage of the many opportunities that the country's agricultural sector has including good technical capacity in both the private and public sector, two to three cropping seasons per year, manageable access to urban markets for most areas, good governmental support for ICT and business, lower levels of corruption compared to its neighbors, and opportunities for export to other countries in the East African Community. However, poverty levels, while declining, are still high.

There is wide recognition in Rwanda that agricultural extension and advisory services (EAS) are key for promoting increased agricultural productivity and incomes. In fact, there is considerable evidence throughout Sub-Saharan Africa that extension and advisory services improve agricultural productivity and incomes, reduce production risks and have high rates of return on investment (Ojjo et al, 2016). Rural extension and advisory services are defined by the Global Forum for Rural Advisory Services (GFRAS) as all the different activities that provide the information and services needed by farmers and other players in the innovation system to develop and build their technical, organizational and management capacities, so they can improve their quality of life and well-being (Christoplos, 2010). Therefore, EAS can encompass training for improved inputs and techniques to increase production. It also includes information on improved crop varieties, soil quality, cropping practices for staples and cash crops, minimizing the impact of climate change (e.g., severe weather events, especially drought), livestock production, post-harvest handling, grain storage, nutrition and improved marketing techniques/approaches.

The United States Agency for International Development (USAID) funded the Developing Local Extension Capacity (DLEC) project to target Feed the Future countries to measurably improve extension programs, policies and services by creating locally-tailored, partnership-based solutions and by mobilizing active communities of practice to advocate for scaling proven approaches. The five-year (2016-2021) project is designed to diagnose, test and share best-fit solutions for agricultural extension systems and services across the Feed the Future countries.

Led by Digital Green in partnership with Care International, the International Food Policy Research Institute (IFPRI) and the Global Forum for Rural Advisory Services (GFRAS), DLEC is an action-oriented, evidence-based learning project that generates evidence through diagnostic studies and engagement activities, which in turn are used as a catalyst for mobilizing global and country-level communities of practice to advocate for improved EAS.

DLEC conducts diagnostics in Feed the Future countries to evaluate the EAS ecosystem. The diagnostics provide insight into the strengths and challenges faced by the national extension systems by evaluating the access, quality and sustainability of the governance structures and policy environment, organizational and management capacities and cultures of country EAS, and advisory methods used within each system. The diagnostics also review the extent to which the system is

market-oriented, how the system engages different communities, including youth and women, and how it supports overall livelihood strategies of farmers. Recommendations on customized improvements and solutions are then provided¹.

This report reviews the status of Rwanda's EAS to recommend areas for potential investment by government, donors, NGOs and the private sector, and will serve to guide investors in EAS. One such program that this report will help guide is the recently-launched Feed the Future Hinga Weze project, a five-year agricultural value chain development project implemented by Cultivating New Frontiers in Agriculture (CNFA).

Evidence generated from this desk review will contribute to the knowledge base for best-fit practices to build up EAS in Rwanda. The modified DLEC best-fit conceptual framework that appears below guides the DLEC project overall and this report.

CONCEPTUAL FRAMEWORK

DLEC uses the adapted best-fit framework (Birner et al., 2009) shown in Figure 1, to guide analyses and to determine EAS areas of focus for on-the-ground activities that are within DLEC's manageable interests. We use the framework to guide DLEC's learning agenda because it outlines EAS system parameters and identifies the levers of change within it. In each country, the levers of change will differ. The best-fit framework allows us to analyze a country's EAS system, begin conversations with local stakeholders to understand the state of their EAS system and where the critical levers for change might be, and analyze and recommend systems change. The framework also enables us to compare across countries and connect country-specific cases to broader learning on EAS, to advance overall learning and apply this to other donor and government programs and priorities.

The framework identifies characteristics of EAS systems on which policy decisions must be made, and the frame conditions to be considered when making decisions. The frame conditions include: the political economy, the business/market and civil society environments, agroecology and the agricultural innovation system. The framework suggests an impact chain approach to analyze the performance and impact of EAS.

Key for DLEC are the EAS characteristics shown in the framework. Referring to Figure 1 below, the **governance structures and policy environment** variables (box F) refer to institutional set-up of EAS, or the "rules of the game." The **organizational and management capacities and cultures** variables (box G) refer to capacity for provision of advisory services, and way in which the services are managed within the respective governance structures. These are essentially the "players" of the game, their abilities and the way they play.

Advisory methods (box H) are used by EAS field staff in interactions with farmers. Advisory methods can be classified according to various aspects, such as the number of clientele involved

¹ For further reports see www.digitalgreen.org/resources/dlec/reports/.

(individuals, groups); the types of decisions on which advice is provided (specific to the production of certain crops or livestock; managerial decisions; group activities, etc.); and media used (radio; internet, etc.).

Market engagement (box I) refers to the market elements that EAS can use to better serve farmers, such as aggregation, finance, price discovery, and input and output markets.

Livelihoods strategies (box J) refers to how EAS develops content to meet the unique needs of clientele and how gender roles impact farming strategies. **Community engagement** (box K) refers to EAS services based on local social institutions, mechanisms to articulate demand and community psychosocial characteristics.

The frame conditions (boxes A-E) are outside DLEC’s manageable interests. The “manageable” outcomes of this framework include the system-level performance areas (box L). The outcomes and ultimate impact at the farm household level (boxes M and N) are outside the core DLEC leader award manageable interests.

Further, the building blocks for EAS are also useful in framing recommendations for engagement. They are as follows:

- ◆ Customer – farmers and their unique needs
- ◆ Content – knowledge being shared
- ◆ Methods – how information and knowledge is shared
- ◆ Provider – who shares information and knowledge

This report also addresses cross-cutting EAS issues, such as women and youth engagement, climate change resilience, food and nutrition security, and use of information and communication technologies (ICTs).

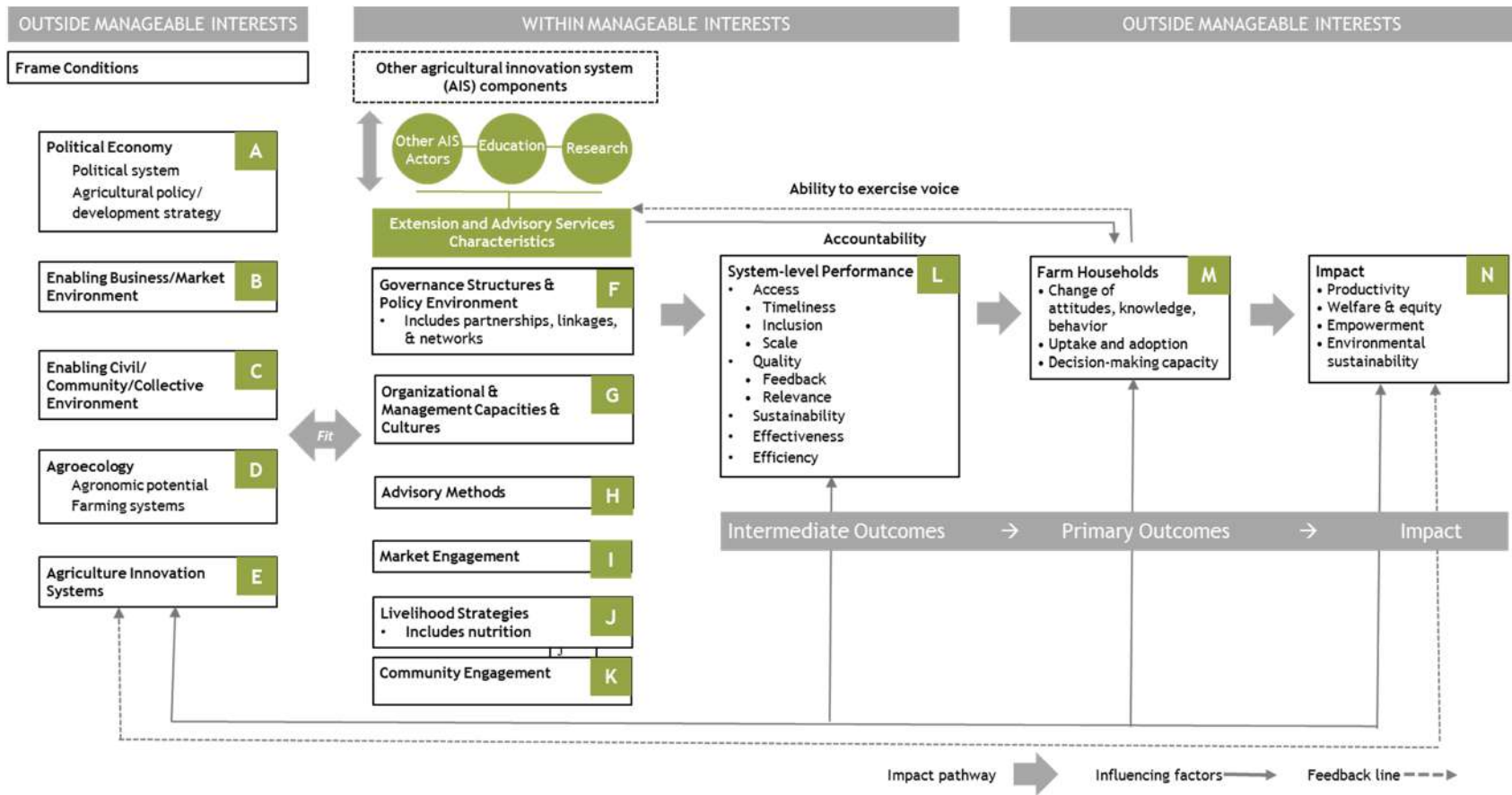


Figure 1. Conceptual Framework for the Study

Source: Adapted from Birner, et al., 2009.

METHODS

This report is based on a desk review from June to August 2017 of existing literature on the status of the Rwandan agricultural extension system. The review includes information from donor annual reports, project documents, academic studies and policy/programming documents from government sources, NGOs, universities and private companies. The report also relies on remote and in-person key informant interviews (conducted from June-August 2017; see Annex A for contacts). The report does not include any primary data or direct observation of Rwandan EAS activities.

RESULTS

Frame Conditions

Rwanda became independent in 1962 and was led by Gregoire Kayibanda and Juvenal Habyarimana prior to the genocide in 1994. The genocide was a watershed event in the history and culture of the country. It began with the shooting of an airplane carrying Presidents Habyarimana of Rwanda and Ntaryamira of Burundi near Kigali in April 1994. This event precipitated the Rwandan genocide, and an estimated 800,000 Tutsis and moderate Hutus were killed in the following three months (Prunier, 1995). The Rwandan Patriotic Front (RPF), led by Paul Kagame, defeated the government forces of ex-President Habyarimana later in 1994. The RPF party has ruled the country since 1994, with Paul Kagame as the current president. Agriculture before and after 1994 has traditionally been the key to the Rwandan economy, and has remained a priority of the RPA government since taking power in 1994. To facilitate agricultural trade with its regional and continental neighbors, Rwanda is a member of both the larger Common Market of East and Southern Africa (COMESA) and the regional East African Community (EAC) blocs.

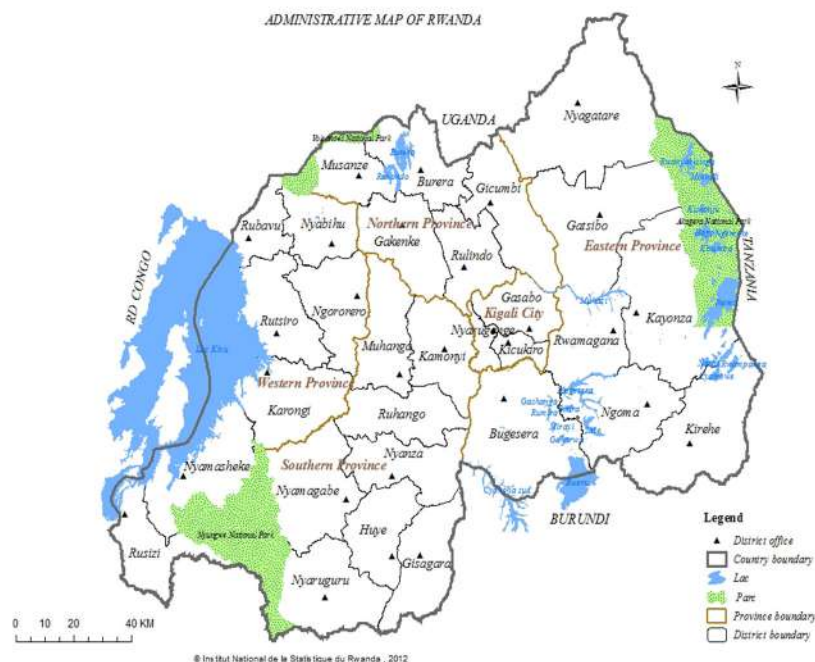


Figure 2. Map of Rwanda

Rwanda's current population is an estimated 12.43 million people, with 71 percent rural and 29 percent urban; additionally, population growth averaged 3.18 percent between 2005-2015 (FAO, 2015). Population density for the country is very high for Africa, estimated at 434 persons/km² (EU,

2014). Rwanda's gross domestic product (GDP) per capita² was \$800 in 2000 and has grown to \$1584 in 2014, a significant annual growth rate of 7 percent per year since 2000. This substantial economic growth may also be slowing over the past two years,³ and also masks the fact that Rwanda still has a food deficit of 232 kcals/capita/day, which was measured as a three-year average from 2013-15 (FAO, 2015). Additionally, Rwanda's stunting rate has recently improved, but is still at 37 percent (Hjelm, 2015).

Rwanda is divided into five provinces, as seen in Figure 2: Northern, Eastern, Southern, Western and Kigali. The provinces, in turn are divided into 30 districts, 416 sectors, 1,500 cells and 14,837 villages. USAID's Zone of Influence (ZOI) for Feed the Future programming includes all four provinces surrounding Kigali (Northern, Eastern, Southern and Western), and 27 of the 30 districts nationally, excluding the three districts covering urban and peri-urban Kigali.

Regarding agriculture, Rwanda's main staples are beans, maize, sweet potatoes, cassava, sorghum, Irish potatoes and bananas, and are all grown throughout the five provinces. Tubers and roots represent the largest category of staple in terms of production tonnage. The commonest crops grown, as measured through planting by individual households, are beans, maize and sweet potatoes, respectively (Hjelm, 2015). Further, beans and sweet potatoes are grown throughout Rwanda's five provinces, while Irish potatoes usually have a surplus in the Northern and Western Provinces, maize usually predominates in the Northern and Eastern Provinces, and cassava is concentrated in the southeast of the country.

In addition to Rwanda's staple crops, coffee is the most important cash crop in-country. An estimated 400,000 smallholder farmers grow coffee, annual production is 18,000-21,000 MT, and coffee contributes to 36 percent of export revenue.⁴ Livestock is also found throughout the country, with agro-pastoralism found more commonly in the southern and eastern parts of the country. Additionally, the average consumption of meat and milk is lower than average for the households that possess livestock, showing that these households tend to sell these high-protein foodstuffs to wealthier and urban households (Hjelm, 2015). Finally, Rwanda's capital Kigali averages 1028 mm of annual rainfall, with slight variations throughout other parts of the country: Huye (Butare) averages 1241 mm, Ngoma (Kibungo) 1015 mm, and Bumazi 1595 mm of annual rainfall.⁵ Rwanda also has only 10,000 hectares equipped for irrigation (0.4 percent of total land area). Irrigation capacity could be significantly increased with further investment (FAOSTAT, 2012).

Food crop production more than doubled the population growth rate between 2007 and 2014 (USAID, 2016). Poverty has also been reduced from 45 percent in 2011 to 39 percent in 2014. The agricultural sector and other factors roughly contributed to a poverty decrease of 45 percent since 2005 (World Bank, 2013): "Rwanda's agro-renaissance was made possible by proactive and pro-poor policies (Ojijo et al, 2016, p. 209)." The agricultural sector meets 90 percent of the country's domestic food needs and accounts for 80 percent of employment, 63 percent of foreign exchange earnings and 39 percent of GDP (MINAGRI, 2013). However, 60 percent of Rwandan farms are

² Using 2011 US Dollars with purchasing power parity (PPP) methodology

³ See <http://roape.net/2017/07/26/faking-rwandan-gdp-growth-myth/>, accessed August 2017, for an alternative view of Rwanda's recent economic growth.

⁴ See <http://www.nacb.gov.rw/index.php?id=48>, accessed August 2017.

⁵ Accessed July 2017; <http://www.rwanda.climateps.com/precipitation.php>

less than 0.5 hectares, and low agricultural productivity occurs due to degraded soils that are prone to erosion, lack of market incentives, low agricultural input access/usage and low mechanization rates (USAID, 2016). Twenty percent of households were reported to be food insecure in the Rwanda 2015 Crop and Food Security Vulnerability Assessment (CFSVA), with the highest levels of food insecurity recorded in the districts of Rutsiro, Nyamagabe, Nyabihu and Nyaruguru (Hjelm, 2015). Therefore, many agricultural challenges persist within the country for the government, private sector, farmers and donors to address.

Rwanda's national fertilizer utilization has increased dramatically over the past decade. In 2008 the government started privatizing fertilizer importation and distribution (IRG, 2015) under the USAID-funded project Privatizing Fertilizer Import and Distribution for Rwanda (IFDC PREFER). Prices are subsidized by the government. According to the Ministry of Agriculture, fertilizer use was 4 kg/hectare in 2006 and increased to 30 kg/hectare in 2013, with the Ministry's goal to reach 45 kg/hectare coverage by the 2017/18 cropping seasons (ROR-MINAG, 2014). However, due to programmatic challenges and some reports of corruption, the Rwandan military now controls the distribution of fertilizer in-country. Some 900 agro-dealers sell fertilizers and other inputs, connected to the subsidized distribution system (IRG, 2015). There may also be private sector options for fertilizer importation/production/distribution in the near term, with rumored interest of Moroccan investment in the Rwandan fertilizer sector.⁶

Overall, Rwanda continues to have high levels of poverty despite its successful economic growth, increase in agricultural productivity and plentiful rainfall. The country ranks 159/188 countries for the United Nations Human Development Index (UN, 2016).⁷ However, the Rwandan government made progress in many areas over the past two decades. According to the World Bank's 2017 index of doing business, Rwanda ranks as the second easiest country to do business for the sub-Saharan African region, and globally ranks a respectable 56/190, with the 190th country representing the hardest place to do business.⁸ For a measure of Rwandan government accountability, Transparency International's perception of corruption index for 2016 ranks Rwanda at 50/176 countries. This ranking again reflects the substantial efforts the Government of Rwanda has made in combatting corruption since 1994.

Financial service provision within Rwanda is low, but improving. An African Development Bank (ADB) study from 2008 reported that only three percent of the population had access to financial services (Augustine, 2016), but that statistic has likely improved, especially due to Rwanda's economic growth. However, unlike many other sub-Saharan African countries, there is no national agricultural development bank to provide significant sectoral investment.

Regarding literacy, the National Institute of Statistics Rwanda (NISR) reports that for those over the age of 15, literacy slightly increased to 68 percent in 2012, from 64 percent in 2002⁹. Additionally, males had a higher literacy rate of 72 percent in 2012, compared to females at 65 percent.

⁶ Non-governmental agricultural stakeholder interview, July 2017.

⁷ Accessed July 2017; http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf

⁸ Accessed July 2017; <http://www.doingbusiness.org/rankings>

⁹ <http://statistics.gov.rw/node/1086>, accessed August 2017.

Rwanda has made huge gains in the ICT sector. They significantly invested in improved wi-fi access in urban and rural areas, and just published the National Information and Communication Technology for Research in Agriculture (ICT4RAG) Strategy (2016-2020) (MINAGRI, 2016). Rwanda's mobile phone SIM penetration for 2016 is 79 percent of the population, with 29 percent having access to fixed Internet connections.¹⁰ Mobile payments are expected to develop a growing market share within the country, due in part to the relative weakness of the formal banking sector. The three main carriers are MTN, Liquid Telecom and Tigo.

The Government of Rwanda's overall country development strategy lies within the Vision 2020 document from the Ministry of Finance and Economic Planning (MINFIN, 2000). For agriculture specifically, that sector is covered in the Economic Development and Poverty Reduction Strategy 2013-2018: Shaping our Development (EDPRS II) (MINECOFIN, 2013). The major goals for EDPRS II are to reduce poverty to less than 30 percent of the population and establish Rwanda's annual average economic growth at 11.5 percent of GDP. Additionally, for agriculture, the EDPRS II details priorities for agricultural diversification, value chain investment from the private sector, rural infrastructural development and overall increased agricultural productivity. The three foundational issues for EDPRS II linked to agriculture are a) food security and improved nutrition, b) macroeconomic stability and c) decentralization. These foundational issues also include gender inclusion and environmental sustainability as cross-cutting issues (USAID, 2016).

Rwanda's agricultural strategy also includes a National Agricultural Extension Policy (MINAGRI, 2009). This policy highlights the crucial role that EAS plays in agricultural development and specifies key principles to guide EAS in Rwanda: (i) participatory extension, (ii) multi-approach and multi-method, (iii) demand-driven and market-oriented, (iv) process- and result-oriented, (v) multi-actor extension, and (vi) build on already existing initiatives. To fulfill Rwanda's strategic agricultural goals, the policy also prioritizes development of farmer organizations (MINAGRI, 2009). For farmer organizations, this currently occurs at the grassroots level within Rwandan villages through the Twigire Muhinzi extension model and cooperatives. This model utilizes farmer field schools (FFS) and farmer promoters (FP)¹¹ to spur on agricultural innovations and productivity, and will be explained in more detail later in the report.

Rwanda's many civil society organizations help bridge the gap between the central state and local communities for agriculture and other programmatic sectors. International and local NGOs also help provide developmental and humanitarian programming.

The Agricultural Innovation System

The Government of Rwanda's agricultural innovation system is mainly composed of research, education, extension, civil society and the public and private sector institutions engaged in agriculture.

Rwanda's four agencies for agricultural research and education include the a) Rwanda Agricultural Board (RAB) within the Ministry of Agriculture and Animal Resources, with 104.0 full-time

¹⁰ Accessed July 2017: <https://www.budde.com.au/Research/Rwanda-Telecoms-Mobile-and-Broadband-Statistics-and-Analyses>

¹¹ Note that Farmer Promoters are not a new model to Rwanda, they were actually in place in the 1980s.

equivalent (FTE) researchers, b) the University of Rwanda-College of Agriculture, Animal Sciences and Veterinary Medicine (UR-CAASVM) in Musanze with 59.7 FTE researchers, c) the Catholic Institute of Kabgayi (CIK) with 4.2 FTE researchers, and d) the University of Kibungo-Faculty of Agriculture and Rural Development with 1.4 FTE researchers (ASTI, 2016).

RAB has the largest number of FTEs and represents the unification of ISAR (the Institut des Sciences Agronomiques du Rwanda), the Rwanda Agricultural Development Authority and the Rwanda Animal Resources Development Authority. This unification was initiated in 2008 and finalized in 2011 (Ojijo et al, 2016). A main motivation behind this merger was to link extension agents with research scientists to improve the effectiveness of the agricultural research and development system.

The National Agricultural Export Development Board (NAEB), and is also registered under Ministry of Agriculture. However, it covers exports and is distinct from the RAB. The Rwanda Tea Authority (OCIR THE), Rwanda Coffee Authority (OCIR CAFE) and Rwanda Horticulture (RHODA) were all merged in 2011 to form NAEB.¹²

The UR-CAASVM has the second largest number of FTEs, and its three departments are a) crop sciences, b) social sciences and c) rural development/agricultural economics. The university also has three master's degree programs, in agroforestry/soil management, agribusiness and crop sciences. A unification of all public universities occurred in 2013, to form the University of Rwanda.

Overall, the Government of Rwanda provides significant funding to the above institutions. However, the RAB has also been able to leverage significant funding from international and regional organizations, the Food and Agriculture Organization, the CGIAR and many donors (ASTI, 2016). RAB's research outputs over the past five years, included releasing 15 new bean varieties, eight new Cassava Mosaic Disease-resistant cassava varieties, seven new rice varieties, five new wheat varieties, four new sweet potato varieties and four soybean varieties (ASTI, 2016 and Uwitonze, 2017).

Total agricultural research and development spending increased by 33 percent from 2011-2014, but that notable increase has not been maintained (ASTI, 2016). Rwanda has a young pool of agricultural researchers compared to other countries in Sub-Saharan Africa, and the overall number of researchers with Ph.D. degrees remains relatively small. Almost half of all agricultural researchers focus on either cereals, horticultural crops or roots and tubers. The proportion of female agricultural researchers has increased from 16 percent in 2008 to 23 percent in 2014 (ASTI, 2016).

Extension and Advisory Services System

Governance Structures and Policy Environment

This section looks at relevant policies, governance and coordination of the EAS system, accountability, financing and major players in EAS, including their roles and functions.

Rwanda rebuilt its state-led EAS and other service provision after the genocide in 1994. The government was quite successful since that time through the establishment first of farmer field schools and then, more recently, farmer promoters, with the support of FAO, Belgian Development

¹² See <http://www.naeb.gov.rw/index.php?id=48>, accessed August 2017.

Agency (BTC) and others. The FFS approach is a group-based adult learning approach at a physical location, often a cropped field, that teaches farmers how to experiment and solve problems independently. Farmer promoters are volunteer model farmers that are selected based on criteria to share agricultural knowledge using extension skills. FPs mobilize groups of 15-20 farmers to amplify their work (MINAGRI-RAB-CCOAIB, 2016).

The FFS approach was improved and steadily expanded by the government to reflect its commitment to a centralized and effective EAS system, embodied in the Twigire Muhinzi extension model. The model was established in 2014. The GoR has also committed to full national coverage reaching all of the country's farmers, and developed the technical capacity of FFS Master Trainers and FFS Facilitators within the FFS structures to do so. The FFS Facilitators are used to help establish and train both FPs and Twigire Muhinzi farmer groups of 15-20 farmers at the village-level to reach this full national coverage. Therefore, both FFSs and FPs undergird the Twigire Muhinzi agricultural extension system. The RAB is also responsible for livestock research and extension, whereas the NAEB covers research and extension for coffee, tea, horticultural products and livestock for export (as mentioned in the Agricultural Innovation System section).

As mentioned previously, EAS provision and overall agricultural development are covered under the EDPRS II, which runs from 2013-18. The Rwandan Government through MINAGRI established in 2009 a National Agricultural Extension Strategy that included the following principles:

- ◆ Be participatory
- ◆ Utilize multiple approaches and multiple methods
- ◆ Be farmer-led (i.e., demand-driven) and market-oriented
- ◆ Be process and results oriented
- ◆ Involve multiple actors in delivering extension education, information and services
- ◆ Build on already existing initiatives (Swanson et al., 2011)

In addition to this national strategy, the MINAGRI is also in the process of developing an agriculture extension policy, with the assistance of the African Forum for Agricultural Advisory Services (AFAAS). Overall, Rwanda's EAS system can be called pluralistic because various government extension service providers, such as the RAB, the NAEB, UR-CAAVSM, projects, the private sector and NGOs, all provide extension services and use multiple approaches/methods.

Additionally, as mentioned earlier, the Rwandan government developed a national ICT strategy, the ICT for Rwandan Agriculture (ICT4RAG) Strategy (2016-2020), to complement agricultural development and the above agriculture extension system (MINAGRI, 2016). The strategy's three main principles are:

1. a national ICT4RAG vision that corresponds to development and achievement of national agriculture modernization goals;
2. a national ICT4RAG action plan that reflects Rwanda's agricultural and rural development priorities; and
3. a national ICT4RAG implementation, monitoring and evaluation plan to manage the implementation and associated risks and measure the outcomes and impact in the context of the stated objectives (MINAGRI, 2016).

This report provides details on how appropriate ICT technology has been incorporated into Rwandan EAS.

Public-Sector EAS Providers

Ministry of Agriculture and Animal Resources/Rwanda Agricultural Board

The RAB is autonomous within the MINAGRI and supports agricultural sector development to improve food security and livelihoods. The RAB's departments include crop production and food security (seven senior staff), animal resources extension (six senior staff), land husbandry-irrigation-mechanization, research, crop services and quality control. One of the RAB's responsibilities is "to provide agricultural extension services in accordance with agricultural and animal husbandry needs," and the RAB coordinates, disseminates and manages the decentralization of EAS service provision.¹³ EAS provision for crops and livestock fit within the above crop production/food security and animal resources extension departments respectively. Formal national extension structures and staff extend down to the district level (e.g., district-level agronomists, RAB HQ technicians, zone technicians and field coordinators). Further EAS service provision and collaboration with the Twigire Muhinzi model occurs through MINALOC below the district level to sectors, cells and villages, to FPs and farmer groups. The NAEB also provides separate extension services as one of its responsibilities for coffee, tea, horticulture and livestock exports. It also seeks to "to identify and support research on agricultural extension regarding agricultural and livestock products for export."¹⁴ In addition to the RAB and NAEB, the Agricultural Information and Communication Center (CICA) also sits within the MINAGRI and CICA's objective is to "regularly collect, produce, process, adapt, store, share and disseminate agricultural information and knowledge."¹⁵

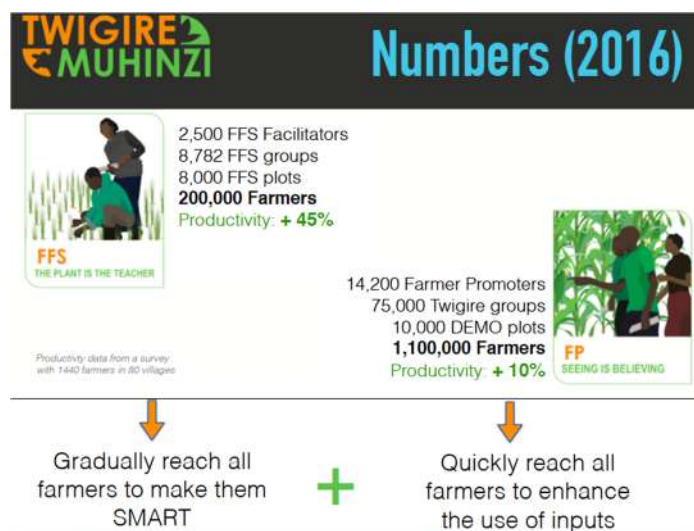


Figure 3. Twigire Muhinzi Numbers for Farmer Field School Facilitators Chain and Farmer Promoters Chain

Source: RAB, 2016

Before 1994, agricultural extension within Rwanda's public sector used a standard, top-down approach that included the "training and visit" model from the World Bank.¹⁶ After the genocide in 1994, Rwanda had to rebuild its national agricultural institutions, including its EAS system. This reconstruction was done initially through FFS, which have greatly expanded and are now included in the country's Twigire Muhinzi EAS model, highlighted in Figures 3. This model is located within the Rwanda Agricultural Board, which in turn is part of MINAGRI. BTC was a strong funder of Twigire Muhinzi, supporting farmer field schools (including fees paid to some facilitators), seed production and dissemination, the

¹³ See www.rab.gov.rw, accessed August 2017.

¹⁴ See www.naeb.gov.rw, accessed August 2017.

¹⁵ See www.minagri.gov.rw, accessed August 2017.

¹⁶ Accessed July 2017; <https://www.g-fras.org/en/world-wide-extension-study/africa/eastern-africa/rwanda.html?highlight=Wyjyd2FuZGEiLjYd2FuZGEncyJd>

Rwanda Agricultural Board, and the CICA. BTC aid to the RAB and Twigire Muhinzi formally ended in December 2016.

Twigire Muhinzi is a hybrid system that encompasses the complementary FFS (motto: the plant is the teacher) and FPs (motto: seeing is believing) (RAB, 2016). The graphics for Twigire Muhinzi in figures 3 briefly summarizes the Twigire Muhinzi system.

Figure 3 shows that 2,500 FFS facilitators, groups and experimental plots have utilized technical knowledge and training to reach 200,000 farmers by 2016. The “productivity: +45 percent” from Figure 3 refers to the finding of Wennink and Mur (2016) that farmers, who participated in FFS, had crop yields 45 percent higher than non-participants. However, since the participating farmers were selected based on their “interest in and [being] committed to... improving agricultural production,” (Wennink and Mur 2016, p. 24) they probably had higher yields than non-participants to begin with. Therefore, the 45 percent higher crop yields cannot be attributed to the FFS approach alone, but to the FFS approach plus other factors. Figure 3 also shows that the broader and less technical FP approach, where 14,200 FPs with simpler demonstration plots have reached 1,100,000 farmers, increasing agricultural productivity by 10 percent.

In the Twigire Muhinzi system, FFS facilitators play a “crucial role” in linking the demonstration and experimental plots. FFS facilitators have much higher levels of technical training (both in agriculture and adult education) and oversee experimental plots whereas FPs have less technical training and host a demonstration plot. The FFS facilitators train FFS farmer groups and one FP for each of the approximately five Twigire Muhinzi farmer groups that the FFS facilitators lead. The FFS facilitator, the FP and the farmer groups then choose talented farmers within their own Twigire groups to eventually form new, unique FFS groups. These new FFS groups will then receive more advanced and frequent training than do Twigire groups at the cell level with an FP. The Twigire model currently only applies to food crops; therefore livestock, coffee and agroforestry are not currently covered.

An FFS includes a facilitator and site, a group of 25 farmers (selected based on their being motivated farmers from a Twigire group), and experimental plots. FFSs are based on principles of adult education, empowerment and discovery learning (“the plant is the teacher”). Typically, FFS group members meet once a week at the experimental plots (RAB, 2016). Trainings focus on good agricultural practices for a single crop per season and include agro-ecosystem analysis: a thorough study of the agricultural environment that considers aspects from ecology, sociology and economics (CICA/MINAGRI, 2016). Farmers become empowered through these teaching techniques and further through skill-building on group savings and loans. Some 71 percent of FFS groups have internal savings components. Further, 86 percent of the FFS groups are sustainable, as defined by lasting for at least three years. Fifty-three percent of FFS group members are women, and the FFS trainings also include content on HIV awareness and gender.

FFS facilitators receive in-depth, season-long training (two to three months in the field) from the 44 qualified FFS master trainers¹⁷ in Rwanda, who have been trained at the university level. FFS facilitator training takes place in the field over the period of a crop cycle and the facilitators spend 60-90 total days¹⁸ away from home for the training. The FFS facilitators backstop the FPs throughout the season (Note that FPs are now trained by RAB extension agents with the end of BTC funding of FFS facilitators.)¹⁹ Next, FP's training for Twigire groups is also periodic, throughout the season, but at a lower technical level than FFS facilitator training for FPs. This cascade reflects the generally higher level of technical education for FFS facilitators when compared to FPs. Once a FP is established with a corresponding TM group of 15-20 farmers, this Twigire group is then permitted to purchase subsidized inputs at government-owned agro-dealer shops.²⁰

For the FP component of the TM model, FPs receive training (explained above) and then lead a typical Twigire group of 15-20 farmers. This decentralization of training and learning occurs gradually, and FFS facilitators then form cooperatives (initiated in 2015) to offer training. These cooperatives have continued to expand in the ensuing three years, and three-party performance contracts for providing farmers' training have been enacted for FFS facilitators between appropriate district officials, the Rwanda Agricultural Board and FFS facilitators' cooperatives. These contracts will also ensure accountability to the farmers and eventually build sustainability for the cooperatives. FFS facilitators are also farmers themselves.

Specific goals of Twigire Muhinzi are to a) maintain national food security, b) improve productivity, c) increase income and d) improve livelihoods. The Rwandan Government's extension strategy is to apply and use the home-grown Twigire Muhinzi model to reach all of Rwanda's farmers with the mission of providing them with access to agricultural advisory services (RAB, 2015). Such an objective is fairly unique among African countries and what is even more unique is that Rwanda is well on its way to achieving this goal. As of 2017, the TM model operates in 14,200 (96 percent) of Rwanda's 14,837 villages (RAB, 2016). Note that within the Rwandan government, structures devolve from province to district to sector to cell to village, and Twigire Muhinzi is designed to be decentralized and integrated into local government structures to increase effectiveness. FFS facilitators and FPs are empowered to make decisions within this model to provide training to farmers, and ultimately farmers become empowered to make their own decisions to improve their agricultural production. TM is a demand-driven system because individuals can provide feedback, and because the model promotes technology transfer and information exchange between producers, farmer organizations and other partners. Twigire Muhinzi also aims to complement other extension service providers (RAB, 2015).

As mentioned above, the Twigire Muhinzi model starts with qualified FFS master trainers, who then train FFS facilitators. The FFS facilitators then train FFS members and FPs in a cascade fashion. The FPs then select three to five key members within the Twigire groups of 15-20 farmers (who maintain their individual Twigire membership and contributions), but also start their own new and

¹⁷ These master trainers generally receive 18 months of agricultural training and coaching from Rwandan, regional and/or other universities.

¹⁸ This work is normally completed in "units" of four to five days at these sites.

¹⁹ Non-governmental agricultural stakeholder personal communication, February 2018.

²⁰ Shops receive inputs from Agro-Processing Trust Corporation, and the government sets prices, which may change from season to season.

more advanced FFS groups to increase their own level of agricultural training and learning. This approach makes the agricultural training of FPs and selected Twigire group farmers reinforced and sustainable. The government provides remuneration for the FFS master trainers and FFS facilitators, but FPs serve as community volunteers.

ICT development is supported through, two-way SMS, training videos and printed materials, and through a toll-free number (4675) that serves as a call-in help desk for farmers. More sophisticated ICT approaches are planned for the near future, under the Ministry of Agriculture and Animal Resources' ICT4RAG strategy 2016-2020 (mentioned previously), which fleshes out goals for improving ICT tool usage for agriculture (and likely application to other sectors) within the Rwandan economy.

At present, there is no official monitoring and evaluation system for Twigire Muhinzi; however, the MINAGRI/RAB plans to establish an effective system to measure its progress, and this is one of the three principles of the ICT4RAG Strategy (2016-2020). BTC evaluated its impact on crop yields, with the previously noted caveats by Wennink and Mur (2016).

EAS content for Twigire Muhinzi is developed by the RAB, and other collaborating sources (e.g., universities, NGOs, other government departments). Twigire groups also collaborate with other development initiatives, from the public sector, private sector and NGOs (for example with USAID projects promoting orange-fleshed sweet potato and high-iron beans, and the NGO One Acre Fund).

Twigire Muhinzi has both its advantages and challenges, as shown in Table 1.

Table 1. Advantages and Challenges of the Twigire Muhinzi Model

Advantages	Challenges
<ul style="list-style-type: none"> ◆ Very effective national coverage, only 32 percent of farmers received extension services in 2012, increased to 69 percent in 2015, and estimated at 75-80 percent currently ◆ Empowers farmers <ul style="list-style-type: none"> ◆ FFS structures allow for informed, collective response such as in combatting armyworm invasions ◆ Structure permits both vertical (from Ministry down to village) and horizontal (within groups) information flow ◆ Strong integration with MINALOC, which facilitates model implementation at local level 	<ul style="list-style-type: none"> ◆ FFS approach is expensive, intensive and difficult to scale up ◆ FFS facilitator training takes a long time (six months), difficult for married women to participate ◆ FPs need more technical training than current system provides; they are limited in what they can do ◆ Some farmers resist forming groups ◆ There is little private sector involvement with FFS groups ◆ Outside of the FFS program, sustained extension contact with farmers is minimal ◆ Despite evidence of good initial performance, there is no guarantee for sustainability or future success

<ul style="list-style-type: none"> ◆ Access to subsidized inputs incentivizes formation of Twigire groups ◆ Farmers' trust is enhanced through facilitation by farmer facilitators rather than GoR or NGO staff ◆ Group savings schemes are a side benefit of being in a TM group ◆ Twigire groups reported to function effectively for dissemination of information and technologies within groups and to neighboring groups, enhanced by geographic proximity ◆ While initial focus was on annual crops, model is flexible enough to include other types of enterprises (livestock, agroforestry) ◆ 53 percent of all FFS group members are female. 	<ul style="list-style-type: none"> ◆ Distinctive functions and differences between FFS facilitators and FPs may get blurred and then be less valuable/effective as TM becomes more established ◆ GoR district and sector agriculture staff are not always attuned to TM and its implementation; they may take some time and adjustment to fully understand and accept the farmer-centered TM model ◆ Though well integrated with local government, there is still potential for some differences to arise between RAB and local government in implementation ◆ In some cases, farmers are told what to grow and where, especially for variations among valleys/terraces/home plots ◆ Quick decisions are often needed for effective implementation ◆ Selection process of FPs at village level is sometimes disputed ◆ Occasional late delivery of inputs and current voucher subsidy of 25 percent (reduced from 50 percent) may reduce overall input usage
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Source: Key Agricultural Stakeholders within Rwanda, July-August 2017.

Livestock EAS provision is provided both through the RAB and the NAEB for exported livestock. This EAS provision is separate from the Twigire Muhinzi model. EAS provision for dairy and other livestock projects use volunteer farmer trainers (VFTs), now renamed community animal health workers (CAHWs) (Kiptot et al, 2016). They are supervised by the appropriate RAB district officer, receive cash for transportation/communication, and also often receive gifts in kind such as clothing and boots. Other EAS providers for livestock outside of the government include Heifer Project International and Technoserve, and they employ CAHPs (community animal health providers) to provide routine animal services on a fee-for-service basis (Kiptot et al, 2016). Both volunteer and fee-for-service models for individuals have been used with success for livestock EAS provision.

For coffee, the NAEB in 2015 presented a policy objective at a conference on the coffee sector “to enhance the extension services and use of inputs in coffee farming systems (Gatarayiha, 2015).” The NAEB also indicated their intention to adapt the Twigire Muhinzi model to the coffee sector. However, as of August 2017, it is unclear what progress has been made on this intention.

EAS have also been developed through other providers outside the public sector, through donors, private sources, NGOs and other organizations.

Donor EAS Initiatives

This section is not exhaustive, but focuses on major donor-funded EAS initiatives. In particular, USAID/Rwanda has supported and continues to support a number of EAS initiatives within Rwanda, through Feed the Future and other sectoral activities.²¹ These initiatives are primarily market-based, and build improved EAS services to further agricultural productivity in-country and in competitive neighboring markets.

Hinga Weze is the USAID/Rwanda Project (USD \$32.6 million for 2017-2021, awarded June 2017), to be implemented by Cultivating New Frontiers in Agriculture (CNFA). The project's objective is to sustainably increase smallholder farmers' incomes, improve the nutritional status of Rwandan women and children, and increase the resilience of the agriculture and food systems to the changing climate. Hinga Weze will collaborate with MINAGRI and the Rwandan Agricultural Board through Twigire Muhinzi, with a goal of tweaking this EAS model to increase impact and reach 200,000 households in over 10 districts:

“The Contractor will rely on Twigire Muhinzi, the national extension program, to disseminate training on good agricultural practices to beneficiary farmers. The Contractor will also be required to strengthen the program if any weaknesses are identified in order to assure effectiveness of the service delivery. In doing this, the Contractor will assess the national extension program to get a better understanding of its strengths and weaknesses and propose interventions to improve it (Feed the Future Hinga Weze, p.F-18.)”

USAID/PSDAG is the five-year Private-Sector Driven Agricultural Growth Project, implemented by IRG (now RTI) from 2014-2019 at USD \$25 million. PSDAG's goal is to increase smallholder farmers' incomes by promoting private-sector investments that contribute to the GoR's Vision 2020 of “transforming agriculture into a market-oriented, competitive, and high-value sector” (Republic of Rwanda/MINFIN, 2000). The project aims to do this through the two objectives of a) assisting the GoR to increase private-sector investment and b) to facilitate increased private-sector investment in upgrading agricultural value chains. PSDAG also works with cooperatives and has some degree of collaboration with Twigire Muhinzi.

USAID Feed the Future Orange-fleshed Sweet Potato (OFSP) for Income and Nutrition is being implemented by the International Potato Center (CIP) from 2015-2019, and the program value is USD \$4 million. This project is designed to increase the production and consumption of OFSP varieties and improve smallholders' livelihoods. This goal will be achieved through a) increased production and distribution of OFSP, b) market development for planting materials, fresh tubers and processed products for OFSP and c) nutrition education, and utilizes the TM model to increase impact.

²¹ Most USAID summaries are taken from the USAID Hinga Weze RFP Activity SOL-696-16-000014

USAID Feed the Future Rwanda High Iron Beans Scaling Up Activity is being implemented by the International Center for Tropical Agriculture (CIAT) and Harvest Plus from 2015-2018, and the program value is USD \$3 million. This project is designed to increase production, marketing and consumption of iron-fortified beans in Rwanda to improve nutritional status, especially for women and children. The goal for these high-iron beans is to increase demand for them in local markets, by linking farmers to national and export markets, and includes nutrition messaging and social marketing. This project also utilizes the TM model to increase impact.

European Union support to the agricultural sector. The EU has committed EU €200 million (USD \$244 million) for six fiscal years (2015-2021) “to enhance the agriculture sector’s sustainable use of land and water resources, value creation and contribution to nutrition security.”

Approximately 90 percent of this funding will go to direct budgetary support to the GoR, and these funds will help “the agricultural sector transform from intensification to sustainable value creation and towards inclusive growth.” The public agricultural extension system will be supported under this priority, including two staff experts, including one who will cover ICT for Agriculture/Management Information Systems. USD \$79,000 was budgeted for Twigire Muhinzi in 2015/16 under Agricultural Support Investment Program (ASIP II), reflecting 6.5 percent of this annual budget. Funding for Twigire Muhinzi will also include support for two-way SMS capability between extension specialists and farmers, and a website will be established for FPs and other extension agents. The EU will also be supporting small-scale irrigation systems to decrease vulnerability to climate change.

IFAD just recently started its **Rwanda Dairy Development Project**, funded at USD \$65 million from 2016-2022, covering 12 of Rwanda’s 30 districts.²² The project will intensify dairy production and increase market access, and the project’s target households will be 80 percent direct dairy producers and 20 percent households that are off-farm and along the dairy value chain. The project will also implement climate-smart dairy production principles and build cooperatives and related infrastructure to expand the dairy sector.

The Clinton Development Initiative (CDI) is also supporting agribusiness development through the 1) Anchor Farm Project, which is targeting 35,000 smallholder farmers (in five districts including N.E. Rwanda) to utilize good agricultural practices to increase yields (e.g., promoting maize-soya rotation), and 2) with the Hunter Foundation it is promoting agricultural value chains.²³ They also aim to collaborate with other agribusiness stakeholders in-country.

Private-sector and NGO EAS Providers

Private-sector EAS provision within Rwanda is generally limited compared to other East African countries. However, entities such as Enterprise Urwibutso, Sosoma Industries and MTN Rwanda serve as examples of increased investments in the agricultural sector and the provision of some technical advice to farmers. These organizations complement state/public-sector ones and the NGO sector to increase agricultural development and productivity and create a more dynamic sector that can effectively utilize EAS tools and services. They will be detailed later in the report.

²² Accessed July 2017,

https://operations.ifad.org/web/ifad/operations/country/project/tags/rwanda/2000001195/project_overview, and targeted districts extend from NW to NE and south of capital.

²³ www.clintonfoundation.org, and agribusiness activities include Nyagatare District in NE, accessed August 2017.

The private sector for EAS provision does exist within Rwanda, but it is much smaller than the equivalent private-sector EAS services in most of its regional neighbors within the East African Community. These services for the private sector are generally tightly controlled by the government regarding prices and supply, as exemplified by the operations of agro-dealer inputs shops. There are also international and local private companies, but they often have to compete with the typically better financed, public-sector entities. Some brief examples are presented below, and there are many other examples too.

Enterprise Urwibutso was founded in 1983 and is a local food processing company. The company's products include fruit juice, bread, yogurt, flour, biscuits, hot chili peppers and grape/banana wine. Enterprise Urwibutso currently has contracts with 3,000 smallholder farmers and employs over 400 staff and also provides social services to the Nyirangirama community and its smallholder farmers, including agronomic training, education and microcredit.

Sosoma Industries is a grain miller in Rwanda, and produces various flours from the cereals maize, soy and sorghum, and also includes some fortification. MINAGRI is one of Sosoma's many partners for commercial activities in-country. Sosoma and its partners also provide informal EAS (e.g., promote good agricultural practices and improved access to inputs for maize and soy) to various agricultural stakeholders, such as farmer groups and cooperatives.

MTN Rwanda is one of the mobile service providers within Rwanda. They and other cellphone service providers facilitate the dissemination of agricultural and market information (e.g., prices and supply) through SMS messaging to farmers and other commercial entities for many crop value chains.

One Acre Fund (OAF) has been in Rwanda for 10 years, receives funding from the Bill & Melinda Gates Foundation, Mercy Corps and other donors, and reaches 164,000 farmers with nearly 1,800 staff. Their Tubura model utilizes lead farmers who receive a salary (notable difference to volunteer FPs) at the village level to provide a service bundle to farmers of: a) finance for farm inputs, b) distribution of seed/fertilizer, c) training on agricultural techniques, and d) market facilitation to maximize profits from harvest sales. Other items that OAF provides to help smallholder farmers include solar lights, harvest storage bags and crop insurance.

World Vision International (WVI) is starting up a new agriculture program, THRIVE, that will be implemented from 2017-2022, and expected funding is USD \$10 million over the five years.²⁴ THRIVE has four parts: income generation, natural resource management, disaster risk and mitigation, and an empowered world view to target poor farmers with some means. The project aims to reach 15,700 households in four districts of Southern Province and one district of the Northern Province, and expects to collaborate with FPs and FFS Facilitators under Twigire Muhinzi structures during project implementation over the coming five years. WVI has a formal MOU with the RAB to coordinate agriculture extension activities.

²⁴ Non-governmental agricultural stakeholder personal interview, July 2017.

Catholic Relief Services (CRS) also has significant agricultural programming within Rwanda, as exemplified by the Gikuriro Project (present in eight districts) and the Byumba Family Nutrition Project.²⁵ For these projects and other activities CRS works with FPs and FFS groups within Twigire Muhinzi to promote bio-intensive agricultural techniques (BIATs), such as dome gardens, zeis, mandalas and double-dug beds, as well as using improved seeds. CRS also collaborates with PSDAG to professionalize cooperatives, also a goal of Twigire Muhinzi.

CABI, a British NGO, supports RAB in implementing 65 plant clinics throughout the country. These clinics operate periodically in strategic locations (e.g., weekly in markets) where farmers can bring samples of plants with problems to get diagnoses and recommendations from “Plant Doctors” (often RAB staff) for solving the problems. The clinics also occasionally hold rallies to inform farmers about pest and diseases problems and how they can be controlled (Boa et al, 2016; CABI, 2017).

Other international NGOs that provide EAS, typically through projects, include Africare, Global Communities, Heifer Project International, Land O’ Lakes and Technoserve. These organizations typically work on a limited scale in just a few districts. Their EAS services are also typically project-bound, and have little impact beyond the project areas.

There are numerous farmer associations and cooperatives within Rwanda and typically they focus on a particular crop or enterprise. Some provide advisory services. For example, the The Coffee Promotion Cooperative (COOPAC), based in Gisenyi, provides shade tree seedlings and information on agroforestry to its 8,000 members (COOPAC, 2017). Cooperatives can provide EAS services both through the VFT approach, and through the Twigire Muhinzi model. The VFT approach has been used successfully for dairy, Irish potato and maize cooperatives (Kiptot et al, 2016). Twigire Muhinzi also plans to use cooperative structures to expand EAS provision for various crops. Targeted cooperatives and the related three-party contracts (mentioned earlier) are to be incorporated in the 2017 cropping season (RAB, 2016), but implementation has been slower than expected in many districts. These cooperatives ultimately are expected to charge fees for EAS services provided to farmers for sustainability.

Finally, the Rwanda Forum for Agricultural Advisory Services (FAAS-R)²⁶ is the umbrella organization for EAS providers within Rwanda, including private and public-sector entities. The forum was established in 2012 and serves to coordinate EAS learning through agricultural information, technologies and innovation networks, among other activities.

Organizational and Management Capacity and Cultures

EAS provision within the MINAGRI is undertaken by regular staff and staff specifically dedicated to Twigire Muhinzi. Regular staff include district agronomists, sector agriculture staff and socio-economic development officers (SEDOs), for example, and they do receive training on the job and continuous education opportunities.

²⁵ Non-governmental agricultural stakeholder personal email, August 2017.

²⁶ <http://www.afaas-africa.org/country-fora/rwanda>

The Twigire Muhinzi agricultural extension model is led and managed by the Rwanda Agricultural Board through HQ and RAB zone technicians, master trainers and field coordinators, within the MINAGRI. The model is a practical application of the broader GoR strategic documents Vision 2020 and EDPRS II, which detail goals for increases in agricultural production. Additionally, Twigire Muhinzi was developed to respond to Rwandan farmers' desire to receive increased technical assistance for improving their farms.²⁷

The FFS approach includes 2,500 FFS facilitators, and over 11,000 FFS groups and experimental plots. The broader FP system includes 14,200 FPs and 75,000 Twigire Muhinzi farmer groups, which cover nearly the whole country.

FFS facilitators typically have a secondary/primary school education, while FPs are drawn from the local community and typically have less formal education. Generally, FFS facilitators have both formal and practical agricultural training, whereas the FPs typically have their own practical knowledge as rural farmers. Being an FFS facilitator is a full-time job, but many also farm as a part-time activity. FFS facilitators are trained by FFS master trainers at full-time training courses that take place at training centers away from their residences. These courses include technical, facilitation and group-building skills. FFS facilitators then train FFS groups and FPs, meeting them periodically during the cropping season. By providing this advanced, cascaded training, agricultural technical knowledge can be passed from FFS master trainers to FFS facilitators²⁸ to FFS groups and FPs to Twigire members, and then the most advanced or interested Twigire members can receive further technical skills to continue this chain of learning and increase agricultural productivity.

Regular government extension agents (e.g., district agronomists) and FFS facilitators are both paid by the government,²⁹ but whereas agents receive regular salaries, FFS facilitators' paid fees are variable depending on the growing season, how often they visit trainees and other factors, and these FFS facilitators on average earn 20,000 RFr (~USD \$24)/month of work.³⁰ FFS facilitators and FPs also both have potential further educational opportunities from government/donor projects and donor-sponsored training, mostly due to similar levels of formal education.

For the 2017 cropping season, FFS facilitators will put into practice the ambitious MINAGRI goal of sustainability by becoming professional service providers. This goal will be achieved by forming facilitator cooperatives, which will then generate money by charging on a fee-for-service basis. The FFS facilitators will eventually be paid by the cooperatives rather than by the government. These cooperatives (29 FFS facilitator-led cooperatives budgeted in 2016 season) are being supported by the RAB at MINAGRI to make the overall EAS system more sustainable. The cooperatives will then create new FFS groups, and train new FPs. The FFS facilitators within the new cooperative structure will also sign contracts. These three-party performance contracts, mentioned above, are to

²⁷ Non-government agriculture stakeholder personal interview, July 2017.

²⁸ With the end of BTC funding for FFS facilitators (2017), their training is now being provided by RAB extension agents.

²⁹ FFS facilitators were designed to be paid 125,000 RFr/group/season, but funding shortages meant that this has not and does not occur.

³⁰ Government agriculture stakeholder communication, February 2018.

ensure accountability for all three parties, and MINAGRI has budgeted 441 million RFr (~USD \$525,626) for three-party contracts in FY 16/17 (RAB, 2016).

The three-party contracts serve as a vehicle to monitor the progress of FFS facilitators, and this performance-based and accountable payment system is already established. Parallel to the three-party contracts is the *imibigo* system for accountability and Rwanda Forum for Agricultural Advisory Services (FAAS-R, for its acronym in French) for collaboration among EAS providers. *Imibigo* is a traditional, consultative process within Rwanda that supports collaboration vertically between mayors, farmers and their needs, and other stakeholders. Financial resources for both three-party contracts and FAAS-R are provided by the government. Donors also support FAAS-R. *Imibigo* is traditional and thus it does not require financing.

Twigire Muhinzi's EAS model builds on existing farmer field schools and the use of FPs to disseminate agricultural extension training to locations throughout the entire country. The FFS facilitator-led formation of cooperatives has started, and will likely take a few years before being fully and effectively institutionalized and functional within Rwanda, especially a) the three-party performance contracts, b) promoting FPs to FFS facilitators and c) promoting Twigire members to receive training to then become FPs. FPs are currently volunteers, and receive reimbursement for their efforts in the form of in-kind gifts such as t-shirts, boots or other items. Many stakeholders propose that FPs continue to receive some form of reimbursement to keep them motivated and the Twigire Muhinzi system sustainable, while not undercutting the community spirit of volunteerism within the model. The RAB may also consider some further incentives or motivation for FPs, such as commissions for increased appropriate input usage in their communities.

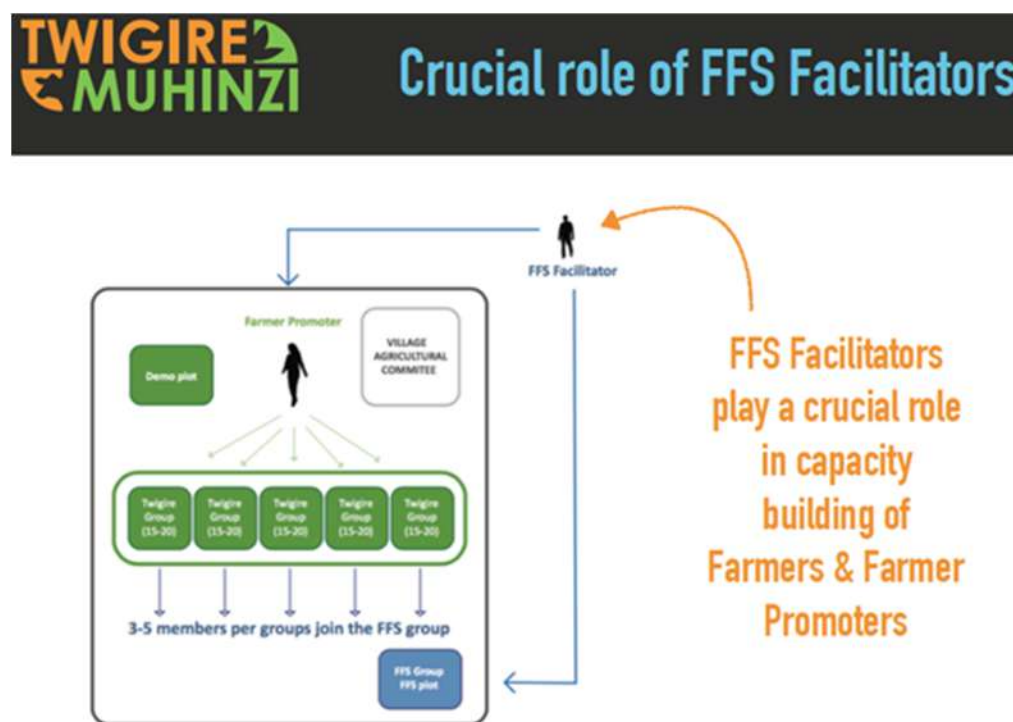


Figure 4. Crucial Role of FFS Facilitators

Source: Twigire Muhinzi: Increase Yield and Foster Solidarity, 2016, RAB

Finally, as a general rule for sub-Saharan Africa, research and EAS need to coordinate better to improve agricultural productivity. More specifically, researchers need to understand farmers' experience with new technologies, while extension staff need to be aware of the available technologies, how to use them and their nuances. Both need to understand farmers' constraints and opportunities. This statement is also generally true for Rwanda, but the example below of effective coordination should spur on further coordination between research and EAS:

Extension providers in the East Africa Dairy Development Project (2008-2012) were impressed with RAB researchers' strong interest in partnering with them in helping farmers test new dairy feed innovations, even though the RAB was not remunerated in the project. Researchers helped project staff to access new feed technologies, test them with farmers, and receive feedback from farmers on technology performance.³¹

Advisory EAS Methods

The Twigire Muhinzi's FFS and FP approaches can be considered advisory methods; these were discussed in detail above so will not be treated here. The Twigire Muhinzi model also utilizes two learning approaches, both appropriate for the different skill sets and backgrounds for the FFS facilitators and FPs respectively. First, FFS facilitators utilize experimental field plots that allow comparisons of crop varieties and agronomic practices. FFS facilitators use the credo, "learn by doing."

Second, FPs utilize basic demonstration plots, which generally include a crop variety with a good performance record accompanied by "good agronomic practices (GAP)" and a particular crop with a good performance record chosen by the individual farmers themselves. FPs utilize the principle "seeing is believing" to teach agricultural training techniques (RAB, 2016). Both the FFS facilitator and FP approaches aim to empower farmers with added knowledge to increase agricultural performance and productivity. Though the FFS usually focus on a single crop each season, they do so using a systems context employing agro-ecosystems analysis.

In line with government policy, the Twigire model places a strong emphasis on another important advisory method: group formation. The model highlights the social benefits of group formation and group maintenance. This model fits in well with life in rural Rwanda and Rwandan cultural traditions and also helps to make extension more efficient as trainers can work with groups rather than individuals.

Regarding targeting approaches, the Twigire groups usually include mixed groups of both males and females (rather than groups based on a single sex) for the typical 15-20 farmer size. Same-sex farmer groups are unusual and they are discouraged because they are not inclusive. Group leaders can either be male or female farmers. Regarding socioeconomic background, farmers within a group tend to have similar income levels, but there could be some variability from group to group, and from one region to another within Rwanda. Twigire Muhinzi practitioners believe that when group members

³¹ Non-government agriculture stakeholder personal interview, August 2017.

have similar socio-economic levels, it is easier to share farming “lessons learned.” The group size of 15-20 farmers, however, is standardized throughout the country.

Twigire group individual members can utilize valleys and terraces (depending on availability and access per geographic location), and/or their own household plots for crop production. Transforming these village-level Twigire groups with their small production into the larger, functioning and effective farmer cooperatives will take much time and patience, and will need further management and leadership training. The cooperatives would take advantage of joint input purchase, production, marketing and price information and build membership from the Twigire groups. Many successful cooperatives already exist in Rwanda (detailed elsewhere in the report) and these new cooperatives can learn from the established cooperatives, for example through FFS Facilitators’ training. The government’s long-term objective is to create cooperatives that will become sustainable (RAB, 2016).

ICT tools are gradually being introduced as advisory approaches, but they have not been fully leveraged yet.³² The Rwandan government established a Ministry of Youth and ICT. Also, the Agricultural Information and Communication Center of MINAGRI produces and disseminates agricultural information, including various ICT tools or approaches. As examples of use of ICTs within Rwanda, mobile phone networks are used for EAS provision and a free national hotline exists. A few examples of use of video for EAS service provision exist (e.g., the CIAT project for high iron bean promotion), and Digital Green is in the process of piloting a video extension model (detailed in the GoR ICT4RAG strategy).

Similarly, AGRO FIBA, a mobile and web-based platform developed by M-Ahwi, a local Rwandan start-up, managed to attract over 10,000 farmers in the maize and rice value chains in one year. The start-up achieved this by providing access to agronomic, market and financial data via its platform and link to large-scale buyers like the Rwanda Grains and Cereals Corporation and East Africa Exchange, as well as financial institutions such as Urwego Opportunity Bank (UOB), which facilitated a 60 percent increase in access to loans by member farmers.³³

The One Acre Fund utilizes ICT by sharing agricultural and market price information via two-way SMS, and piloting digital video with tablets. Another example of ICT use is CRS’s digitizing operations and data collection (e.g., prices and quantities of potatoes produced and sold) with tablets for potato collection centers under cooperative support as part of the PSDAG Project. Twigire Muhinzi also utilizes mobile phones for information dissemination.

Community and national radio and SMS texts are also used by Twigire Muhinzi, OAF and other EAS providers. The IPC Orange Fleshed Sweet Potato (OFSP) project also used mobile/SMS, radio and video to help disseminate information on the value of OFSP and for effective production and consumption of the sweet potato.

For scaling purposes, radio, video and mobile phones can reach larger numbers than face-to-face training. The use of ICT tools for advisory services in Rwanda is encouraging, but can be more fully exploited within Rwanda.

³² Governmental agricultural stakeholder interview, July 2017.

³³ <http://agra.org/aast2016/>, p. 209, accessed August 2017.

Another advisory method is the use of volunteer farmer trainers (VFTs), now renamed CAHWs (used by ICRAF and RAB) and the CAHPs (used by Heifer Project International) (Kiptot et al., 2016). They are being used successfully in the dairy, Irish potato and maize sectors (mentioned earlier), and can provide EAS through volunteering/altruism (CAHWs) or fee-for-service (CAHPs). VFTs are similar to FPs (Kiptot et al., 2016).

Extension campaigns supported by ICT are an important tool used by RAB and are particularly important for controlling pest and disease attacks. Fall armyworm attacked Rwanda during the first cropping season of 2017, consuming maize, wheat, millet and rice, and affecting an estimated 25 percent of the total area planted under maize and sorghum. (~15,700 ha of ~63,500 ha affected according to the GoR MINAGRI website). IPM techniques were used to combat fall armyworm with about 80 percent reduction in infestation,³⁴ through utilizing pesticide applications and handpicking of the caterpillars.³⁵ ICT approaches contributed to this success, including an education awareness campaign that coordinated with the RAB and targeted local leaders, agronomists and farmers at provincial and district levels, and the use of public, private and community radio for information dissemination about fall armyworm. The Rwandan Defense Forces assisted these efforts and further response has been successful in reducing impact for second 2017 cropping season, and the situation is much better in early 2018. Twigire Muhinzi structures that drill down to the village level are useful to augment ICT approaches for educational messages regarding pest outbreaks and other natural disasters, agricultural techniques or price information. CABI's plant clinics and rallies, mentioned earlier, are also important for supporting such efforts.

Market Engagement

Market engagement in the context of EAS is concerned with farmers' access to credit, aggregation, quality certification and other market-related issues.

Access to credit and other financial services remain an under-exploited area for farmers, farmer groups and cooperatives (only 4 percent access (IRG, 2015)). While credit is essentially affordable, there is limited access to formal credit (IRG, 2015). Another option is microfinance institutions that operate in rural areas, albeit at a higher rate than banks (IRG, 2015).

However, 71 percent of Twigire Muhinzi FFS groups have internal savings components, which helps some farmers for access to credit on a very small scale. Rwanda has no national agricultural development bank, and agricultural credit for projects needing significantly more funding than nominal sums can be a challenge. Collateral must typically be provided in the form of land, and interest rates for loans are 17-19 percent.³⁶

Many EAS staff at the district and sector level, FFS master trainers and FFS facilitators provide some market-related information and advice to farmers, but they receive relatively little training in marketing themselves.

³⁴ One Government agricultural stakeholder in a personal interview made this claim in July 2017;

³⁵ Governmental agricultural stakeholder personal interview, July 2017.

³⁶ Key agricultural stakeholder interview in August 2017.

Aggregation remains a key challenge for farmers and agriculture overall within Rwanda. Farmer group development has the potential to help individual farmers sell their produce collectively and obtain better prices for their produce. The push by the Rwandan government to encourage Twigire farmer groups to form cooperatives should also help for broad aggregation, but many key stakeholders reported that the track record so far is mixed, with some successes (e.g., maize and Irish potatoes) and some less successful.³⁷ With time and patience the track record for cooperative organization and development in-country will likely improve, as farmers and farmer groups get more exposure to and gain experience utilizing marketing strategies, such as aggregation.

Quality certification and standards for the export-oriented coffee and tea crops are in place and functional. COOPAC, mentioned above, is an example of a cooperative that has been very successful in gaining Fairtrade certification and marketing its coffee. Tea is mainly a plantation crop and is therefore not discussed in this report. Quality certification and standards still need to be established for horticulture and are not established for Rwanda's staple crops. Rwanda grows horticultural crops for both international markets and the domestic market. International market standards include harvest and post-harvest handling regarding bruising, packing, temperature management, pesticide residues, and so forth (IRG, 2015). The domestic market has few quality, volume, or standard specifications (IRG, 2015). There are also no price premiums to incentivize particular production and handling practices (IRG, 2015). While demand is increasing for domestic markets through supermarkets, the low absorptive capacity prevents this from being an opportunity for many Rwandan horticultural producers (IRG, 2015).

A problem experienced by a crop processor illustrates the importance of including market criteria in the selection of which crop varieties to grow, and not just selecting varieties that increase yield.³⁸ A processor identified potato varieties that met his processing criteria and for which he was willing to pay farmers a substantial premium to make it worthwhile for them to grow and sell to him. However, the varieties yielded less than the recommended varieties and were thus rejected by the extension service, which was trying to follow the government's directives to maximize production to meet food security goals. There was no means for the processor to influence RAB's potato variety selection, nor any way to access varieties he needed for product transformation and for helping farmers to increase their incomes from growing the proposed variety.

For traceability, there is minimal application for this market engagement characteristic. This application is in place in some small niche markets within Rwanda, for example for certain organic products, but, overall, there is little to no traceability within the country.

For price discovery, there are a number of fora for market price dissemination throughout Rwanda. These fora include informal communication of market prices through SMS (e.g., MTN Rwanda) and radio, and more formal systems through government/donor-supported channels, including the e-Soko Project with its Agricultural Market Pricing Information System (AMIS). However, a number of key informants reported that they were not aware of price information from e-Soko/AMIS or how to access it if it was available.³⁹

³⁷ Non-government agriculture stakeholder personal interview, July 2017.

³⁸ Non-government agriculture stakeholder personal interview, July 2016.

³⁹ Non-government agriculture stakeholder personal interview, July 2017.

For postharvest handling and processing, advances have been made, but further progress is also required. Crop losses can be significant from postharvest handling, depending on the crop and where it is cultivated within the country. Certain cooperatives specializing in particular food crops receive training for postharvest handling with support from MINAGRI. Many international and local NGOs include postharvest handling in their agricultural production projects.

As mentioned earlier, agro-dealer shops that provide inputs in Rwanda are controlled by the state. This fact means that the seeds/fertilizer and other inputs supply is determined by the government, and prices for these inputs are also set by the government. Established subsidy price levels for seeds or fertilizer may change notably from one year to the next, and can make it difficult for cooperatives and farmer groups to make effective and agro-ecologically sound cropping decisions.⁴⁰

The RAB is responsible for import, production and testing of staple crops. Foundation seed from RAB is sold to private providers. However, this process takes a long time, leaving farmers with older varieties (IRG, 2015).

Livelihood Strategies

Regarding EAS content, the Twigire Muhinzi leaders (FFS master trainers and FFS facilitators) are effective in developing, targeting and integrating EAS content for individuals. FFS and Twigire groups use the group methodology to encourage participation of individual farmers and empower them, and the group structures themselves create a solidarity that gives confidence and trust to individual farmers for cropping decisions, or taking on agricultural risk. These groups tend to be mixed in gender (rather than solely one sex), which helps build good lasting group dynamics. The Twigire groups also encourage certain agricultural know-how to be shared between group members for improved livelihoods, and then spread to other groups through FPs.

Rwandan universities (UR-CAAVM, CIK, UK-FARD) and the Rwanda Agricultural Board can also develop EAS content for Twigire groups and other EAS implementers (e.g., NGOs). However, sometimes their research is not particularly relevant for farmers, or communication between these places of higher education and farmers could be improved. Further, coordination could also improve between research and extension: even though they were merged in 2011, they need to take better advantage of the merger and other coordination mechanisms, such as FAAS-R, to improve overall collaboration.⁴¹

Gender issues are also unique in Rwanda, as exemplified by its mandated high proportion⁴² of female parliamentarians, compared to regional neighbors. Women are also empowered by being able to hold land through registration (along with their husbands) and open bank accounts. Typically, most agricultural chores (plowing, planting, weeding, harvesting, marketing) are commonly done by

⁴⁰ Non-government agriculture stakeholder personal interview, July 2017; as an example, farmers may want to intercrop with maize and beans, but specific seed subsidies may be reduced, discouraging this practice and the derived agro-ecological benefits.

⁴¹ NGO agriculture key stakeholder interview, August 2017.

⁴² Rwandan law mandates 30 percent of government representation for females, and this has been used by female legislators to actually increase their representational levels within government.

both sexes. Therefore, EAS content in many cases can be gender-neutral, making Rwanda stand out compared to its East African neighbors.

However, whereas the proportion of FFS members who are women in TM is over 50 percent, the proportion of women in other TM positions (e.g., FFS facilitators, FPs, extension staff⁴³) appears to be low. This can be improved. For example, certain FP programs in East and Southern Africa have increased the proportion of women as FPs to 50 percent by ensuring that those selecting FPs undergo gender training, that training takes place at times and locales convenient for women, and that husband and wife teams are targeted to serve as FPs (Davis et al, 2016).

During a few key informant interviews regarding the bio-fortified OFSP and high iron beans, it is important to note that some key facts regarding gender and agriculture were obtained.⁴⁴ One was that for OFSP, original cultivation patterns were that 80 percent of farmers were female, and only 20 percent were male. However, in the past couple of years, with further education and some successes with commercialization, male farmers have come to realize its commercial potential; therefore, they have become more interested in OFSP, to the point where now roughly 65 percent of farmers cultivating OFSP are female, and 35 percent of farmers are now male. For high-iron beans, cultivation patterns are balanced and have not changed much since project inception; therefore, current trends are accurate where generally 45 percent of farmers cultivating high-iron beans are female and 55 percent of farmers are male.

Many Rwandan farmers (mainly women) also raise vegetables for home consumption and the local market. According to IRG (2015), over 60 percent of tomatoes, onions and carrots and 50 percent of cabbage are sold in the markets for cash.

For climate-smart agriculture and climate change adaptation, Rwanda can expect more severe weather events, especially drought. Many donors (e.g., USAID, the EU and IFAD) have incorporated climate change adaptation into their programming. One example is USAID's new Hinga Weze Project, which when fully implemented by CNFA aims to build the resilience of food and agriculture systems to respond to climate change. Another project, Rwanda Climate Services for Agriculture runs from 2016 to 2019 and is managed by the CGIAR Research Program on Climate Change. This project aims to provide climate services for farmers and government/institutions, climate information to all stakeholders and a national climate services governance process.⁴⁵ Other initiatives, such as those of World Vision mentioned above, emphasize helping farmers adopt climate-smart practices, such as agroforestry (hedgerows that produce useful products such as fuelwood and fodder, but also control soil erosion), mulching, shade-grown coffee, recycling crop residues and improved pastures (CIAT-World Bank, 2015). These and additional initiatives, if used effectively, should help farmers in Twigire groups adapt to expected weather volatility.

Youth and other vulnerable populations are sometimes an often-overlooked demographic within Rwanda. The Rwandan government has a Ministry of Youth and ICT that acknowledges these

⁴³ As of late 2017, there were notably 28% female FFS facilitators and 10% female FPs.

⁴⁴ Non-government agriculture stakeholder personal interview, July 2017.

⁴⁵ <https://ccafs.cgiar.org/building-climate-services-capacity-rwanda>, accessed August 2017.

challenges. Youth under 18 include nearly six million people (2012 estimate).⁴⁶ These and other vulnerable groups may not meet targeting criteria for government or NGO assistance programs. Some examples of successful programming that has targeted youth includes agricultural clubs like 4-H, SNV's UMUTANGUHA Project that includes microfinance and other training, and Technoserve's STRYDE Project that promotes youth in agribusiness.⁴⁷

Additionally, drones were used on a pilot basis for crop monitoring in northwestern Rwanda. The company providing the drones believes that they can achieve EAS functionality in Rwanda and other African countries.⁴⁸

Community Engagement

Finally, EAS is concerned with community engagement, that is, land size and distribution, education levels, gender roles, demographics including age, community organizations (e.g., producer organizations) and capacity to collaborate. Here the section focuses particularly on how to reach women farmers with respect to EAS, noting earlier that gender equity for female farmers within Rwanda is generally higher than Rwanda's East African neighbors.

Social institutions within communities that do contribute to EAS services/provision include schools, NGOs, community-based organizations, churches, market structures and groupings, clinics, athletic clubs and other institutions. In the Rwandan context, the state can exert a strong influence, but its capacity is also notable too, and corruption, relative to neighboring countries, is low.

Farmer demand can be articulated through the Twigire farmer groups, local committees or the larger cooperatives, but also through participatory radio and video programs, mobile phone networks, dialogue with agro-input dealers and other channels. Farmers' voices and their empowerment are enhanced by Twigire Muhinzi structures, but in some cases, it may hard to obtain honest feedback from the farmers, due in part to cultural factors and norms.

While farmer groups are an important conduit for development in the programs of most extension providers, the role that these groups play in social relations should not be ignored. When Rwandan farmers were queried in an informal survey on why they formed groups, the most popular response was the social benefits of the group, the second response was to put food on the table and the third was marketing.⁴⁹ Therefore, marketing to improve their own livelihoods, per this rough survey, was perceived to be less important than the social benefits of being part of a group and producing enough food for one's own household. This survey, if generally true nationally and not prone to change (one would likely obtain quite different results with the same survey in more capitalistic Uganda or Kenya), should be taken into account by all agricultural stakeholders in-country for longer-term program design and project implementation.

Finally, psychosocial dimensions that should be considered for improved community engagement can include gender and social status, religious differences from the majority Catholic population with

⁴⁶ https://www.unicef.org/infobycountry/rwanda_statistics.html, Accessed August 2017.

⁴⁷ Non-government key agricultural stakeholder interview, August 2017.

⁴⁸ More information on pilot activities in Rwanda and other African countries can be obtained at: <http://www.agrilift.com/>

⁴⁹ Non-governmental agricultural stakeholder interview, July 2017.

other groups, political preferences and many other factors. Rwanda's unique history, due to the 1994 genocide and the specific, enormous psychosocial demands for survivors, the delicate social fabric of specific villages, and the continued post-traumatic stress disorder are still challenges for many Rwandans 23 years later.

RECOMMENDATIONS

Based on the literature review and interviews of key informants, several key assets, which can be considered as drivers for success in Rwanda's agricultural development, can be identified:

- ◆ High agricultural potential in Rwanda, due to good rainfall and soils
- ◆ Policymakers' strong commitment to support EAS and reach all Rwandan farmers
- ◆ An effective EAS model, Twigire Muhinzi, that implementing partners can employ to achieve their objectives
- ◆ Effective agricultural research and training institutes (e.g., RAB, UR-CAAVM, CIK, and UK-FARD)
- ◆ ICT approaches in use that can be further piloted, applied and scaled up, especially SMS, radio and video
- ◆ Strong donor support: Hinga Weze and other relevant donor agricultural projects, which can be used to further support and strengthen EAS, especially within targeted agricultural value chains

Based on these drivers, the recommendations for making EAS in Rwanda more effective, relevant, sustainable and scalable are below. The recommendations are intended for any national, regional and/or international EAS stakeholder interested in strengthening Rwanda's EAS system, including government, donors, the private and civil society sectors and others. There are specific recommendations made for how donor-supported EAS programs such as Hinga Weze can maximize the use of the current EAS landscape, including TM, to achieve their goals. These recommendations can be further refined with a more in-depth study and/or a stakeholder validation meeting. Specific institutions that can take action on the recommendations are included in parentheses with each recommendation.

Governance Structures and Policy Environment

1. Engage research institutes and universities more to improve TM through problem solving through applied research, curricula development, EAS message content, training, implementation and mentoring. (Rwandan universities and research institutes, RAB, CGIAR-affiliated institutes, other regional universities, donors and TM members and structures)
2. Establish clear coordination and management channels for the government's EAS system nationally, extending from central government to villages. Currently there is no coordination body for extension, and RAB does not extend below provincial level. (GoR, FAAS-R, MINAGRI, RAB and linked sector-level local government structures, NGOs)
3. Raise awareness and profile of TM for long-term support from government and donors by updating the National Agricultural Extension Strategy and supporting CICA's efforts to document TM achievements. (RAB, MINAGRI, FAAS-R)

4. Make TM even more participatory and democratic by decentralizing and delegating more authority to village structures and individual Twigire farmers (e.g., cropping decisions or choosing new FPs). (MINAGRI, TM, donor-supported EAS programs)

Organizational and Management Capacities and Cultures

5. Better equip extension staff to handle commercial agriculture and market information, and to train FPs and agro-dealer owners, who in turn will train farmer groups. (MINAGRI, NGOs, donor-supported EAS programs)
6. Incentivize FPs for their efforts (e.g., through cellphone credit, bicycles, inputs at reduced cost, or cellphones) and also through recognition by community leaders, establishing different grades of FPs and promoting high-performing FPs to higher grades, signposts at their homes, or contests with prizes. Programs could explore ways for the community to provide these reimbursements rather than relying on budgets of donors or the central government. (MINAGRI, NGOs, donor-supported EAS programs)
7. Establish professional development opportunities for FFS facilitators and FPs. (GoR, MINAGRI, donor-supported EAS programs, universities and research institutes within Rwanda and regionally, NGOs)
8. Improve cooperative management for FFS cooperatives by providing more in-service market and management training to FFS facilitators. (MINAGRI, NGOs, donor-supported EAS programs)
9. Budget EAS funding as a separate and transparent line item in the RAB budget. (GoR, MINAGRI, RAB)

EAS Methods

10. Conduct research on the impact and effectiveness of TM and FFS methodology. The assessment should include both quantitative evidence (evidence on changes in knowledge, attitudes and practices) and qualitative research (e.g., what are people's perceptions of the approach?). Impact studies should include both the overall impact of the model as well as specific components (e.g., do FPs increase their training efforts in response to particular low-cost incentives?). (Social scientists in universities and RAB, research institutes, regional universities and research institutes, donor-supported EAS programs)
11. Build on the potential of and government support for using ICT tools for EAS provision through developing ICT strategies and experimenting with innovations from other countries and programs, while at the same time evaluating the effectiveness of ICT tools. (GoR, Ministry of ICT and Youth, MINAGRI, donor-supported EAS programs, research institutions)

Market Engagement

12. Promote new and increased information and training in business, entrepreneurship and marketing for FPs and other actors/institutions along value chains. Two models that RAB could consider for this market and commercialization training are FAO Farmer Business Schools and CRS Farmbook. (MINAGRI RAB, FAO, NGOs, Hinga Weze and other donor-supported EAS programs)

13. Encourage farmers to specialize in particular crops for more efficient EAS provision and ultimately to enable bulking of large quantities of particular products to make marketing more efficient and profitable. At the same time, policymakers need to understand farmers' need to diversify to meet household food needs, manage price and production risk and smoothen resource requirements throughout the year. (GoR, MINAGRI, RAB and linked sector-level local government structures and below, NGOs, Hinga Weze and other donor-supported EAS programs)

Livelihoods Strategies and Community Engagement

14. Expand the TM program to other sectors not currently covered such as livestock, agroforestry and coffee to meet additional needs of farmers. (MINAGRI, including RAB and NAEB, and NGOs)
15. Make use of surplus human capital such as the master trainers from the completed BTC project to strengthen existing programs. (MINAGRI, Hinga Weze and other donor-supported EAS programs)
16. Emphasize climate-smart practices, including ones such as providing weather information to farmers, mulching, recycling crop residues and agroforestry that offers important benefits over the medium and longer term. (TM, GoR MINAGRI, RAB, donor-supported EAS programs, NGOs)
17. Promote youth engagement with agriculture, and potential (pre)-membership in Twigire groups, through agricultural activities such as Agriculture Clubs at primary and secondary schools and 4-H groups to provide productive livelihoods for them. (GoR, MINAGRI, Ministry of ICT and Youth, NGOs, donor-supported EAS programs)
18. Promote nutrition education through the RAB's EAS services and the TM model. In addition to adding general nutritional education for FFS facilitators, FPs and TM groups, the training should be specifically related to options available to farmers for improving nutrition, such as OFSP and high-iron beans. (GoR, MINAGRI, donors and donor-supported EAS programs, Twigire farmers, NGOs)
19. Increase the proportion of women extension staff, FFS facilitators and FPs. (GoR, MINAGRI, RAB, donor-supported EAS programs, NGOs)

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ANNEX I. KEY INFORMANT INTERVIEWS FOR DLEC RWANDA EAS REPORT

Key Informant Interviews for DLEC Rwanda EAS Report, conducted between June and August 2017

Joseph Anania, FAO

Safari Dieudonne, World Vision/Rwanda

Leonidas Dusengemungu, RAB

Nady El Shal, One Acre Fund

Dan Gies Claude Bizimana, Nicolas Uwitonze, Landouard Semukera, Olivier Habimana, Tim Muzira, Katie Murray and Paul Scipola, CNFA Hinga Weze Project Team

Sylvain Hakizimana, FAO

Joseph Higiyo, RAB

Juvenal Kabiligi, FAO

Richard Kanyarukiga, University of Rwanda-Musanze

Bridget Kimball and Zacharie Maniraro, CRS/Rwanda

Lucy Mwangi, RAB

Athanase Mukuralinda, ICRAF

Joseph Mulambu and Jean Pierre Mbagurire, CIAT/High Iron Bean Project, USAID

Innocent Musabyimana, independent agricultural consultant

Hakiza Ndatiaya, RAB

David Moussa Ntambara, independent Rwandan farmer

Jean Damascene Nyamwasa, USAID

Kirsten Pfeiffer, USAID/PSDAG Project

Tom Remington, independent agricultural consultant, Lilongwe, Malawi

Serge Rwamasirabo, independent agricultural consultant

Kirimi Sindi of IPC/OFSP Project, USAID

Raf Somers, BTC

Anne Daniel Turner, independent agricultural consultant, Harare Zimbabwe

Nicolas Uwitonze, RAB (now CNFA)

Paul Van Mele, Access Agriculture