Burundi in the Agribusiness Global Value Chain

SKILLS FOR PRIVATE SECTOR DEVELOPMENT

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Acronyms

ACT	African Conservation Tillage Network
AGRA	Alliance for Green Revolution in Africa
AfDB	African Development Bank
ADP	African Development Projects
AU	African Union
AMPU	Autonomous Mobile Processing Unit
BAP	Agribusiness Development Program, USAID
BBI	Burundi Business Incubator
BTC	Belgian Development Agency
BOAM	Burundi Organic Agricultural Movement
CAADP	Comprehensive Africa Agriculture Development Programme
CfW	Cash-for-Work
CAPAD	Confederation of Agricultural Producer Associations for Development
CDM	Beer of Mozambique (Cervejas de Mocambique)
CERADER	Center for Study and Research in Agriculture (Centre d'Etude ET de Recherche en Agriculture)
COMESA	Common Market for Eastern and Southern Africa
CEPGL	Economic Community of the Countries of the Great Lakes
CNTA	National Center on Food Technologies
CWIQ	Core Welfare Indicators Questionnaire
DADTCO	Dutch Agricultural Development and Trading Company
DPAE	Provincial Directorates of Agriculture and Livestock (Directions Provinciales de l'Agriculture ET de l'Elevage)
DAP	Diammonium Phosphate
DRD	Department of Research and Development, Tanzania
EAC	East African Community
eRAILs	Regional Agriculture Information and Learning System
ESE	Ethiopia Seed Enterprise
EU	European Union
FABI	Faculty of Agronomy and Bio-Engineering
FAO	Food and Agriculture Organization of the United Nations
FACAGRO	Faculty of Agronomy and Bio-Engineering
FBSPMS	Farmer-based Seed Production and Marketing Scheme
FCC	Federal Chamber of Commerce
FDI	Foreign Direct Investment
FFS	Farmer Field Schools
FFV	Fresh Fruit & Vegetables
FfW	Food-for-Work
FTE	Full Time Equivelent
GAFSP	Global Agriculture and Food Security Program
CA-SARD	Conservation Agriculture for Sustainable Agriculture and Rural Development
GDP	Gross Domestic Product
GVC	Global Value Chain
ICRISTAT	International Crops Research Institute for Semi-Arid Tropics
IER	Institute of Rural Economy (Institute d'Economie Rurale)
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Center

IITA	International Institute on Tropical Agriculture
IRRI	International Rice Research Institute
ISA	Higher Institute of Agriculture (Institute Superior de Agriculture)
ISABU	Institute of Agricultural Sciences of Burundi (Institut des Sciences Agronomiques du Burundi)
ISAR	Rwanda Agricultural Research Institute
ITAB	Burundi Institute of Agricultural Techniques (Institut Technique Agricole du Burundi)
IRAZ	Agronomic and Zootechnique Research Institute
KARI	Kenya Agricultural Research Institute, Kenya
LWH	Land Husbandry, Water Harvesting and Hillside Irrigation
MAFC	Ministry of Agriculture Food and Cooperatives, Tanzania
MEBSEMFPA	Ministry of Basic and Secondary Education, Technical and Vocational Education and Literacy (Ministère de l'Enseignement de Base et Secondaire, de l'Enseignement des Métiers, de la Formation Professionnelle et de l'Alphabétisation)
MDGs	Millennium Development Goals
MINAGRI	Ministry of Agriculture and Animal Resources
MINAGRIE	Ministry of Agriculture and Livestock
NADPs	National Agricultural Development Projects
NAIP	National Agricultural Investment Program
NARO	National Agricultural Research Organization, Uganda
NSIA	National Seed Industry Agency
ONCCS	National Office for Seed Control and Certification (l'Office National de Control ET de Certification des Semences)
SAN	National Agricultural Strategy
SPIR	Smallholder Private Irrigation
PAIOSA	Institutional and Operational Support Program for the Agriculture Sector
PNSEB	National Fertilizer Subsidy Program
PPCDR	Program Post-Conflict de Development Rural
PPP	Public Private Partnership
PRASAB	Agriculture Rehabilitation and Support, and Sustainable Land Management Project of Burundi (Projet de Réhabilitation ET d 'Appui au Secteur Agricole et de Gestion Durable des Terres du Burundi)
PRODEFI	Value Chain Development Program, IFAD (Programme de développement des filières)
PReFER	Privatization of Rwanda's Fertilizer Import and Distribution System
PRSP	Poverty Reduction Strategy Paper
R&D	Research and Development
SED	Seed Enterprise Development
SOSUMO	Moso Sugar Company (La Société Sucrière du Moso)
SSA	Sub-Saharan Africa
TBC	Tanganyika Business Company
TVET	Technical Vocational Education Training
US	United States of America
USADF	United States African Development Foundation
USAID	United States Agency for International Development

Table of Contents

I. Introduction 5
II. Agribusiness Global Value Chain 6
III. Upgrading and Governance in the Agribusiness GVC 9
A. Upgrading Trajectories and Governance Implications 9
B. Standards 11
IV. Burundi in the Agribusiness GVC 13
A. Introduction 13
B. Burundi's Participation in Agribusiness GVCs 14
C. Key Non-Firm Stakeholders in Burundi's Agribusiness Value Chain 25
D. Important Constraints Underlying the Development of the Agribusiness Chain 27
V. Current Employment and Workforce Development in Burundi's Agribusiness GVC 29
A. Current Employment and Workforce Development in Burundi Agribusiness GVC 30
B. Current Workforce Development Initiatives in Burundi's Agribusiness GVC 34
Public Technical 37
(*Institut Technique Agricole du Burundi(ITAB*) Kirika 37
C. Current Challenges for Human Capital 39
VI. Improving Burundi's Competitiveness in Agribusiness Value Chains: Potential Upgrading Strategies 41
A. Process Upgrading 42
A.1. Process Upgrading: Improving Productivity through Low-cost Microfertilization Technology 43
A.2. Process Upgrading: Restoring Soil Fertility and Productivity through Minimum Tillage and Direct Planting 45
A.3. Process Upgrading: Increasing Productivity through Small-scale Private Irrigation Schemes ..48
A.4. Process Upgrading: Increasing Productivity through Land Terracing 51
B. Functional Upgrading: Reducing Post-harvest Loss and Increasing Farmer Income through Processing 53
C. Functional Upgrading: cold storage, processing, and packaging of fruits and vegetables 56
VII. Skills for Upgrading Burundi's Participation in the Agribusiness GVC 59
A. Process Upgrading: Required Workforce Development Initiatives and Key Job Profiles 62
B. Functional Upgrading (Cereals/Root Crops Processing): Required Workforce Development Initiatives and Key Job Profiles 65
C. Functional Upgrading: Cold Storage, Packaging, and Processing of Fruit and Vegetables 66
D. Engage Stakeholders in Skills Development for Upgrading 67
VIII. Bibliography 69
IX. Appendix 81

List of Boxes

Box 1. SPS Protocols in the East African Community 12
Box 2. National Fertilizer Distribution Program 16
Box 3. The Emerging Palm Oil Value Chain in Burundi 20
Box 4. The Role of the State in Burundi's Agribusiness Sector 25
Box 5. Agricultural R&D and Post-Graduate Education in the EAC 33
Box 6. IFAD Youth Program: Engaging Youth in Agribusiness Value Chains 40
Box 7. Driving Yield Increases through Low-cost Microfertilization Technology in Mali 44
Box 8. Restoring Soil Fertility Through Minimum Tillage in Tanzania 46
Box 9. Driving Productivity through Smallholder Private Irrigation in Nigeria 49
Box 10. Increasing Soil Fertility and Productivity through Land Terracing in Rwanda 52
Box 11. Transforming Cassava Production from Subsistence to Cash Crop in Mozambique 55
Box 12. Cold Storage, Processing and Packaging of Fruits and Vegetables in Kenya 58
Box 13. Farmer Field Schools: Kenya Tanzania and Uganda 64

List of Figures

Figure 1. Simplified Agribusiness Global Value Chain 6
Figure 2. Burundi in the Agribusiness Chain 15
Figure 3. Fertilizer Consumption in the EAC Countries and Sub-Saharan Africa 16
Figure 4. Burundi's Cereal Productivity Relative to the EAC Countries 19
Figure 5. Burundi's Sugar Productivity Relative to Africa's and Global Average 20
Figure 6. SWOT Analysis of the Agriculture Sector in Burundi 29
Figure 7. Example of a High-Value Agriculture Value Chain 81
Figure 8. Example of a Rice Value Chain 81
Figure 9. Example of a Palm Oil Value Chain 82
Figure 10. Wheat Value Chain Map 82
Figure 11. Burundi's Main Agribusiness Products in 2011 83
Figure 12. Severity of Land Degradation in Burundi 84

List of Tables

Table 1. Select Upgrading Trajectories in the Agribusiness Global Value Chain 10
Table 2. Prominent Standards in the Horticultural Industry 12
Table 3. Burundi's Agribusiness Production and Trade by Major Crop Categories 17
Table 4. Production Models of Principle Agricultural Products, 2013 18
Table 5. Evolution of Palm Fruit Production in Burundi, 1990-2012 21
Table 6. Industrial Scale Agribusiness Processing Firms in Burundi 31
Table 7. Job Profiles in the Agribusiness Value Chain 32
Table 8. R&D Employment and Spending in East Africa Countries, 2008 33
Table 9. Burundi's Public and Private Education Institutions Providing Workforce Training in Agribusiness GVC 37
Table 10. Advantages and Disadvantages of the Two Micro-dosing Approaches 44
Table 11. Job Profiles in Agribusiness Value Chain: Process Upgrading 59
Table 12. Palm Oil Imports into EAC countries (2011) 83
Table 13. Palm Oil Exports from EAC countries (2011) 83
Table 14. Evolution of Production and Import for Burundi's Main Cereal Items 84
Table 15. Training Initiatives in the Burundi Agribusiness GVC, by Segment 2006-2012 85
Table 17. List of People Interviewed by CGGC Researchers fall 2013 & spring 2014. 88

I. Introduction

Agriculture is the central pillar of Burundi's economy, accounting for more than one third of the country's Gross Domestic Product (GDP) and employing virtually the entire rural workforce. With good geographic conditions and a suitable climate to production, the country has the potential to be a strong participant in the regional agricultural market. Yet, after years of conflict, the country faces important productivity, infrastructure and institutional challenges that continue to undermine the development of a market-oriented sector, and agriculture remains a primarily subsistence activity, dominated by smallholders with poor knowledge of modern agricultural practices and weak connections to the formal economy. All these constraints have limited the possibility of the country to participate in the global agribusiness value chain. However, Burundi is experiencing slowly rising incomes, growing domestic demand for foodstuffs and a need to formalize the country's economy, placing pressure on the agricultural sector to modernize and organize to create productive, off-farm employment opportunities, generate revenues and, importantly for the short-term, contribute to the country's food security.

This paper builds on earlier analyses of the country's agribusiness sector by using the Global Value Chain (GVC) framework to understand exactly how the industry is structured and to identify specific, and feasible strategies for improving competitiveness. In the GVC literature, undertaking these initiatives such as improving performance, learning new job functions and adding value to production, is referred to as upgrading and it allows actors in the GVC to capture greater value from their participation in a sector (Humphrey & Schmitz, 2002). By examining industry- and location-specific input-output structures and related technologies, standards, regulations, processes, and dynamics in relationships among chain actors, the GVC framework provides a systematic analytical lens that allows top-down and bottom-up assessment of industries (Gereffi, Fernandez-Stark, Bamber, et al., 2011). Thus, by using this analysis, policies can be designed first to meet the domestic and regional market, but in doing so provide the necessary foundations for later engaging in global markets. Indeed, the GVC framework has been highlighted by numerous different development agencies, including the World Bank and the African Development Bank (AfDB) as a key means of helping to build Africa's competitiveness in the agricultural sector while, at the same time, helping countries to reduce poverty by creating employment and to ensure food security (African Development Bank Group, 2010; Webber & Labaste, 2013).

One of the most critical factors in supporting these GVC upgrading measures -- frequently overlooked -- is the human capital aspect; that is, improving actors' capabilities within the chain (Gereffi, Fernandez-Stark, & Psilos, 2011). To achieve upgrading, these actors must develop a wide variety of new skills, be it learning to operate new equipment or understanding how to handle new products (Gereffi, 1999; Gereffi et al., 2005). In general, however, GVC upgrading is discussed without fully unpacking the process of skills acquisition or how knowledge transferred through the chain is assimilated by individual actors (Morrison et al., 2008; Ramirez & Rainbird, 2010). This "black box" approach makes it difficult to develop adequate policies to support upgrading; in developing countries, in general, and even more so in post-conflict countries such as Burundi, resources are often scarce and raising the general education levels to support such upgrading sufficiently quickly to improve competitiveness levels is often beyond their capacity (Gereffi, Fernandez-Stark, & Psilos, 2011). A more tailored approach to skills training and other human capital development initiatives towards specific GVC activities can be a more cost-effective and efficient way to support upgrading. Thus, in addition to identifying more generalized constraints to the industry development, this paper places specific emphasis on understanding the workforce

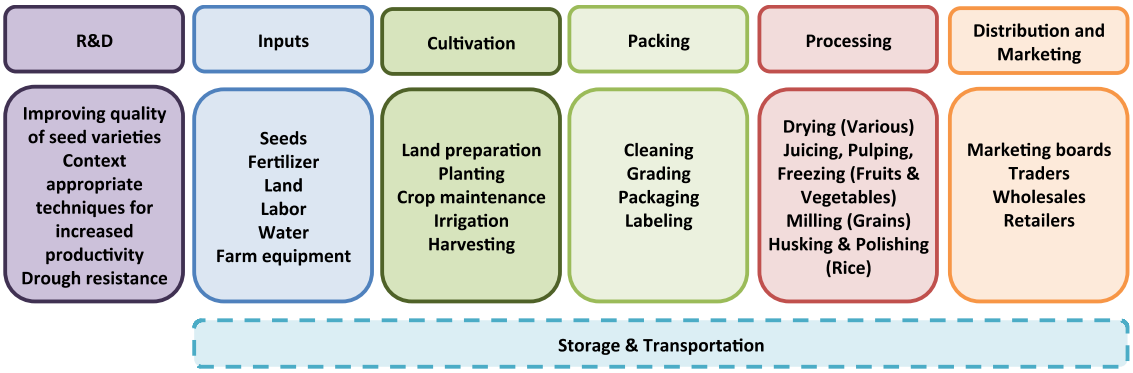
development system in the country and how this can be leveraged and complemented to support upgrading in the agribusiness sector.

The paper is structured as follows: Section II provides an overview of the agribusiness value chain at global level, including a description of the functions and basic activities associated with each stage of the value chain, followed by discussion of governance and upgrading in agribusiness value chain. Section III examines Burundi's current position in the agribusiness value chain in reference to other East African Community (EAC) countries, as relevant. Due to the breadth of the agribusiness sector, which encompasses a broad range of agricultural products, it is important to highlight that the paper focuses only on those product groups that are relevant to the Burundi and East African agribusiness sector. These include fruit and vegetables, cereals and root crops, including, rice, cassava and other staple crops, palm oil and sugar. This discussion is followed by Section IV, which outlines the current employment, workforce development initiative, and challenges of human capital in Burundi's agribusiness value chains. Finally, Section V & IV present the analysis on potential upgrading strategies and recommendations for associated workforce development strategies.

II. Agribusiness Global Value Chain

The agribusiness value chain includes all aspects of agricultural production and subsequent processing of crops. Main activities in the pre-production and production stages of the chain include provision of inputs, cultivation and harvesting, post-harvest handling and processing. Post-production activities are particularly important to consider, especially since these increase the shelf life of products, reduce losses and constitute a large share of the value-added in agricultural goods. Such activities include packaging, processing, branding, marketing and distribution of final products. Figure 1 below illustrates a generic agribusiness GVC. In practice, however, as there are a wide range of products included under the umbrella of agribusiness, from fruits and vegetables to cereals, sugar and other staples such as roots and tubers and palm oil, it is important to remember that the specific sets of activities involved to move through the value chain from Research and Development (R&D), to production, to processing and finally to the consumer can differ considerably. This diversity also makes it difficult to estimate value distribution across the chain, however, there is consensus that production generally consists of the lowest value segment of the chain, with agro-processing, retailing and R&D segments capturing much higher shares of the final product's value (African Development Bank Group, 2010; Gereffi, Fernandez-Stark, & Psilos, 2011; UNIDO, 2009; Webber & Labaste, 2013). These different stages of the chain and their varying role in different product chains are briefly described below.

Figure 1. Simplified Agribusiness Global Value Chain



Source: Duke CGGC.

R&D: While agribusiness is not considered to be high tech, R&D plays an essential role at different stages of the value chain. For the cultivation stage of the chain, for example, research tends to focus on how to increase productivity, improve seed varieties, adapt existing varieties to local conditions and improve disease and drought resiliency of crops. Research requirements also extend to other parts of the chain including extending shelf life of produce through the use of cold chain and processing technologies such as freezing, and/or cooking and drying foods. New technologies and techniques introduced as a result of this research can drive upgrading and help countries to open up new markets.[1] In many developing countries, R&D in the production stage of the chain is carried out by government funded research centers, while ongoing research regarding shelf life and food processing often takes place either within private firms or in universities. Ideally, R&D institutions must be closely linked with other value chain actors to ensure effective and efficient use of resources to support chain development (Hall et al., 2002).

Inputs: Input requirements will depend on the specific agricultural product, but generally, the most important inputs for production are typically land, seeds, fertilizers, agrochemicals (herbicides, fungicides and pesticides), farm equipment, and water and irrigation equipment. Other services in the pre-production phase include extension services, market information, credit, and certifications for production in niche organic or other high-value markets. Poorly developed inputs markets can inhibit the use of fertilizers, drought and disease resistant seeds, and increased mechanization, contributing to low productivity which is an important problem in many countries across Africa (AGRA, 2013). In general, input supply is typically provided by private sector firms in response to demand from producers in most countries around the world, however, poor access to credit and information together with poor infrastructure can weaken this demand, and as a result, it is not uncommon for the public sector, or international development agencies to offer inputs through a variety of free or subsidized programs, albeit with varying degrees of success (AGRA, 2013; Banful, 2011; Morris et al., 2007).

Cultivation: Geographic, environmental, social and political characteristics are important contextual drivers of competitiveness in cultivation of different crops. Soil types, rainfall or access to water, temperature variations, as well as land ownership structures significantly affect the types of crops that can be produced in different parts of the world (Reardon et al., 2009b). For example, economically viable cultivation of rice typically requires high average temperatures during the growing season, abundant supplies of water, relatively flat areas of land to facilitate flooding and drainage, and subsoil that inhibits filtration of water (FAO, 2013c, p. 132). Average farm size, land ownership patterns and labor cost and availability are also key factors (Fernandez-Stark & Bamber, 2012). High value products, such as fresh fruits and vegetables, honey, and stevia tend to be significantly more labor intensive than cereal crops and other traditional agriculture, largely because mechanization is complicated by the need to prevent damage to fragile produce (Joshi et al., 2004). These products are often well suited to smallholder production typically drawing on low-cost family labor. Cereal crops, on the other hand, tend to have lower margins at the production level and success often depends on economies of scale; competitive production of these crops is thus often

[1] For example, in Sierra Leone, investments in rice R&D channeled through the state-run Rokupr Rice Research Station have delivered regionally superior varieties of rice (Dalton & Guei, 2003) that enabled increased regional exports by 3% between 2000-2005 (Johnson et al., 2013), while at the same time generating a 15-20% price premium in local and regional markets through improved nutritional value and taste (Demont, 2013).

concentrated in large scale, modern production operations with heavy mechanization and low labor engagement (Murphey et al., 2012).

Packing and Processing Post-Harvest: Post-harvest processing activities for various agribusiness products may include several stages and depend on a wide variety of technologies. For example, following harvest, fruits and/or vegetables can be washed, graded, mixed, and packaged if they are destined for the fresh produce market, or sent on to be milled, pulped, juiced, frozen or prepared as conserves such as jam. Cereal products such as rice and wheat must be threshed, dried, cleaned, stored, and milled before being incorporated into a wide range of end products and palm oil must first be extracted and then refined.[2] The skill and technologies incorporated in these stages can differ considerably according to the scale of operations and access to capital of key actors (UNIDO, 2004, 2009). Primary processing often entails some degree of aggregation in order to achieve economies of scale, either with producers self-organizing, through intermediaries or sale to exporters or processing firms. Secondary processing operations (for example, dry milling) tend to be further consolidated; again this is due to economies of scale required for inputs and to ensure return on investment for high capital expenditure in necessary machinery and infrastructure. In many developing countries, the three major actors in the post-harvest processing stage are producer cooperatives, small- and medium-sized enterprises, and industrial scale processors (da Silva et al., 2009).

Marketing and Distribution: Marketing and distribution systems consist of those channels which control access of products to the final consumers. In the agribusiness sector, these include supermarkets, kiosks and wholesale markets as well as food service operations such as hotels and restaurants. In the agribusiness sector as a whole, these distribution channels will differ according to the final industries for which products are destined, for example, palm oil can be used in the production of hygiene and beauty products. These marketing channels also differ somewhat according to geographic end-markets. These geographic end-markets can be local, regional or global in scope and exhibit differing patterns of market control. For example, in leading US and European Union (EU) markets, supermarket chains such as Walmart, Tescos and Sainsbury control a significant share of the market (Gereffi, Fernandez-Stark, & Psilos, 2011), while in some developing countries although supermarkets are gaining market share (Humphrey, 2007; Michelson et al., 2012; Neven et al., 2009), a large portion of agricultural products are still sold on informal markets, including in East Africa (Dihel, 2011). Dominant supermarkets typically require that wide range of quality and safety standards be met in order to become an approved supplier, while smaller chains or informal markets will tend to have much lower standards and be more easily accessible for less sophisticated production operations (Kaplinsky, 2010).

Supporting Services: Logistics and transportation fulfill key supporting functions, while government regulatory bodies are required to approve the sanitary and phytosanitary (SPS) conditions of outbound products and to ensure food safety and contain the spread of plant and animal disease domestically. Depending on the perishable nature of the product, a high degree of coordination between these different actors along the chain may be required. Highly perishable products, require adequate transportation and coordination measures and a functioning cold chain to avoid significant losses, particularly when cultivation, packing and processing and the final market are geographically separated. Post-harvest losses as a result of inadequate transportation and storage can account for as much as 30% of production in developing countries, undermining improvements in productivity and reducing incentives for producers to invest in the adoption of new techniques (Fernandez-Stark, 2013). Transportation alternatives often also vary depending on the value-to-weight ratio of the product. High-value, low-weight products such as French beans or blueberries are

[2] See Figure 10&11, page 88 in the appendix for illustrations of these global value chains.

a good fit for air transportation. These products often do not have sufficient shelf lives to withstand shipping by sea to their final markets and access to foreign markets will generally depend on the availability, reliability and cost of this airfreighting. Cereal products and sugar, on the other hand, are bulk commodities requiring large storage facilities and must generally be shipped in large vehicles or by sea.

III. Upgrading and Governance in the Agribusiness GVC

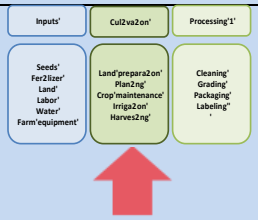
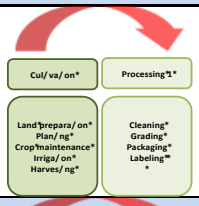
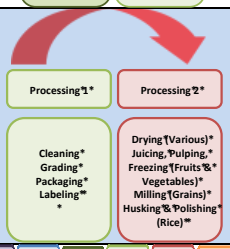
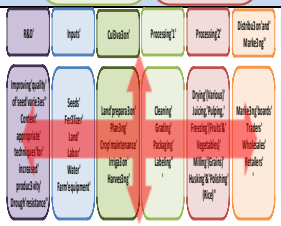
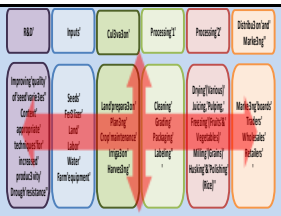
A. Upgrading Trajectories and Governance Implications

Moving between these different stages of the chain, or 'adding value' to existing activities within a particular segment of the chain is referred to as "economic upgrading" in the GVC literature (Gereffi et al., 2005). Upgrading in the agribusiness sector is essential to improve productivity, integrate transformation activities to increase shelf life and reduce post-harvest losses, and improve overall competitiveness of production. Furthermore, it helps to increase domestic value-added to agriculture, stimulate off-farm job creation for rural populations and, by generating additional incomes, alleviate liquidity constraints of small producers (Henson & Cranfield, 2009; Maertens, 2009; Maertens & Swinnen, 2009). In the fruits and vegetables sector, for example, upgrading into the packing segment of the value chain is a strong driver for off-farm female employment, as it relies on dexterity and food preparation skills (Bamber & Fernandez-Stark, 2013). These benefits afforded by successful upgrading are particularly important for countries in Africa, which face considerable food security challenges, growing pools of unemployed youth which need to be absorbed in the labor force, and at the same time, an increasingly sophisticated middle class willing to purchase differentiated and higher-value products (Brooks et al., 2013; FAO, 2013e). A range of these upgrading strategies have thus recently been incorporated into many national and regional strategies for the development of the agribusiness sector across the continent, including by Common Market for Eastern and Southern Africa (COMESA), the EAC and the AfDB (African Development Bank Group, 2010; UNDP, 2012). Table 1 presents examples of some of the most important upgrading trajectories in the industry.

Achieving upgrading, however, is neither straightforward nor achievable for many actors in the agribusiness value chain in developing countries. Smallholders often lack the knowledge, scale and the financial resources to make the investments and improvements required to successfully upgrade (Bamber & Fernandez-Stark, 2013; Fernandez-Stark & Bamber, 2012; Lee et al., 2012). They may also have difficulty self-organizing to establish cooperatives to achieve sufficient economies of scale to gainfully engage in the markets, even at a domestic level, and are often exploited by unscrupulous third party contractors (Barrientos, 2013). In these cases, there is often a need for explicit interventions, either by the private sector through contract growing operations or by public sector or donor support to overcome these specific constraints (Fernandez-Stark & Bamber, 2012). At the processing stage, "leapfrogging" into traditional, large scale processing activities without having established expertise in production stages of the chain is difficult, given that processing is typically capital-intensive and the supply of raw material inputs must be stable and reliable to ensure operations run at the estimated capacity, thus providing predictable returns on investment (Fernandez-Stark et al., 2011). Furthermore, in developing countries, these specific firm level constraints to upgrading often are further compounded by country-level challenges to competitiveness (Bamber et al., 2013). These challenges include weak regulatory institutions, such as poorly designed and implemented sanitary and phyto-sanitary (SPS) regulations, inadequate transportation, power and water infrastructure and the absence of important upstream value chain

actors, such as equipment, seed and fertilizer suppliers and firms providing supporting services (Hazell et al., 2010; Markelova et al., 2009).

Table 1. Select Upgrading Trajectories in the Agribusiness Global Value Chain

	Diagram	Description
PRODUCTION (GVC ENTRY)		Planting and cultivation of a particular crop for sale, not for household consumption. Production may be undertaken by smallholders or by larger estates. Entry point into the agribusiness GVC.
		Example. In 2008, small producers in **Kenya** began producing stevia, an emerging crop valued globally for its natural sweetener characteristics. Although this was a new crop to the country, with no domestic market, a strong outgrower program developed by global leader, Pure Circle, quickly attracted additional producers & by 2012, the company had 140 technicians supporting 1,500 producers in their production activities. Globally, production is dominated by smallholders and, rainfed with a productive life of 4 years, it can be profitable with as little as ¼ ha under production (Bamber, 2012; Lewis, 2013).
PACKAGING & COLD STORAGE (FUNCTIONAL UPGRADING)		The introduction of packaging and cold storage activities. Packing produce into 2-5kg bags instead of 50kg boxes and storing it in a cold room prior to sale can help to protect it from damage and increases the shelf life, significantly reducing post-harvest losses.
		Example. After increasing their market access to US supermarkets, **Honduran** pepper producers struggled with high rejection rates for their smaller peppers sold on a per-piece unit basis. To overcome this, they introduced washed and packaged multicolor packs of small peppers. By shifting to packaged exports, they not only reduced rejection rates, but were also able to charge an even higher price, boosting overall returns (Banegas, 2012).
PROCESSING (FUNCTIONAL UPGRADING)		Transforming fresh produce to increase the shelf life of the product and/or facilitate its final consumption. This can include canning (e.g. tomatoes), freezing (e.g. vegetables), juicing (e.g. citrus fruits), pulping (e.g. passion fruit), milling (e.g. wheat), pickling (e.g. onions). Typically requires manufacturing & food preparation skills and investments in capital equipment.
		Example. By 2000, **Chile** was a leading off-season exporter of fresh fruit to the US and EU markets; including fragile, highly perishable fruit such as raspberries and blueberries. To reduce losses & capture higher added value year-round, Chilean producers began processing fruit, particularly through freezing. By 2012, processing plants absorbed over half of fresh produce, employed 24,000 people & exports had reached US$1.5 billion (Fernandez-Stark et al., 2011).
PRODUCT UPGRADING		Product upgrading involves the production of a higher value product, such as the cultivation of organic produce. This requires knowledge of market preferences and prices for different products and production processes. Some certifications, like Fair Trade, simultaneously require process upgrading during the input, growing and processing stages to ensure a higher value product.
		Example. Organic production in **Tanzania** experienced a significant boom in the 2000s. In 1998, there were a few commercial operations including spices, paprika & cotton; by 2008, 55,000 farmers on 85,000ha were producing a range of organic products including cashews, cocoa, sesame and honey. A certification body was established in the country (Tancert), along with national organic standards. Farmers saw more significant improvements in their income in high value rather than commodity crops (Sida, 2008).
PROCESS UPGRADING		Introduction of new technologies into the production system or restructuring the existing system to improve efficiency. For many products, the incorporation of adequate crop rotation, mulching, fertilizer use, land terracing and irrigation techniques can improve productivity dramatically (FAO, 2013c).
		Example. In **Rwanda,** high susceptibility to soil erosion generates an annual loss of 1.4 million tons of productive soil, equating to a decline in annual capacity to feed 40,000 people (Bizoza 2011). To combat these challenges and restore productivity, the Government of Rwanda has made land terracing a national strategic priority and through a series of large-scale interventions has more than doubled the number of terraces in the country since 2006 (Bizoza and De Graaff, 2012; Government of Rwanda, 2012).
MARKET UPGRADING		Shifting sales between different markets for increased returns. This can include moving from lower margin local markets to high value export markets, such as the EU; but can also include entering higher-volume, lower-margin markets such as China. Focus should be on increased net revenue (volume by margin). Often requires efficiency gains in transportation infrastructure & services and/or meeting new standards and certifications to reach new markets.
		After independence, **Kenyan** producers identified key agricultural products to export to the growing Asian population in the United Kingdom. Today, they successfully export a wide variety of fruit and vegetables to the EU as a whole (Fernandez-Stark, Bamber et al. 2011). The introduction of KenyaGAP in 2010 was essential to maintaining access to this high value market.

Source: Duke CGGC.

At the same time, upgrading potential can be either constrained or enhanced by the governance structures in the chains in which different actors are operating (Gereffi & Lee, 2012). Shifting governance structures at both the global and regional level are putting increased pressure on chain actors to undertake product and process upgrading to improve their operations across Africa. In key global markets, lead firms, such as Tescos and Walmart, require their providers to meet strict protocols on varieties, quality, price and reliable delivery as well as compliance with public SPS standards (Reardon et al., 2009b; van der Meer, 2006). The establishment of these standards and quality and delivery protocols can be essential instruments for disseminating information on improving supply and, in turn, reducing producers' "learning curve" and enhancing both upgrading potential and speed (Diaz Rios & Jaffee, 2008). In addition, time constrained urban supermarket customers in developed countries favor pre-prepared and packaged foods; these products must thus be prepared as such prior to delivery to supermarkets. Supermarkets are pushing this function upstream to their suppliers, offering an opportunity for producers or new actors to provide washing, grading, mixing and packing services as well as further processing foods for easy consumption (Humphrey, 2005).

Yet, while this shift in power towards lead firms offers upgrading opportunities for their suppliers, it also creates important barriers to entry as buyers seek to reduce transaction costs by establishing longer-term relations with fewer but more capable group of suppliers (Kaplinsky and Farooki 2010; Lee, Gereffi et al. 2012; Gereffi 2013). While more traditional markets still prevail in many African countries (Dihel, 2011), they are increasingly replaced by these highly coordinated chains; for instance, Kenyan and South African supermarket chains, Nukamatt, Shoprite and Massmart are fast gaining market share in urban areas and expanding their footprints across Eastern and Southern Africa.[3] These chains have adopted similar sourcing strategies to their northern counterparts, suggesting that this pattern of consolidation of the chain towards competent suppliers is possible even within Africa. Regional suppliers that have already upgraded by serving the global export markets will be well positioned to take the lead in these emerging regional markets as well, making it increasingly difficult for new producers and firms to enter. Furthermore, functional upgrading, into processing and marketing functions of the chain is becoming ever more challenging due to consolidation of these segments and growing brand recognition at a regional and global level, and successfully competing in these stages of the chain may depend on attracting foreign direct investment (FDI) (Henson & Cranfield, 2009).

B. Standards

At the center of the shift in upgrading and governance in the agribusiness value chains are the expanding array of public and private standards that have developed to ensure food and plant safety as well as to signal quality differentiation or the particular social or environmental conditions under which products were cultivated and/or processed (e.g. Fair Trade International, Organic and Rainforest Alliance) (Barrientos et al., 2003; Dolan & Humphrey, 2004; Henson & Humphrey, 2009; Lee et al., 2010; Reardon et al., 2009a). Generally, the proliferation of private and civil society standards has occurred more amongst high value products, and public SPS standards are applied to all types of agricultural products, including cereals and other staple crops. However, this may begin to change; for example, due to potential negative environmental effects of palm oil production, lead

[3] Shoprite is Africa's leading food retailer, with outlets in 18 African countries and Massmart has 9 wholesale and retail chains, with 288 stores in 14 African countries (USAID, 2012b). Nakumatt has 37 stores across Kenya, Rwanda,

Tanzania, and Uganda and have plans to open a store in Burundi in the near future (Dihel, 2011; Herbling, 2013; Nakumatt, 2013).

buyers Woolworths, Coles, Arnotts, Magnum and Walmart have committed to sourcing only 100% certified sustainable palm oil (CSPO) by 2015.[4] Table 2 provides an overview of the key standards in the horticultural sector.

Table 2. Prominent Standards in the Horticultural Industry

	Public		Private	
	Mandatory	**Voluntary**	**Individual**	**Collective**
National	• National legislation (pesticide use, labor regulations, sanitary inspections etc) • USDA Standards	• HACCP • USDA National organic program	• Nature's Choice (Tesco) • Field-to-Fork (M&S) • Terre et Saveur (Casino) • Conad Percorso Qualità (Italy) • Albert Heijn BV: AH Excellent (The Netherlands)	• British Retail Consortium (UK) • Assured Foods Standards (UK)
Regional	• EU Regulations		• Filieres Qualite (Carrefour)	• EurepGap • Dutch HACCP • Qualitat Sicherhiet (QS – Belgium, Holland, Austria) • International Food Standard (German, French, Italian)
International	• World Trade Organization	• ISO 9000 • ISO 22000	• SQF 1000/2000/3000 (US)	• GlobalGap • Global Food Safety Initiative • SA 8000 • IFOAM Standard

Sources: (Dolan, 2004; Henson & Humphrey, 2009; Jaffee & Masakure, 2005).

In much of Africa, until recently, these standards have primarily played a role in serving global export markets; with much less focus on domestic or regional markets (Bolwig et al., 2013; World Bank, 2011; Lee et al., 2012). However, with increased regional integration through the formation of new trade blocs such as the EAC and COMESA (see Box 1), agribusiness standards are now also being developed to govern trade of agribusiness products at the regional level (Juma, 2010; Stefan, 2010). While these regional standards for agribusiness are often less stringent than global ones and require lower initial capital investments (Juma, 2010; Stefan, 2010), their development is contributing to the scaling-up in quality and sophistication of existing national standards, and providing a starting point for those countries with no standards systems in place. For example, groups such as the Eastern Africa Grain Council (EAGC) are working together to collectively develop and regulate standards suitable to the region that are more in-depth than most national standards (UNDP, 2012). This will not only facilitate the free movement of agricultural produce within the region, but also will provide a manner in which countries, such as Burundi, can begin to scale up their capabilities in regulation and enforcement of standards before having to face the challenge of complying with complex, global standards.

Box 1. SPS Protocols in the East African Community

In 2006, the EAC initiated development of regional SPS protocols. That year, the East African Council enacted the Standardization, Quality Assurance, Metrology and Testing Act, aimed at three broad objectives: establish the East African Technical Standards Committee (EATSC) and Accreditation Board; harmonize standardization, quality assurance and testing to facilitate industrial development and trade; and protect health, safety and environment (Oduor, 2009). Under the act, each member state is required to establish a National Standards Body, National Metrology Institute, National Legal Metrology Department, and National Accreditation Body or focal point (EAC, 2010). Since the enactment, 1,100 EAC standards have been harmonized by the member states (General Secretary, 2013). Furthermore,

[4] http://www.rspo.org

since 2009, the EATSC, EAGC, the private sector and National Bureaus of Standards have been working to develop and adopt harmonized standards for 22 staple foods products. In November 2012, quality standards for the four staple food products – maize flour, wheat flour, sorghum flour and dry milled maize – were approved; the draft standards for the other 18 staple products were also approved in Standards Management Committee meeting on July 22 – 24, 2013 (USAID, 2013c, 2013e).

In order to successfully implement these new standards in the region, the East African Phytosanitary Information Committee (EAPIC) has been tasked with helping the National Plant Protection Organizations (NPPOs) to develop the necessary infrastructure and human capital to ensure compliance and mutual recognition (USAID, 2013f). Under the new structure, member states are obliged to adopt these provisions to facilitate the smooth functioning of the common market, as well as access to foreign markets. While product certification capacity, however, varies considerably within the region making compliance challenging, member states should benefit from the strong development of SPS systems and experience in Kenya, which has exported agribusiness to the European market since the 1970s. KenyaGAP, for example, has been accepted as a substitute for GlobalGAP since 2010 (Fernandez-Stark et al., 2011).

IV. Burundi in the Agribusiness GVC

A. Introduction

Agriculture is the mainstay of Burundi's economy, accounting for approximately 35-40% of GDP, and employing almost 96% of the country's labor force (FAO, 2013b; World Bank, 2013; MINIAGRI, 2013). Leveraging this potential, agribusiness can play a critical role in driving economic transformation through employment and income generation in the country. Currently, however, agribusiness value chains are characterized by a poorly developed input sector, low productivity, lack of storage capabilities and an absence of organized processing and downstream markets. Furthermore, agriculture is dominated by subsistence smallholder farming with only a fraction of production destined for commercialization. Given this small-scale feature, locally produced agribusiness items are generally not competitive abroad and mainly supply the domestic market, which remains largely informal and fragmented. Exports are limited to small quantities of fresh fruits, primarily to regional markets.

Burundi's agriculture has one of the lowest productivity rates in the world (WFP 2012; UNIDO 2013; USAID 2013). In general, yields for major agribusiness crops have changed very little during the past 40 years (Wodon, Morris et al. 2008). At the same time, the lack of off-farm job opportunities has contributed to a decline in value added per worker, as more family members are dedicated to work on dwindling plot sizes (World Bank 2011). Declining income from farming as the only livelihood option has inevitably created more pressure on land, leading to shorter fallow periods and expansion of cultivation to marginal lands, further degrading the scarce land resources in the country (Cochet 2004). Adding to these challenges, underdeveloped downstream activities lead to high losses of perishable products, increasing food security risks and increasing dependence on often expensive, imported food products. Burundi's total value of agricultural imports increased from US$22 million to US$78 million between 1990 and 2011 (FAO, 2013b).[5] Given increasing world food market prices, the escalating dependence on food imports has the potential to increase

[5] For the same years, vegetable oil imports increased from 381 thousand tons to 2,804 thousand tons, sugar imports increased from 5,681 thousand tons to 22,606 thousand tons, cassava imports from 0 in 1990 to 14,830 thousand tons and cereals imports increased from 37,973 thousand tons to 47,080 thousand tons (FAO, 2013b).

vulnerability to rising food insecurity, in addition to creating strain on Burundi's foreign exchange reserves.[6]

Considering the importance of agriculture for Burundi's economy and its potential to benefit large segments of the population, policy makers in Burundi must seek opportunities to drive growth in the sector. The continuing low productivity and shortage of agricultural land mean that future growth in agribusiness value chains must derive from sustainable intensification, supported by restoration of land fertility. At the same time, adoption of productivity-enhancement technologies by farmers requires upgrading in storage, processing, and packaging capabilities to minimize post-harvest losses and ensure profitability at farm level. Upgrading in these post-harvest capabilities is also essential to Burundi's competitiveness in regional agribusiness value chains; particularly after adoption of regional standards by the EAC member countries (see Box 1). While this strategy will in the short- and medium-term increase competitiveness in import-competing sectors, it is essential in the long-term to diversification of agribusiness exports, which currently relies narrowly on coffee and tea.

Building on a review of both primary and secondary sources, the remainder of the report provides detailed analysis of Burundi's current position within the chain and its potential for upgrading in the future. Specifically, it examines employment and workforce development in the sector to identify key gaps in both existing skills and the institutional arrangements required to develop the skills necessary to drive upgrading. It draws on discrete examples from other countries in the region and beyond to identify potentially replicable best practices in skills development. It closes with action-oriented recommendations regarding workforce development programs to be implemented to support upgrading.

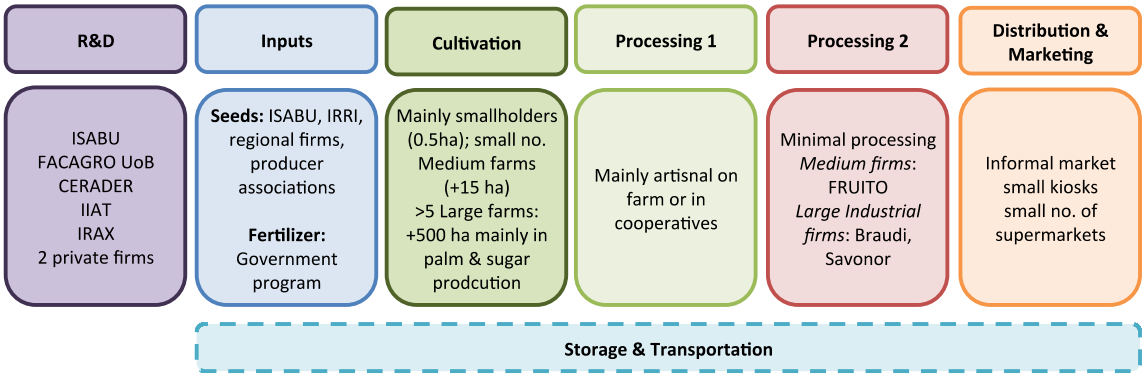
B. Burundi's Participation in Agribusiness GVCs

Burundi's agribusiness sector is dominated by subsistence production on plots of approximately 0.5 ha (Thorp et al., 2013).[7] Roughly 1.56 million of households are primarily dependent on agriculture for their livelihoods (MINIAGRI, 2013; World Bank, 2006) A hallmark of Burundi's opportunities in the agribusiness sector is its exceptional climate for growing horticulture products along with multiple growing seasons. The major agribusiness product categories are fruits and vegetables, root and tuber crops, sugarcane, and palm fruit (FAO, 2013b). These crops will be the primary focus of the following analysis. Livestock production fell to insignificant levels as a result of displacement and looting during the war, and is still recovering. Post-harvest handling of different crops is mostly limited to artisanal processing at the household or cooperative levels, although there are a few larger industrial scale operations in the country. Marketing is primarily through informal produce markets, small kiosks and a few small supermarkets in Bujumbura. Figure 2 highlights the key actors in the different stages of Burundi's agribusiness value chain.

[6] According to WFP, 58% of the population was chronically malnourished in 2012 (WFP 2012).

[7] Due to population growth, average size of landholdings in the country has declined from over 1 ha in 1973 to 0.5 ha in 2009 (Thorp et al., 2013).

Figure 2. Burundi in the Agribusiness Chain



Source: Duke CGGC.

The **inputs segment** of the value chain remains largely underdeveloped, and continues to be concentrated by public sector actors. The formal market for seed production, accounts for just 5% of the market (Bararyenya et al., 2013) and is dominated by the *Institut des Sciences Agronomiques du Burundi* (Institute of Agricultural Sciences of Burundi, ISABU) and the International Rice Research Institute (IRRI). Together, in coordination with a small number of domestic and, more recently, foreign firms, a few new seed varieties of staple crops like potatoes, bananas and rice are being created (Claes, 2013; Duat, 2013). Individual producers or cooperatives bartering seeds or distributing them through solidarity chains, contribute to the informal supply (Claes, 2013; Duat, 2013; USAID, 2010c). Seed multiplication at the producer level has featured prominently in several of the value chain projects carried out since 2006 (Field Research, 2013; IFAD, 2012a; USAID, 2013a), however, the seed supply, both in terms of quality and quantity, is still considered to be inadequate for the requirements to increase yields, improve disease and drought resistance and nutritional content in the agricultural sector (USAID, 2010c). The recent creation of *l'Office National de Control et de Certification des Semences (*National Office for Seed Control and Certification, ONCCS*)* under the Ministry of Agriculture and Livestock (MINAGRIE), responsible for regulating the seed sector, aims to improve the quality of seeds sold in the country and to facilitate the import of foreign seeds to meet the need for improved seed varieties (Claes, 2013).

Since the government extension program was reinitiated in 2006, technical assistance is primarily provided by MINAGRIE's *Directions Provinciales de l'Agriculture et de l'Elevage* (Provincial Directorates of Agriculture and Livestock, DPAE) extension agents (Curtis, 2013; IMF, 2010), as well as through a variety of programs with development partners and donor agencies, including International Fund for Agricultural Development (IFAD), the Food and Agriculture Organization of the United Nations (FAO) and Oxfam (Field Research, 2013) and a limited number of private sector contract farming schemes (Field Research, 2013). Mineral fertilizers are available on the informal market, but these are imported and tend to be expensive due to weak competition and high transportation costs (Kaboneka, 2013). The large bags available also tend to be inappropriate for small producers with limited needs due to small plots, and who must carry the fertilizer back to their farm on foot or by bicycle (ADISCO, 2012). The prevailing access challenges for mineral fertilizer is expected to be resolved in the short term by the launch of national fertilizer distribution program (see

Box 2). However, the availability of locally produced, organic fertilizer and mulch is scarce,[8] and as a result, is also expensive. Concomitantly, it is not cost-effective to import these products from neighboring countries (Pandey, 2013; UNIDO, 2013a). Supply of farm equipment, on the other hand, is virtually non-existent.

Weak demand from producers, lack of technical knowledge and financial resources and market distortions from subsidy programs have contributed to this poor development of the input segment. There are only a few medium and large farms driving demand and small scale producers employing traditional practices tend to be unaware of the benefits of engaging modern agricultural techniques such as use of new seeds, fertilizers or farm equipment (USAID, 2013a). Furthermore, even when smaller producers understand the benefits of these techniques, with over 65% of the population living below the poverty line, these producers often do not have the financial means, or access to credit to purchase these inputs (IMF, 2012; USAID, 2010c). Technical assistance programs aimed at improving producer understanding of these benefits are said to lack both the size and the resources to adequately reach producers on a large scale (USAID, 2010c; World Bank, 2012), further perpetuating poor farming practices. In addition, ongoing donor-funded distribution programs focused on food security provide producers with free inputs such as seeds, leading producers to prefer to wait for free handouts rather than to spend precious resources on these inputs (Field Research, 2013; USAID, 2013a). Together, these problems undermine demand for inputs, and deter private sector investment in this stage of the chain.

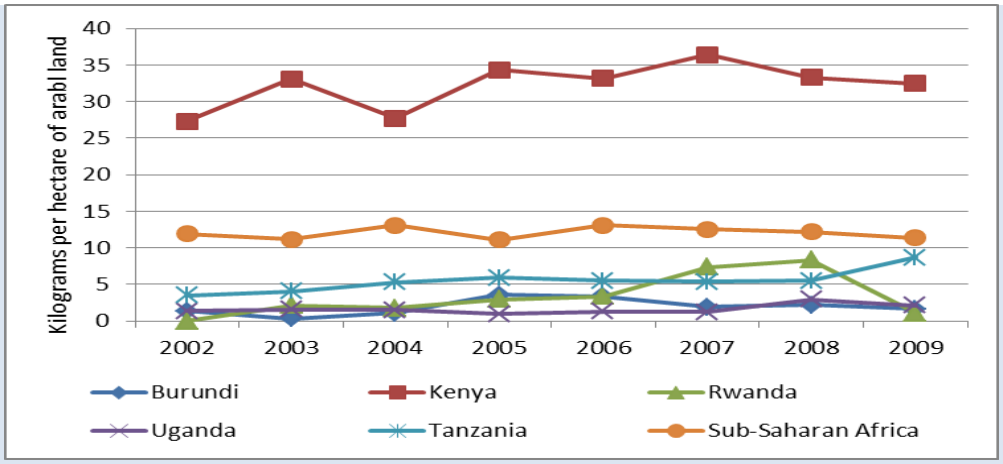
Box 2. National Fertilizer Distribution Program

Over the last decade, Burundi has recorded very low rates of fertilizer consumption by agricultural producers, falling below both EAC and Sub-Saharan Africa (SSA) averages (see Figure 3). By comparison, during this time, annual consumption by Burundian farmers has not exceeded 5kg/ha, whereas the SSA average has been12kg/ha and the world average has been122kg/ha (FAO, 2013b). The resulting outcome of low fertilizer application has been widespread soil fertility losses that have exacerbated already low agricultural productivity levels (Wodon et al., 2008). As much of Burundi's farmable land suffers from high levels of soil acidity and significant soil infertility due continued overexploitation, efficient use of fertilizer is critical not only to counterbalance soil acidity, but also to enhance sustainable production and improve productivity.

While the Burundian government has offered subsidized fertilizers through its National Fertilizer Subsidy Program (PNSEB) for some time, efforts thus far have been insufficient. However, through US$12 million in funding from the government of the Netherlands in Spring 2013, efforts are now being scaled up. The purpose of this scaling up is to contribute to the generation of sustained annual demand amongst producers, especially amongst food crop producers, and to increase total national fertilizer consumption rates from 10,000 T/year to 60,000 T/year (Republic of Burundi, 2013). To accomplish this, the distribution system is being changed to a market-based voucher system wherein eight private sector actors will take over the government's role in managing the import, distribution and sales of 25kg bags of chemical fertilizer to be sold to farmers across the country at 40% subsidized costs (Philipp, 2013; Vlaar, 2013). It is important to note here that the technical sciences that ground fertilizer application cannot be overlooked if maximum productivity is to be achieved (Kaboneka, 2013).

Figure 3. Fertilizer Consumption in the EAC Countries and Sub-Saharan Africa

[8] Availability of livestock manure has also been in short supply due to the dramatic decline in households' livestock numbers, decreasing since the conflict from an average of 2.37 per household in 1990s to 0.42 in 2001(D'Haese et al., 2010).



Source: World Bank, 2013c

EAC Approach to Fertilizers: Similar to Burundi, all other countries in the EAC have both adopted liberalized fertilizer policies in addition to offering fertilizer subsidies. As the figure above reflects, Kenya is a clear leader in the EAC for fertilizer consumption rates. Beginning liberalization policies in the early 1990s, the success of the Kenyan story is attributed to its fast growing agribusiness industry which created a strong demand base thereby increasing the number of private sector suppliers. This resulted in increased competition and drove down fertilizer prices that further increased consumption rates (Haggblade, 2011). While Uganda and Tanzania implemented similar reforms including voucher subsidy programs, the fertilizer market in these countries has not had the same success as in Kenya, primarily due to insufficient awareness raising on the demand side (International Food Policy Research Institute, 2013; Yamano & Arai, 2010). In the case of Rwanda, after having a nationalized fertilizer procurement and distribution system for years, in 2010, the country started implementing a privatization project with funding from United States Agency for International Development (USAID) to develop private sector enterprise in the fertilizer market (Kimenyi et al., 2013; Neeliah et al., 2013).

Cultivation: Fresh fruit & vegetables (FFV), root and tuber crops, cereals, sugarcane and palm fruit, account for approximately 80% of the total gross value of crop production in Burundi, valued at approximately US$1.9 billion in 2011 (FAO, 2013b). FFV production accounts for the largest share at 46% of production value, followed by roots and tubers (25%) and cereal production (7%) (FAO,2013b). Overall, banana, a major staple product, was the single most important crop from a value perspective produced, accounting in gross value for US$632 million (FAO, 2013b). Excluding tea and coffee, which represent 89% of exports for the 'Others' category, FFV also account on average for the largest export share, with tropical fruits[9] making up 36% of all exports (UNComtrade, 2013). This is the only product category with a positive trade balance and exports are destined for the regional and European markets (UNComtrade, 2013). Annual export volumes still remain very small and irregular, at less than US$1 million, constrained by cost-competitive airfreight contracts for extra-regional exports and lack of sophisticated packaging (Somera & Somera, 2013; Vrijlandt, 2013). While a small portion of cereals, sugar and palm oil are currently exported to countries in the region, Burundi imports considerably more than it exports and the remaining balance is primarily destined for the either household consumption or for local food markets.

Table 3. Burundi's Agribusiness Production and Trade by Major Crop Categories

Product	Production (US$ million)	Import (US$ million)	Export (US$ million)	Net Trade

[9] Passion fruit, bananas, pineapple and mangos

	Average 2005 -2011	2011	Average 2005 -2011	2011	Average 2005 -2011	2011	Average 2005 -2011
Fresh Fruit & Vegetables	800	888	0.13	0.4	0.7	0.7	0.6
Root & Tuber Crops	413	473	0	0.4	0	0	0
Cereals	114	135	30	29	0.4	1.5	(29.9)
Palm Oil*	10	14	5.3	5	0	0	(5.3)
Sugar*	16	22	8.6	19	1	0.5	(7.6)
Others	294	395	26	23	63	81	37
Total	1,647	1,927	61	59	64	83	24

Note: *Production figures denote sugarcane and palm fruit & kernels while trade data sugar and palm oil
Source: CGGC based on FAOSTAT

Three production models can be identified within Burundi's agribusiness sector, smallholder production, medium sized production (+15ha) and industrial production. Crops produced tend to vary according to these different models as shown in Table 4.

Table 4. Production Models of Principle Agricultural Products, 2013

	Smallholder production	Medium size producers	Industrial production
Fresh fruits & vegetables	X	X	
Roots & Tubers	X		
Cereals	X	X	
Palm fruit	X		X
Sugarcane			X

Source: Duke CGGC based on field research and review of secondary literature.

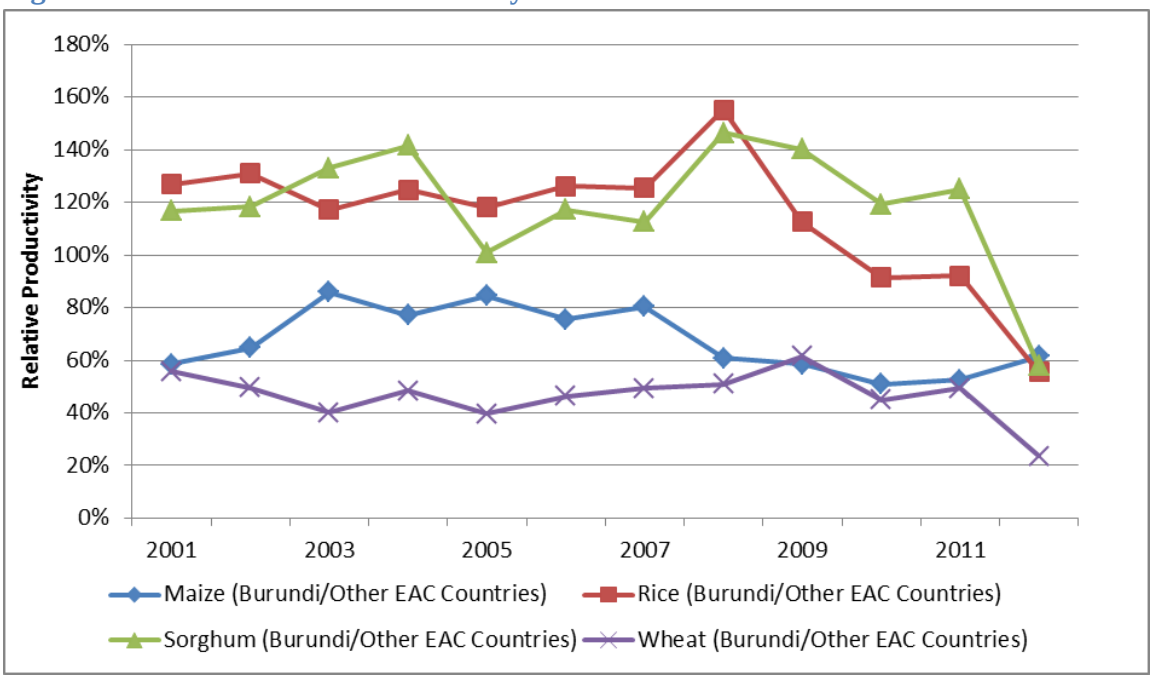
Smallholders typically produce a diverse range of products in small quantities as a means of managing risks for household food supplies and balancing this with cash crop production. These crops include FFV, rice, maize, sorghum and wheat as well as cassava and sweet potatoes. Some producers may also produce palm fruit. Generally, production is based on primarily traditional farming methods, that is, manual, hand-hoe powered, limited, if any, water management and irrigation techniques and minimal use of inputs (PROFEDI, 2012; USAID, 2010c). Although some producers may belong to a cooperative or be engaged in contract farming schemes, generally they are not well organized, they are typically disconnected from markets and only an estimated 20% of the average producer's crop makes it to market (PROFEDI, 2012; USAID, 2010c).[10] When they do engage in markets, these producers have limited power to bargain with intermediaries due to lack of market information, management skills and economies of scale (USAID, 2010c).

Despite these challenges, this category accounts for the largest share of production in the country (USAID, 2010c) and smallholders produce the majority of staple food crops (USAID, 2010c). Poor

[10] There is a nascent, but emerging, value chain for sorghum in the country as a result of Brarudi brewery's launch of a low-cost sorghum based beer in 2010. The organization has established a contract farming scheme with small holder producers in coordination with a local NGO to provide technical assistance (Ntahe, 2013). Continued growing demand for the low-cost beer suggests that this chain is likely to develop further.

agricultural practices employed by these producers and weak access to improved inputs have contributed to overall declining productivity in these product categories (Bararyenya et al., 2012). In addition to Burundi's comparatively low average productivity for maize and wheat within the EAC, its relative productivity for rice and sorghum has continued to decline since 2009 (see Figure 4). Together with a growing population, this has forced the country to increase the volume of cereal imports. The value of cereal imports, particularly, for wheat, maize and rice, account for the largest share of Burundi's agribusiness imports, on average US$30 million per year between 2005 and 2011(FAO, 2013b; USAID, 2010c) . As such, they generate considerable strain on Burundi's limited foreign exchange reserves. Unlike other smallholder crops, cassava production has demonstrated resilience during the years of conflict, serving as the staple product for Burundians (USAID, 2010c). However, yields have also fallen significantly in recent years, declining from 9 T/ha in the 1990s to 4 T/ha in 2012 (FAO, 2013b). This is partly as a result of plant disease and severe mosaic attacks (USAID, 2010c). Failure to redress declining cassava productivity will generate acute food security concerns in Burundi.

Figure 4. Burundi's Cereal Productivity Relative to the EAC Countries



Source: Duke CGGC Based on FAOSTAT.

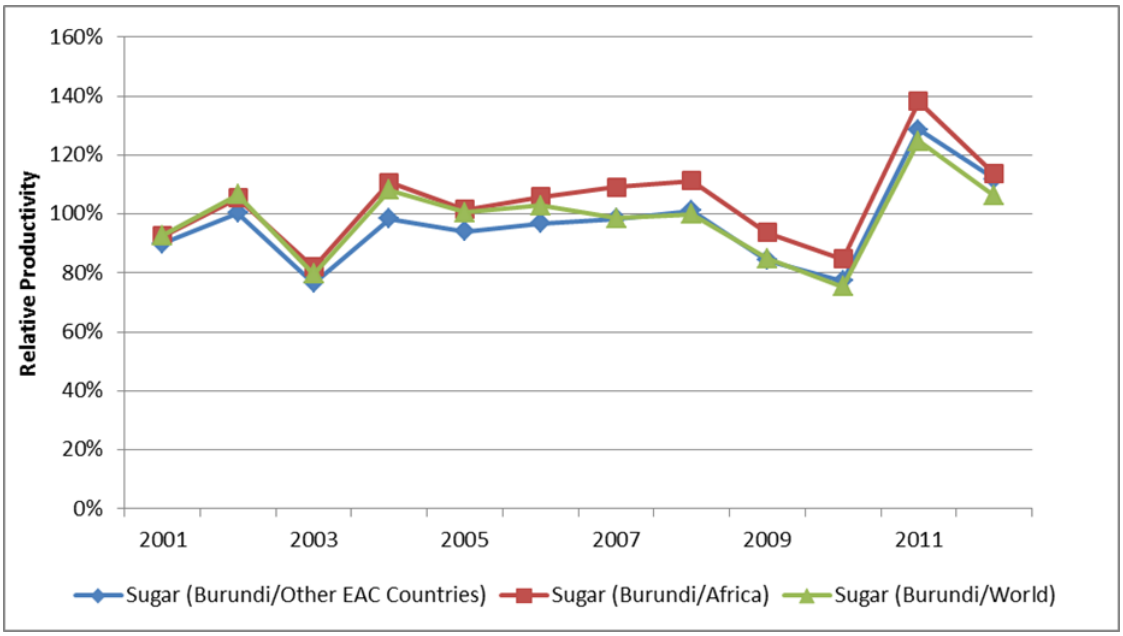
Medium-sized producers also produce a range of products, including FFV and cereals. These producers tend to operate more as commercial farmers with the majority of their produce intended for the market. The number of these producers is limited; the newly formed Chamber of Agribusiness, established to represent these farmers in 2010, for example, had just 30 members by 2013 (Butoke, 2013). Since November 2013, PRODEFI has an embedded local technical expert at the chamber and works with its members to support agribusiness in Ngozi and Bubanza, PRODEFI's target provinces (Baranyanduza, 2014). The use of inputs and improved agricultural practices is typically higher on these operations and they are generally better organized, although mechanization continues to be low due to lack of access to credit and a poorly developed farm equipment market (ADB 2011; UNIDO 2013). In the fruits segment, 25 producers have come together to form an industry association, IPE Fruits, which aims to improve packaging, distribution and marketing operations in the FFV value chain to reduce post-harvest losses, eliminate intermediaries, and establish a product better suited to the purchasing power of the local market (Somera & Somera, 2013). Currently products intended for

the local fresh produce market are packed and shipped in bulk containers in open trucks resulting in spoilage during transportation (Somera & Somera, 2013; UNIDO, 2013a).

Several of these producers have also obtained certifications for organic production and are now able to export a portion of their harvests to Europe (Somera & Somera, 2013). This has been facilitated in part by the support from the Burundi Organic Agricultural Movement (BOAM), which received funding from the Swedish Development Agency, and has begun to train extension agents to support organic certification. Nonetheless, two key factors may derail these initiatives: first, the actual certification process remains expensive as there are no local certifying agencies and auditors must be brought from Kenya (Field Research, 2013) and second, strong and rising demand from a non-discerning domestic market provides similar margins for producers compared to exports without the challenges related to serving the export markets.

Three **large-scale producers**, Ruzizi, Tanganyika Business Company (TBC) and *La Société Sucrière du Moso* (Moso Sugar Company, SOSUMO) are primarily engaged in monoculture operations, in palm fruit and sugarcane. Ruzizi has forged strong linkages with downstream processing operations in palm oil (see Box 3), while both TBC and SOSUMO which have over 3,000 ha of sugarcane plantations each, are vertically integrated sugar processors (Field Research, 2013). Figure 5 demonstrates that under this industrial-scale model, Burundi has a clear comparative advantage in the production of sugar cane, with productivity levels on par or slightly higher than global averages. Furthermore, anecdotal evidence suggests that Burundi is well-known for its high quality sugar production (Field Research, 2013). The success of these operations indicates that under the correct business model and in the correct product category, Burundi can indeed become a competitive player in the agribusiness sector.

Figure 5. Burundi's Sugar Productivity Relative to Africa's and Global Average



Source: Duke CGGC Based on FAOSTAT.

Box 3. The Emerging Palm Oil Value Chain in Burundi

Although the number of actors is very limited, the palm oil value chain has recently emerged as the most dynamic and well-organized agribusiness in Burundi. The local lead firm, Savonor, runs an industrial size

palm oil processing plant in Bujumbura. The company maintains a vertically-integrated business, including production, processing, packaging, marketing and distribution (Pandey, 2013). Over the past decade, the company organized and trained numerous smallholder farmer cooperatives, encouraging them to deliver their palm fruit to their extraction plants. Today, there are an estimated 10,000 small producers growing palm trees (Carrere, 2010; MINAGRIE, 2011). Production value of palm fruit nearly tripled from less than US$5 million to approximately US$14 million between 2005 and 2011 (German et al., 2011), while the area under cultivation almost doubled during the same period (see Table 5). More recently, Savonor has also partnered with Ruzizi, a local family-owned agribusiness, to establish the largest palm tree plantation in the country, with approximately 700ha under cultivation (Muheto, 2013; Pandey, 2013). Enhanced coordination of supply chain activities has ensured availability of raw materials. The company also invested in its own nation-wide distribution system and owns its transportation and retail outlets, in addition to supplying existing kiosks and supermarkets. This improved coordination and organization of the chain, coupled with strong local demand, has been a key factor driving growth of palm oil production, allowing Savonor to more effectively compete with imports from neighboring countries (Pandey, 2013).

Table 5. Evolution of Palm Fruit Production in Burundi, 1990-2012

	1990	1995	2000	2005	2010	2012
Area (ha)	1,250	1,250	1,200	3,300	5,800	5,900
Production (T)	14,200	14,000	13,000	33,000	58,000	59,000

Source: Duke CGGC Based on FAOSTAT.

Generally, the palm oil industry is an important contributor in the EAC region as a whole. Somewhat similar to Burundi, in Kenya, Tanzania and Uganda, the palm oil value chains are fairly well organized from production through marketing and distribution. However, a unique difference between these countries and Burundi is that the presence of multiple producers increases industry-wide competition. Through a large-scale multi-year IFAD and World Bank project beginning in 1998 Uganda was able to achieve regional-first-entry to value chain production, and is today the dominant producer (IFAD, 2011) and exporter in the region (Carrere, 2010; German et al., 2011). Rwanda has the least developed palm oil value chain, and has suffered setbacks from a government shutdown of its largest palm oil producer in 2012 due to public health concerns (Mbonyinshuti, 2012).

Large trade deficits in the region reflect an exceptional market opportunity for regional export expansion by EAC palm oil producers. In 2010, the combined value of palm oil imports by all EAC countries exceeded more than US$1.5 billion, while total exports only slightly exceeded US$108 million (Mbonyinshuti, 2012; UNCOMTRADE, 2013). While palm oil is predominantly used for human consumption in the EAC, growing investments are being made by numerous private international biofuel companies in Kenya, Tanzania and Uganda, offering additional growth potential (Carrere, 2010; German et al., 2011).

Packaging & Processing: The packaging and processing segment of the value chain is poorly developed. There are no advanced packing operations for fresh produce in the country, while industrial scale operations are in their early stages of development in Burundi, with just a one or two medium- and large-scale processors operating in each product line in the country. These currently include the sugar processor, SOSUMO (HR Director, 2013); Brarudi, downstream processor of sugar for beverages and the largest consumer of sugar in the country (Ntahe, 2013); Savonor, which processes oil products (Pandey, 2013); Muraymva Flour Mill (MINOLACS, 40T/day), Pembe Mills (200T/day) and Farisana (45T/day) which mill wheat (USAID, 2010c),[11] and, FRUITO, a medium sized fruit juice processor (USADF 2008). Another medium sized operation, Mutoyi, has also begun

[11] In 2012, all three firms indicated that they were currently under expansion to 200MT, 400MT, and 150 MT respectively (USAID, 2012a).

to commercialize fruit juice concentrates, although at a comparatively much smaller scale and sales are primarily made through the company's retail outlet in Bujumbura (UNIDO, 2013a). Because these firms are the dominant, and the only local processors in their respective sectors, they tend to have little local competition. Nevertheless, they operate in import-competing sectors; therefore, joining the EAC is expected to change local market dynamics and require Burundian firms to improve their price competitiveness that are on par with those of the firms in Kenya and Tanzania (Pandey, 2013).

All other processing takes place at an artisanal level, carried out by individual producers or cooperatives (USAID, 2010c) although these methods are relatively inefficient compared to industrial processing (PROFEDI, 2012). This is particularly common for rice, maize and cassava. Processing of dried cassava chips to produce cassava flour, for example, is carried out using hammer mills, often owned by small traders or women's associations (FAO, 2013e). Small rice mills result in a ratio of white rice to flour about 4:1, reducing the quality of the product (PROFEDI, 2012; USAID, 2012b). The Federal Chamber of Commerce (FCC), Confederation of Agricultural Producer Associations for Development (CAPAD) as well as the National Center for Food Technology (CNTA) and a number of donors, including United States African Development Foundation (USADF) and OXFAM, have been actively providing technical and financial support to these small-scale operators and upgrade their operations (Field Research, 2013; IMF, 2010; USADF, 2013a; USAID, 2013a).

Large scale processing is constrained by several factors: First, low yields at the production level, combined with poor coordination through value chains, particularly with respect to information on production, and undeveloped transport services contribute to irregular and unpredictable supply of raw materials. This makes it difficult to determine potential for installed capacity to deliver returns on investment. Second, limited access to long term financing in the country due to liquidity constraints in the banking system, mean that it is difficult for operations to secure the capital to invest in the necessary equipment required for these operations (Mutabazi, 2013). Third, electricity supply is unpredictable (PROFEDI, 2012), and likely to become more so, as the country struggles to meet its rising demand (Ministry of Energy and Mines, 2013).[12] Fourth, there are no suppliers of packaging materials in the country (UNIDO, 2013a). For example, glass and plastic containers, along with labels and lids must be produced in-house or imported from neighboring countries (Demeester, 2013; FAO, 2013e; Field Research, 2013), inhibiting the storage, distribution and marketing of processed products. Despite these challenges, new market entrants expected to begin operations within the next two to three years include: TBC's sugar processing unit at an annual capacity of 30,000 T by 2016 (Barankiriza, 2013); Afritextile, the new owner of state-owned cotton company, and Bakhresa, a Tanzanian grain processing mill commissioned in 2009 with a capacity of 360 T/day (Field Research, 2013; PTI, 2009). The emergence of these new entrants suggests that when value chain gaps and supply issues are resolved through coordination mechanisms – such as contract farming techniques and imported raw materials – strong local demand combined with improvements to the investment code along with the liberalization of several agribusiness products, mean that private sector investors and development banks are willing to provide financial support to develop agro-processing operations.

An underdeveloped processing sector, combined with lack of proper storage, transportation and cold chains, leads to significant waste in post-harvest operations (IMF, 2012; USAID, 2010c). While country-specific estimates for Burundi is lacking, in East Africa, post-harvest losses for maize in

[12] See companion paper on Burundi's position in the energy value chain for an in-depth analysis of demand and supply challenges in the country's energy sector.

2008 ranged between 16 and 22% (GTZ, 2010). For other agribusiness products such as fruits, vegetables and root crops, which have relatively higher perishability, post-harvest losses reach 50% (GTZ, 2010). One estimate for Burundi suggests that as much as 50% of the tomato crop goes to waste annually due to lack of transportation and downstream processing (African Development Bank, 2011; IMF, 2012). Furthermore, because of poor storage availability in many rural areas, many farmers are forced to sell their produce immediately in oversupplied seasonal markets or incur loss due to spoilage. This results in price fluctuations and leaves little chance for income-smoothing across the year. Given the high rates of food insecurity and poverty in the country, resolving these downstream constraints in the value chain are essential to secure the benefits for food security from productivity improvements.

Distribution and Marketing: With the exception of palm oil and sugar,[13] distribution channels in Burundian agribusiness are generally uncoordinated and inhibited by the lack of a market information system regarding production data and prices in the country (USAID, 2012a) and weak brand development; few widely recognized local brands, such as Cooki oil and Fruito juice, can be identified (Pandey, 2013; USAID, 2012b). Agri-products are distributed through small kiosks, a number of small supermarkets, brand-specific retail outlets, wholesalers, restaurants and hotels, and the large informal market (Dihel, 2011). Coordination of these chains is expected to improve in coming years as several foreign distributors from Belgium, China, India, the Netherlands and Pakistan have set up operations in the country following improvements to the country's investment code (Dihel, 2011). These distribution channels in Burundi are similar to those in other countries in the EAC. Although supermarkets have been growing rapidly, driving retail growth at compound annual growth rates of over 10% in Rwanda, Uganda and Tanzania between 2006 and 2010, small independent, and often informal, retail stores and street vendors dominate the distribution sector in the region, accounting for an estimated 70-80% of sales (Dihel, 2011).

Poorly developed markets and a weak marketing and branding approach can in part be attributed to Burundi's post-conflict status, the dominant role played by the state in productive activities during the past two decades and the continued importance of informal markets. During the years of conflict, both formal and informal markets were to a large extent replaced by extensive emergency food aid programs. Since then, the informal market has played a central role in the distribution of products in the country (Dihel, 2011), while in the formal market, state-owned firms have traditionally dominated and been accustomed to markets where competition has largely been absent due to small number of suppliers and supply shortage. This situation generated little or no competitive pressures on firms to invest in marketing and regularly assess and adjust their cost structures (Pandey, 2013). Burundi's ascension to the EAC, however, makes it increasingly difficult for local firms to remain competitiveness compared to imports from other countries unless they invest in the marketing and brand management techniques.

R&D: Burundi's agricultural R&D segment was severely disrupted by the years of conflict in the country (Stads & Ndimurirwo, 2011). Research infrastructure was destroyed and equipment stolen (Castelo Magalhaes et al., 2003), donor funding withdrew and human capital capacity declined as researchers either left the country or were confined to urban areas and unable to carry out research (Beintema & Stads, 2006). Since the peace accords, these operations have slowly been recovering and, while overall capacity is still below that of pre-crisis levels (Stads & Ndimurirwo, 2011), today, there are several public, private and international organizations as well as educational institutions that

[13] In the sugar sector, due to subsidized prices, the state-owned sugar company coordinates distribution through five retail outlets and sales per person are limited to avoid buyers from neighboring countries from purchasing subsidized sugar for sale abroad (HR Director, 2013).

are carrying out research in the sector. Consistent with the country's need to improve productivity, R&D is focused primarily on crop production, accounting for 45% of research. This is followed by food technologies at approximately 15%.[14] Vegetables are the most researched crop (10%), followed by rice (7%), fruit (6%), and potatoes (6%) (Stads & Ndimurirwo, 2011).[15]

Public sector actors include ISABU, CNTA and the Agronomic and Zootechnique Research Institute (IRAZ). With six research stations around the country, ISABU is the country's principal agricultural research center and accounts for nearly two thirds of the research capacity and close to three-quarters of investments (Claes, 2013; Stads & Ndimurirwo, 2011).[16] CNTA is focused primarily on developing and adapting processing and storage technologies for small and medium sized operations in the country, while IRAZ, being part of the Economic Community of the Countries of the Great Lakes (CEPGL), is mandated to support food security through agricultural and animal science research (Castelo Magalhaes et al., 2003). Both the University of Burundi and the University of Ngozi[17] have research departments dedicated to agriculture, although research projects at these institutions are limited due to few employed researchers and limited budget (Stads & Ndimurirwo, 2011). Private sector investment in R&D is low as can be expected with just two private firms, AGROBIOTECH and PHYTOLABU in operation since 2003, although AGROBIOTECH was established in 1998 (Castelo Magalhaes et al., 2003; Stads & Ndimurirwo, 2011; Rishirumuhirwa, 2014). These two in-vitro cultivation laboratories focus on the bulk production of in-vitro seedlings for commercial purposes (Stads & Ndimurirwo, 2011). AGROBIOTECH employs 25 people and through its network of nurseries and laboratory in Bujumbura, and its collaboration with a Belgian University, is the only player in the country capable to produce banana saplings using tissue culture technology, which during multiplication can effectively prevent transmission of specific plant diseases common in the region (Rishirumuhirwa, 2014). In addition, to these local institutions, the International Institute on Tropical Agriculture (IITA) and the International Rice Research Institute (IRRI) primarily carry out applied research in the country.

In comparative terms, the overall structural composition of agricultural R&D endeavors in other EAC countries is in many ways similar to that of Burundi's, albeit with Kenya being a clear front-runner in funding, human capital and output (Karugia et al., 2013). In all EAC countries, the overwhelming majority of staffing and R&D output is channeled through the largest national R&D center – akin to Burundi's ISABU - that accounts for upwards of 40% of total agricultural R&D expenditure (e.g. Kenya Agricultural Research Institute (KARI), 49% of total spending; Department of Research and Development (DRD) in Tanzania, 40%; National Agricultural Research Organization (NARO) in Uganda, 73%; and Rwanda Agricultural Research Institute (ISAR) in Rwanda, 73%) (Flaherty, 2010; Flaherty, Kitone, et al., 2010; Flaherty & Munyengabe, 2011; Flaherty, Murithi, et al., 2010). Similarly, these dominant national R&D centers also fall under the administrative domain of their Ministry of Agriculture. Each country in the EAC also exhibits similar

[14] Note, these figures are from 2008 and are the latest available figures for the country from ASTI.

[15] Coffee, the most researched crop accounting for 11% of research is excluded from this analysis.

[16] While ISABU also works in close collaboration with MINAGRIE, carrying out soil analyses and plant-health diagnostics, in general, the organization does not appear to have any strong institutional connections to the government's extension services program. This pattern is repeated in the lack of interaction between researchers and the private sector at educational institutions. Furthermore, the weak development of the seed sector has increased pressure on ISABU's seed multiplication operations, in part, diverting capacity and resources away from R&D. This means that there are few opportunities for research outcomes to be successfully transferred to producers.

[17] At the University of Burundi this research is concentrated in the Faculty for Agronomic Sciences and Bioengineering (FACAGRO). The University of Ngozi, which was established in 1999, carries out agricultural research through its Science and Technology Faculty and its Center for Rural and Agricultural Studies (CERADER).

proportional allocation of funds as a percentage of total agricultural R&D funds between crops, livestock, forestry and natural resources, with crops commanding the largest percentage in all five countires; within each coutnry, however, differences exists in spending on particular crops (e.g in Rwanda spending is highest on potatoes, while in Uganda spending is highest on coffee) (Flaherty, 2010; Flaherty, Kitone, et al., 2010; Flaherty & Munyengabe, 2011; Flaherty, Murithi, et al., 2010). The most significant difference between EAC countries in agricultural R&D compostion relates to overall size according to full time equivilent FTE researchers employed (e.g. Kenya has over 1,000 while Burundi roughly 100), and in national availability of agricultural programs on offer at the university level (e.g. in Burundi and Rwanda no agricultural PhD programs are offered, but in Kenya, Tanzania and Uganda there are) (these topics will be taken up in greater deatil in section V).

C. Key Non-Firm Stakeholders in Burundi's Agribusiness Value Chain

In Burundi, the role of the state has been crucial to facilitating the prioritization of the agribusiness sector (see Box 4). In recent past though, a number of non-firm stakeholders have been involved in shaping the development of Burundi's agribusiness industry. Through various projects, donations and consultations, these stakeholders have been instrumental in catalyzing important initiatives to stabilize the agribusiness industry and pave the way for new growth, albeit far more coordinated efforts are needed. Some of the recent key stakeholders include: IFAD, World Bank, FAO, EU, Belgian Development Agency (BTC) and USAID. The primary focus of each stakeholder can be usefully distilled as follows:

- IFAD has been heavily involved in value chain initiatives that promote food security especially amongst smallholders and the rural poor (IFAD, 2010);
- The World Bank is currently invested in a US$45 million project through 2016 targeting improved productivity enhancement in several commodities through diffusion of new technologies and irrigation practices, as well as in the strengthening of producers' access to markets via the infrastructural development of new feeder roads (World Bank, 2008c);
- FAO has been involved in the promotion of improved farming techniques including the use of fertilizer and irrigation technologies to generate sustainable supplies of food, especially for rice, vegetables and ground nuts (FAO, 2012);
- Similarly, the EU has encouraged the scaling up of better inputs use amongst smallholders such as improved seed varieties to help stabilize food prices through increased productivity;
- Working from an institutional development approach, the BTC has been trying to streamline more effective institutional efforts to better support agribusiness value chain development in the of Mosso, Bugesera Imbo regions (Belgian Development Agency, 2012).;
- Finally, USAID has been involved in a number of different value chain promoting activities that ranged from facilitating better regional trade within the EAC to bolstering value chain competitiveness in food crop commodities (Lentz, 2009a, 2009b).

While these efforts have certainly been helpful to Burundi's agribusiness sector, much of the outreach has been geographically and technically limited, and large areas of the country receive little support. Coordinating current and future efforts amongst stakeholders is necessary to advance Burundi's agribusiness industry beyond its nascent stages.

Box 4. The Role of the State in Burundi's Agribusiness Sector

Over the past decade, Burundi's national government has increasingly demonstrated a concerted effort to bolster the agribusiness sector through a series of national strategies, projects and mandates. Proactively adopting numerous agricultural reforms, the government's efforts are comparable to actions taken by other EAC and nearby SSA governments (IFM, 2012; USAID 2010). Leading these efforts, MINAGRIE has

centered its strategy on stabilizing the agricultural industry to pre-war levels in the short-medium term, with longer-term goals of exceeding well beyond previous outputs (USAID, 2010). To better understand how the Burundian government has approached agricultural reform, it is useful to briefly unpack some of the key strategies, projects and mandates undertaken in recent past.

Creating a great deal of initial impetus in MINAGRIE's reform agenda was a project between the World Bank and MINAGRIE beginning in 2002, *Projet de Réhabilitation ET d 'Appui au Secteur Agricole et de Gestion Durable des Terres du Burundi* (Agriculture Rehabilitation and Support, and Sustainable Land Management Project of Burundi, PRASAB). This project helped set the MINAGRIE strategy for agricultural stabilization to pre-war levels through its explicit focus on restoring productivity in rural agricultural areas and the reintegration of displaced persons and other vulnerable individuals back into agricultural production. Recent reports state that approximately 200,000 households of refugees and over 170,000 rural women were reached with agricultural reintegration services (World Bank, 2010, 2012a).

Through support gained during PRASAB, MINAGRIE proceeded to more formally initiate several key agricultural strategies. In 2005, the Government Program was launched, which included a key focus on agriculture and ways of addressing some of the most challenging barriers facing rural farmers. In 2006, MINAGRIE rolled out an official Agricultural Policy. The primary significance of this policy was that it officially declared the agribusiness sector to be a primary driver of national economic growth (USAID, 2010). Two influential outcomes were achieved through this. First, the government introduced a new legal framework for land management and environment, which was adopted and legally put into effect (World Bank, 2010) and second, in accordance with the New Partnership for Africa's Development (NEPAD), the government committed to strive to allocate 10% of the Burundian national budget to agriculture. While at times falling short of this goal, improvements have been made in this effort, rising from 1.4% at the time of announcement in 2006 (USAID, 2010) to 4.1% in 2008 (World Bank, 2012) and up to 8.3% in 2009 (World Bank, 2012). One recent report (Curtis Research, 2013) suggests that total budget allocation to agriculture increased to 10.9% in 2011, but to date this has not been reported as confirmed elsewhere.

As stability improved in the country, government efforts crucially began to weave in a number of emerging and related reforms (the Poverty Reduction Strategy Paper I (PRSP I), the Millennium Development Goals (MDGs), Comprehensive Africa Agriculture Development Programme CADDP and the EAC Development Strategies) into its agricultural policy framework. In 2008, the Burundian government enacted the National Agricultural Strategy (SAN) (2008-2015). The primary purpose of SAN has been to create a collective base for all efforts related to national agricultural development (IMF, 2012; USAID, 2010). SAN also pioneered a commitment to an annual agricultural growth rate of 6%. This figure has yet to be achieved though, and may have been too ambitious given that average agricultural growth rates for the African continent average between 3.8-4% (World Bank, 2012b). In 2009, the National Food Security Program was also added to SAN to create a strategic plan for not only solidifying commitment to food security, but also to implement national nutritional health programs and to establish a food-aid emergency program in the event of disasters.

Additional mandates by the government since the launch of SAN have promoted the agricultural sector in specific ways. For example, the government has engaged in the privatization of some state-owned agribusiness firms – the largest of which has been the cotton firm COTEBU (IMF, 2012). In addition, in 2010, the Burundian government enacted new legislation to allow for higher salaries to be paid to PhD scientists at ISABU, enhancing the organization's ability to attract and retain top talent (Stads and Ndimurirwo, 2011). Furthermore, in 2011, MINAGRIE mandated a more dedicated commitment to the important work of extension service workers by increasing total expenditure as a percentage of MINAGRIE budget.Finally, and most recently, MINAGRIE has raised US$95 million to support the implementation of the National Agricultural Investment Program (NAIP). Laying out this initiative from 2012-2017, the NAIP aims to specifically enhance the development of 15 agribusiness value chains as well as to increase training and human capital development amongst value chain producers (MOA, 2012).

While from a policy and strategy perspective, the government has made important advances, institutional

capacity at MINAGRIE to bring these strategies to fruition remains relatively weak, particularly with respect to planning and coordination capacity (Curtis, 2013; World Bank, 2012), and there has been less emphasis placed on developing action plans to effectively implement these strategies (Field Research, 2013). Low salaries and limited accountability have undermined motivation of policy makers, advisors and project officers. In order to improve performance of staff, performance evaluation contracts have been implemented at the Ministry and foreign advisors from BTC are embedded within the organization to help strengthen capacity while responsibilities for management have been devolved to regional offices (Republic of Burundi Senate, 2013). Employees achieving their targets receive incentive bonuses funded through international support (Field Research, 2013). Together with continued improvements to the country's investment environment and improved coordination with donors, these efforts are necessary to shift the focus from short-term efforts oriented towards relief and recovery towards a long-term focus on investment and development of the private sector in agribusiness.

D. Important Constraints Underlying the Development of the Agribusiness Chain

Six key constraints underlying the development of the agribusiness chain have been identified through both interviews of actors in the sector in addition to an extensive overview of relevant secondary literatures. These principally include the lack of reliable data, limited access to finance, an unclear land tenure system combined with land scarcity and a growing population, weak rural transportation infrastructure, underdeveloped SPS system, and soil degradation. Each constraint should be reviewed and addressed individually, in addition to considering how constraints may be interrelated. For example, in improving the SPS system and in increasing SPS adoption rates, it should be recognized that improving access to finance is in many cases a prerequisite. Failure to comprehensively address these constraints will undermine the effectiveness of workforce development initiatives, upgrading strategies and recommendations discussed in the following three sections.

First, the lack of reliable statistics and information system related to agriculture and agribusiness sector is a major barrier to realizing agribusiness potential in the country. Two key impacts of this on the sector's growth can be highlighted. First, a lack of knowledge regarding the number of producers, specific crops produced and labor needs undermines the provision of adequate technical assistance. There is general consensus that the current number of extension agents in the country (2,803) is far from optimum, but without up to date, easily accessible information, it is difficult for actors to determine exactly how many agents are required and their precise technical training. This, in turn, limits the potential for educational and training institutions to tailor their program offerings to the market. Second, the lack of production information makes investment and planning challenging for entrepreneurs seeking to develop agro-processing operations and uncertainty about supply of raw materials increases investment risk in processing facilities (Pandey, 2013).

Second, access to finance is a significant challenge for agribusiness in the country, despite it being a key requirement to help producers, and smallholders in particular, to make the necessary investments in production techniques like irrigation and infrastructure to enter and upgrade in agricultural value chains (Fernandez-Stark & Bamber, 2012). As in many other developing countries (World Bank, 2008a), banks in Burundi are generally reluctant to lend to agribusinesses because the sector is perceived to be inherently risky, farming systems are dominated by scattered and smallholder producers, and agricultural investment can require long lead times (Mutabazi, 2013; Nkengurutse, 2013; Somera & Somera, 2013). For instance, generating revenue from mango production from planting through maturity takes 4-5 years, similarly, palm trees takes 4-7 years to reach peak production levels (Muheto, 2013). In this context of high risks and transaction costs, commercial banks have done little to develop financial products to meet the needs and expectations of smallholders (World Bank, 2013a). Political instability woes in the country have the added effect of

suppressing foreign investment within the sector through higher perceived risks. Furthermore, banks currently charge between 17 -22% interest on agribusiness loans even for processing operations (Nkengurutse, 2013), which makes it cost-prohibitive for many chain actors. Agribusiness development will significantly benefit from cost-competitive financial services, particularly, financial products that match the needs of the prevailing smallholding agricultural in the country.

Third**,** a lack of freehold tenure due to communal ownership of land is common, which is problematic for private investment in the sector. In general, private land ownership is very limited and all valleys and low land areas are communal or government-owned (Claes, 2013; Duat, 2013). Prevailing land tenure systems further hinder bank lending to agriculture because persistent insecurity over property rights impedes the use of available assets as collateral for obtaining credit. Although numerous policy initiatives have been undertaken related to land management and mediation of land conflict issues since 2006, these interventions have lacked overarching coordination and success in addressing the complicated issues in the country (Kohlhagen, 2012). In general, land tenure still is a major cause land disputes related to multiple claims on land ownership (Kohlhagen, 2012; Muheto, 2013).

Fourth, the constraints caused by weak infrastructure and services in the transportation sector undermine the development of linkages between different actors throughout the chain, resulting in poor use of inputs and contributing to high post-harvest losses, particularly of perishable goods (African Development Bank, 2011). The distance of producers from markets and the time it takes to get there is a key determinant of their participation in formal sectors in Burundi (Ouma et al., 2010). In many parts of the country, feeder roads in rural areas were left unmaintained during the crisis (African Development Bank, 2011; IMF, 2012), increasing the difficulty for producers to bring their products to market. In addition, this poor infrastructure, combined with aged and limited rural public transportation (IMF, 2012) and inability of many small farmers to pay for high transport costs, means that all inputs sourced for the farm must be carried either by foot or by bicycle over considerable distances (Field Research, 2013; UNIDO, 2013a). Although no empirical evidence has found that this reduces use of inputs, several interviewees highlighted this as a key concern for using inputs to improve productivity (Field Research, 2013).

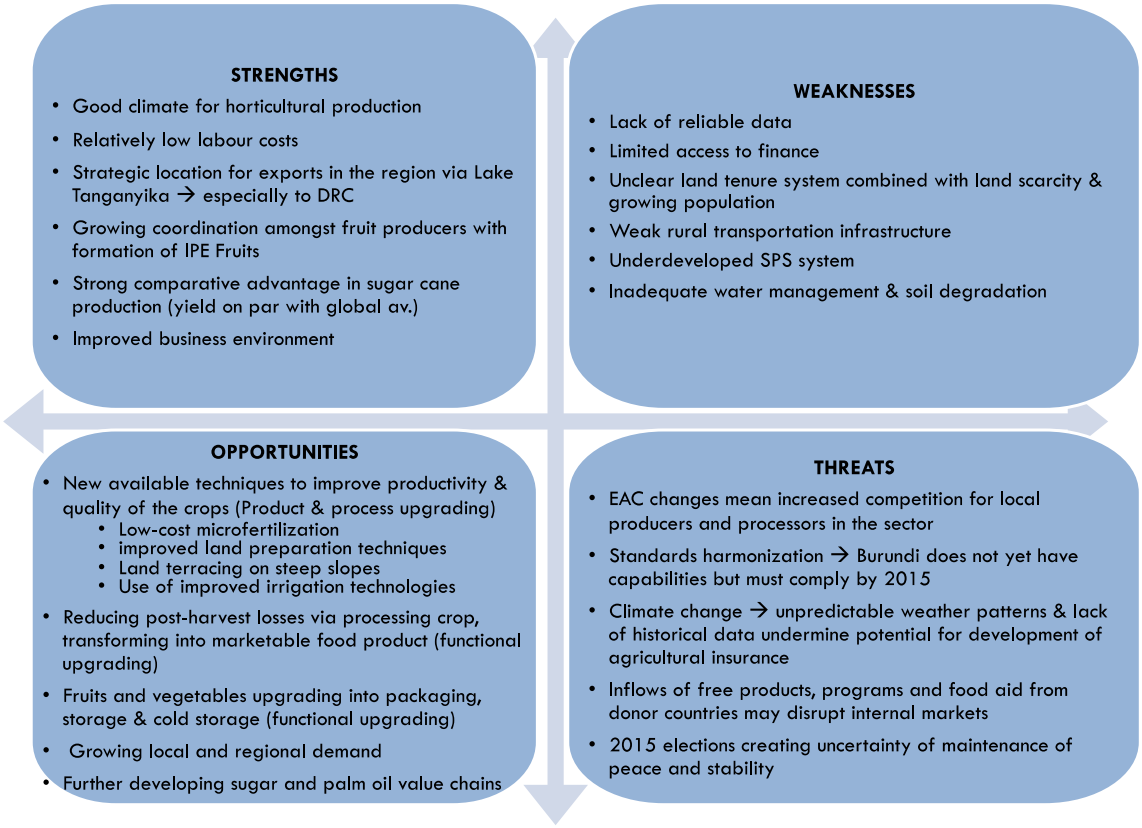
Fifth, the SPS system in the country is in its infancy. This affects both the country's potential for identifying and isolating crop diseases that are undermining productivity and also limits export potential. This true even at a regional level as Burundi must comply with the EAC SPS standards by 2015 (see Box 1). The Bureau of Standards laboratories in the country neither have the capabilities nor the credibility to provide product testing and certification for export markets and local agribusiness firms have to rely on expensive service providers in the region (Pandey, 2013; Somera & Somera, 2013; USAID, 2013a). High investment costs make these services unaffordable for many local entrepreneurs. Cost-competitive quality certification for local agribusiness will become essential for regional exports, particularly, after the adoption of the harmonized standards by the member states (Pandey, 2013).

Sixth, the country has experienced severe soil degradation linked to deforestation and expansion of cultivation to marginal land areas. With the predominantly hilly landscape, soil degradation is directly linked to deforestation and non-terraced hillside agriculture on steep slopes. Between 1990 and 2005, Burundi lost approximately 47% of its forest cover, or around 137,000 ha, (World Bank, 2013b), and has been losing its forests at the average rate of 1.3% between 2000 and 2010 (USAID, 2010b; World Bank, 2013b). The remaining forest area, estimated at 152,000 ha, has largely been modified for cultivation. Besides deforestation, given the high population density, farmers have extensively expanded slope-land cultivation on grazing areas, destroying the vegetative cover (USAID, 2010b). In the absence of protective measures, cultivation of these marginal lands has

caused erosion of topsoil in high rainfall areas and its deposition on fertile lowlands (see Figure 12, in Appendix).

Despite these considerable constraints to growth, Burundi does have several important factors in its favor for the development of a better functioning agricultural sector that can simultaneously improve productive employment and contribute towards food security. The country has a good climate and geographic conditions for agricultural production, with multiple growing seasons, competitive labor costs, growing coordination among fruit producers and a strategic location to export in the region via Lake Tanganyika. Furthermore, there is strong and growing domestic demand for agrifood products in the country. However, Burundi needs to confront its underlying weaknesses in order to take advantages of these opportunities and to meet rising threats of increased entry of highly competitive crops from the region. Based on the analysis of Burundi's current footprint in the agribusiness value chain, Figure 6 highlights the key strengths, weaknesses, threats and opportunities facing the sector.

Figure 6. SWOT Analysis of the Agriculture Sector in Burundi



Source: Duke CGGC.

V. Current Employment and Workforce Development in Burundi's Agribusiness GVC

While the previous sections provided a strong understanding of Burundi's position in the agribusiness GVC, this section unpacks how the constraints to upgrading in the agribusiness sector can be addressed from a human capital development perspective. More specifically, the GVC analysis focuses on the relative change of skill levels required for particular upgrading trajectories with respect to the status quo, existing structures to improve those skills and the corresponding

investments to fill gaps in that structure. Based on this analysis, the most feasible upgrading trajectories can then be identified, prioritized and analyzed with regard to the specific skills to develop and actors to involve. This section thus examines the existing workforce by segment in the value chain, the current WFD framework in the country and the key challenges that the country faces to making improvements in these areas.

A. Current Employment and Workforce Development in Burundi Agribusiness GVC

As presented earlier, agriculture accounts for majority of rural employment in Burundi. The largest share of this employment is in the production segment of the value chain on family owned, smallholder farms across the country. According to the 2013 National Agricultural Survey of Burundi, agriculture sector employs an estimated 7.9 million people, 47.7% male and 52.3% female, consists of 1.56 million households working primarily on family owned farms (MINIAGRI, 2013; Lutherau, 2014; Ndabemeye, 2014).
This represents approximately 96% of the labor force.[18] The survey findings suggest that employment in agriculture has gradually increased since 2006. Findings by Core Welfare Indicators Questionnaire (CWIQ) data (2006) and the Permanent Household Survey (2009), respectively, had estimated agricultural sector employment approximately 62% of the labor force, 15-64 year-olds, in 2006 and 70% in 2009 (African Development Bank, 2012).

As small-scale agriculture is pervasive in the country, it can be assumed that agricultural jobs are primarily informal, self-employment on family farms.[19] Informal farm work tends to encompass a wide range of agricultural job profiles, is generally related to all aspects of production and typically engages all members of the household. Larger farms do offer some employment, although this is characterized by a degree of seasonality and differing levels of labor-intensity due to the product mix.[20] For example, a mid-size farm (150 ha under cultivation) with mixed FFV, cereals, and cassava production employed close to 640 people in 2013, 7% in full time positions; another operation with 700 ha under mono-cultivation offers approximately 1,000 jobs, while the two large sugar plantations with some 2,500-5,000 ha each, employ between 2,000 - 3,000 unskilled and semi-skilled daily and seasonal workers depending on the time of the year (Field Research, 2013). Year-round, full time employment opportunities in the production segment, however, appear to be limited to a small percentage of labor on medium and large sized farms, supporting organizations such as CAPAD, IFAD, FAO and government positions, such as agronomic technicians acting as extension agents. Of the 2,803 government agriculture monitors or extension agents who work under the DPAE (Curtis, 2013; UNOCHA, 2008), approximately 20 % are women (Curtis, 2013). Neither a degree in agronomy nor field experience appear to have been requirements for these positions (USAID, 2013a). While the firms interviewed indicated that unskilled daily and seasonal employees are almost exclusively Burundian, in the sugar sector in particular, due to limited availability of specific skills within the country, there are a number of foreigners in higher skilled positions.

Current employment in the processing stage of the value chain is difficult to deduce due to the large informal sector characterized by low margin artisanal processing operations with relatively few large agro-processing firms in the country. A large proportion of rice milling, for example, is carried out

[18] The labor force is estimated to be 8.2 million (World Bank, 2013c).

[19] The average size of a farm household was estimated almost five persons and the average age for the head of households to be 44 years in 2013 (MINIAGRI, 2013).

[20] Lack of production data and farm size data, together with varying labor intensity makes it impossible to extrapolate out precise figures for employment on these properties.

by small-scale operations where potentially one to two individuals operate the machinery at any one time and other employees focus on manual labor such as loading the machine, and packaging the rice for distribution and sale (PROFEDI, 2012).[21] Currently, the three largest employers in this segment are Brarudi, Savonor and SOSUMO. With 650 employees, the largest employer in this stage is the national brewery, jointly owned by Heineken and the government (Ntahe, 2013), while Savonor employs approximately 405 employees in its primary and secondary processing operations (Pandey, 2013). Job profiles at Brarudi range from manual labor, to technicians and mechanics to chemists and senior management, and employees range from unskilled to semi-skilled to highly skilled depending on the job profile within the organization, although the company requires that all employees be able to read and write. Senior management at both Brarudi and Savonor are foreigners. Due to limited other productive employment opportunities in the economy, turnover at these firms is very low. Several processing firms also engage in direct contract farming relationships with small producers. This provides greater job security for smallholders. For example, in addition to 50 full-time employees, the domestically owned fruit juice processing firm, FRUITO, contracts with 1,800 small producers (USADF, 2013a, 2013b).

Table 6. Industrial Scale Agribusiness Processing Firms in Burundi

Company Name	Ownership	Sector	Value Chain Position	Employees
Brarudi	Heineken	Brewery	Processing & marketing	650
SAVONOR	Private	Palm Oil	Production, processing, & marketing	Production: 949 Processing: 405
SOSUMO	State-owned	Sugar	Production, processing, & marketing	Permanent: 550 Seasonal workers: 2399 Daily workers: 350
Bakhresa	Private	Grains	Milling	Permanent: 15 Daily workers: 140-200

Source: Duke CGGC based on company interviews.

Employment in formal enterprises in this segment of the value chain is expected to increase in the near future, with three large processing firms beginning operations: Afritextile, Bakhresa Grain-Milling and TBC's sugar processing plant. However, the employment impact upstream of the value chain from the processing operations of Bakhresa is almost none because the company imports all its raw material from the U.S. and European markets (Bayisenge, 2014). Although Afritextile operations continue to maintain and upgrade its equipment and technology, the company similarly believes that sourcing cotton from local producers will be challenging both in terms of cost and volume (Firoz, 2014). The principal job profiles required for Afritextile will be related to milling cotton and apparel manufacturing. In many developing countries, these jobs are typically held by young women (Gereffi, Fernandez-Stark, & Psilos, 2011). Job profiles at TBC will be a combination of mechanics, technicians and manual labor. All three firms will operate within the province of Bujumbura.

In the R&D segment, in 2008, there were approximately 98 full time researchers engaged in agricultural research in the country. At ISABU, 74% of these researchers held post-graduate degrees, while 41% of university researchers held doctoral degrees (Stads & Ndimurirwo, 2011). Retaining

[21] During the field research in Burundi between August 26 and September 6, 2013, the field team visited one such operation run by a cooperative in Bujumbura.

these skilled workers has been a challenge for ISABU (Claes, 2013). The organization has not been seen as an attractive place to work as salaries are low compared to those offered by universities, NGOs and international agencies, as well as these organizations in neighboring Rwanda (Stads & Ndimurirwo, 2011). Investments in reconstruction of the Institute of Agronomic and Animal Production in Gitega which was destroyed in the war, together with ongoing support from BTC through the Institutional and Operational Support Program for the Agriculture Sector (PAIOSA) program indicate that the demand for full time researchers is likely to continue to rise in coming years. In addition to these highly skilled workers, the R&D stage is supported by a number of skilled (Bachelor degree & technical diplomas), semi-skilled and unskilled workers. In 2008, support staff to research staff ratio was 6.6:1 (Stads & Ndimurirwo, 2011), suggesting that approximately 745 workers were employed in the R&D segment of the chain at that time. The vast majority of these employees are Burundian, although BTC have placed one researcher within ISABU to support ongoing capacity building initiatives (Claes, 2013).

In addition to direct value chain activities, there are a number of administrative jobs supporting and regulating the agribusiness sector. Public sectors roles include employees of MINAGRIE responsible for policy development and implementation; the Burundi Bureau of Standards and Plant Protection Laboratory that are responsible for beginning to implement SPS standards both within the country and to control the country's exports as well as the Ministry of Environment who play a role in water management issues for the sector. In addition, within the private sector, although financial services remain weak for the agribusiness value chain, employees in these institutions play an important contributing role for the sector.

Table 7 highlights the principle job profiles in the agribusiness sector at this time. The majority of jobs remain in production, that is, involved in land preparation, planting and maintenance of crops and harvesting. The specific skills required for each of these jobs can vary by the type of product under cultivation. Likewise, processing jobs vary significantly by product group. At the artisanal level, many of the conservation activities including milling of rice, cassava or maize, are undertaken by the same producers; at the semi-industrial and industrial level, many of these jobs are considered to be manufacturing positions, and involve the operation and maintenance of processing equipment. Overall, education requirements to date have been low across production job profiles, while in processing jobs technical diplomas (A2 and A3) are typically required.

Table 7. Job Profiles in the Agribusiness Value Chain

Position	Job Description
Production	
Agronomist	Conduct research to improve crop seeds, yield & disease resistance. Determine mineral composition of soil & fertility management requirements such as use of fertilizers, herbicides and pesticides for optimal quality & productivity.
Extension Officer	Work with farmers, cooperatives and companies to improve production. Duties may include disseminating technical knowledge on good agricultural practices.
Nursery & seed multi	Plant, cultivate, harvest, transplant seedlings, for grains, fruit & vegetables, and palm oil in nurseries and seed multiplication plots.
Producer	Performs all tasks related to land preparation, sowing, irrigation, application of fertilizer. For large farms, duties include managing labor, buying inputs, keeping production records, dealing with clients, obtaining credits, and supervising crop calendars.
Industrial Level Processing	
Manager	Manages procurement and processing activities at industrial plant level. Manages budget, workflow, logistics, stakeholder relations, and hiring of permanent and daily workers.
Aggregator/ Buying Agent	Regularly interacts with farmers and farmer organizations to procure raw material needed for processing facility.
Warehouse Manager	Keeps account of delivery and ensures proper storage of raw material, ingredients, packaging materials, spare parts for machinery and finished products.

Mechanics/ Machine operator	Has technical knowledge of processing machinery. Responsible for operation, repair and maintenance of processing machines and equipment at the processing facility.
Truck operator/ Distributor	Delivers final product, for instance, vegetable oil or sugar, to retailers or distribution centers.
Cooperative/Association level* Processing	
Cooperative manager/association leader	Responsible for procurement, processing, financial management, and marketing activities at a cooperative or association level. Manages budget, workflow, logistics, and stakeholder relations.
Line Worker	Activities vary depending on the desired final product. Activities include several methodologies sun-drying, preparing concentrates, artificial dehydration, extraction, mixing, boiling, frying, and fermenting.
Members	In addition to all tasks related to production on land owned, association members also work as aggregators and buying agents procuring surplus from other farmers from the same or neighboring communes.
Household Level Processing	
Family Labor	Primary processing duties involves washing, peeling, cutting, chopping, drying, boiling, as relevant to various agribusiness products including fruits, rice, and root crops produced for household use. For products, such as rice or cassava, requiring secondary processing in mills, the pre-processed product is taken to hammer mills or sold to wholesalers.
Institutional Support	
Regulator	Plan, coordinate and implement activities to comply with regulations and operating procedures for the state-owned enterprises.

*Common in rice wholesale trade and hammer mill operations for secondary level cassava processing.
Source: Duke CGGC.

The concentration of employment in agriculture in general, and production in particular, in Burundi is consistent with other countries within the region. In Uganda, agriculture contributes 80% of all jobs, 90% of which are in production roles (Ministry of Education and Sports, 2011). In Rwanda and Tanzania about 80% of the population works in the farm sector (Ministry of Industry and Trade, 2010; Rwanda Development Board, 2013). The preponderance of smallholder ownership in these countries also means that employment is primarily on family plots and is often uncompensated. Labor productivity on these plots is also considered to be very low (Rwanda Development Board, 2013). In Kenya, the growth of the horticulture export industry has contributed a number of off-farm jobs in pack-houses, most of which are filled by women (Gereffi, Fernandez-Stark, & Psilos, 2011). However, the development of the post-harvest segments of the value chain remains a priority in all countries (EAC, 2011; Republic of Kenya, 2012; Republic of Uganda, 2011; Tanzania, 2012), and still accounts for a relatively small proportion of employment in the agribusiness chain. Employment in R&D is highest in Kenya, which accounts for approximately half of the jobs in R&D in the region. As shown in Box 5, across the region, researcher positions tend to be highly skilled, with the majority of researchers holding one or more post-graduate degrees.

Box 5. Agricultural R&D and Post-Graduate Education in the EAC

Total employment in R&D across the EAC accounted for approximately 9,020 FTE positions, including 2,204 FTE researchers, the majority of whom hold an MSc or higher. The research intensity ratio, that is, total spending on R&D as a percentage of agricultural output is highest in Burundi, although with the lowest number of FTE researchers in the region, this accounts mostly for falling agricultural output rather than an increase in R&D spending (Stads & Ndimurirwo, 2011).

Table 8. R&D Employment and Spending in East Africa Countries, 2008

	Burundi	Kenya	Rwanda[a]	Tanzania	Uganda[b]
Research intensity ratio	US$1.78	US$1.43	US$0.50	US$0.50	US$1.40
FTE Researchers	98	1,011	116	673	306
FTE/million Farmers	27	79	27	42	28

Researcher qualifications	BSc: 26% MSc: 64% PhD: 10%	BSc: 17% MSc: 49% PhD: 34%	BSc: 48% MSc: 42% PhD: 10%	BSc: 28% MSc: 47% PhD: 25%	BSc: 14% MSc: 51% PhD: 35%
Post-graduate programs in agricultural sciences	No; graduate programs recently included under new law.	Yes, several universities incl. University of Nairobi, Egerton University & Jomo Kenyatta University.	1 MSc program at National University of Rwanda in Soil Mgmt. Post graduate diploma in drip irrigation.	Yes, leading university offers MScs and PhDs in all departments 2011/12: 377 MSc & 23 PhD enrolled.	Yes, Makerere University offer MSc & PhD programs; large number of foreign students enrolled.
Ratio Support staff/researcher	6.6	5.3	4.0	2.7	2.4
Total FTE in R&D	**647**	**5,358**	**464**	**1,817**	**734**

Source: (Flaherty, 2010; Flaherty, Kitone, et al., 2010; Flaherty & Munyengabe, 2011; Flaherty, Murithi, et al., 2010; Stads & Ndimurirwo, 2011)
Notes: [a] Rwanda data is based on 2009. [b] Only accounts for NARO qualifications. Higher education institutions have higher proportion of PhDs at 50%.

Post-graduate education: The proportion of researchers with post-graduate degrees is highest in Uganda (86%) and Kenya (83%). Donor funded scholarships to Europe and the US continue to play a role in ensuring the necessary post-graduate education to support agricultural R&D, particularly in Burundi and Rwanda as neither country offers a doctoral level training and have only recently paved the way for Masters degrees to be initiated. In return, awardees must commit to a certain number of years of service; in Rwanda PhD's must commit to 8 years, and MScs to 4 years (Flaherty & Munyengabe, 2011). However, there is a growing emphasis on local provision of this education in Kenya, Tanzania and Uganda. Local universities, such as Sokoine University of Agriculture in Tanzania and Makerere University in Uganda have established post-graduate degree programs in agricultural sciences and both universities have seen an important increase in enrollment in these programs since then. Sokoine offers degree programs in a wide range of relevant subjects, including MSc in Applied Agricultural Extension and Irrigation Management (Sokoine University of Agriculture, 2013). In Kenya, confidence in the local university system meant that recent scholarship programs funded by the World Bank and the EU for 25 MSc and 15 PhDs, were only eligible for positions at local universities (Flaherty, Murithi, et al., 2010).

Regional Competition for Qualified Employees: Demand for competent and experienced staff appears to be highly competitive amongst public research agencies, universities and international agencies in the region. This has been partly precipitated by Rwanda's policy to offer highly competitive salaries to entice the best talent from the region, and partly due to the large number of international agency programs operating in the sector that also offer higher salaries than most state institutions. In an effort to limit this loss of human capital, the governments of Burundi, Tanzania and Uganda implemented policy changes to allow for improved compensation packages to their research staff; Tanzanian and Ugandan researcher salaries increased by 80% and 100% respectively in 2010 and 2005 respectively, while Burundi changed the status of researchers at both universities and ISABU to allow for overall increased salaries. Demand in Kenya for researchers is currently high as a result of its aging R&D workforce and the growth of agricultural sciences programs; in 2007 36% of its researchers were over 51 years old. As a measure to address shortages, the government raised the retirement age from 55 to 65.

B. Current Workforce Development Initiatives in Burundi's Agribusiness GVC

Over the past decade, since the end of the conflict, there have been multiple workforce development initiatives in Burundi (see Table 16, in AppendixTable 16). These have been characterized by a multi-stakeholder approach with a heavy emphasis on donor support due to weakened institutions and a

nascent private sector. Formal Technical Vocational Education Training (TVET) and tertiary education (see Table 9) has played a limited role in general to prepare graduates with the skills required in the labor market. Conversations with both public and private sector actors emphasized that university training programs are very broad focusing on theoretical knowledge and lack training in practical and applied skills (Bayisenge, 2014; Gahungu, 2014; Ndereyimana, 2014). This is partly because education institutions at the university, technical and professional school levels are struggling with rapidly increasing enrollment and lack the facilities, equipment and teaching staff to provide high-quality education to growing number of students. While donors are providing financial and technical assistance to technical and professional schools, universities lack donor support.
Workforce development initiatives by development organizations have been primarily focused on improving productivity for local consumption, consistent with the concentration of the population in family-owned, on-farm employment and the importance of reversing declining yields for food security. Fewer initiatives have been carried out with respect to post-harvest handling, and as a result, the growing population means that small plots of land increasingly have to absorb more labor, leading to underemployment and further declines in labor productivity. In addition, training has been very broad; it covered a wide range of issues in production, including soil management, irrigation techniques and fertilizer use and has addressed numerous different crops. However, these initiatives have lacked scale. As noted above, an estimated 96% of the working population is engaged in agriculture, yet even the larger initiatives, such as the World Bank PRASAB program, only reached a very small portion of the population.
Training in production has been driven mostly by development agency partners, although partly via collaboration and institutionalization through MINAGRIE DPAE extension program and with a few private sector actors providing some technical support as well. Partners have included the EU, FAO, IFAD, United Nations Development Program (UNDP), USAID, the World Bank and the Belgian and French cooperation agencies as well as a range of both local and international NGOs. The use of private extension service providers, as has emerged through public-private partnership in Uganda under the National Agricultural Advisory Services Program (Benin et al., 2011), has generally been low, although they were noted to have performed better than the public service providers in the World Bank's PRASAB between 2004 and 2010 (World Bank, 2012). Training programs have focused on both technical training issues, as well as administrative and literacy issues to support the development of producer organizations. Where training programs have been practical and applied with demonstration plots, and ongoing extension services, producers have been seen to be "quick learners" and willing to adopt new techniques (USAID, 2013a). The farmer field school approach, which has been increasingly, and apparently successfully, used in other countries in the region (see Box 13) (Brooks et al., 2013), appears to be a relatively recent introduction to producer training in Burundi, with PROFEDI establishing 15 new schools in 2012 (IFAD, 2012a). The Government's Global Agriculture And Food Security Program estimates that the average cost of a farmer field school is US$1,000 in Burundi and proposes to organize 300 each year, thus enabling 6,000 male and female farmers to be reached directly each year, or a total of 36,000 over the project period (Government of Burundi, 2012).

Workforce initiatives driven the private sector are more difficult to identify due to the large number of producers and cooperatives involved in the sector and the disparity of crops. Amongst the larger organizations, CAPAD has played a central role in training producers, providing a systematized and tailored approach to training including technical production skills to post-harvest conservation and marketing as well as institutional capacity building for producer organizations (Ndayishimiye, 2013). The Burundi Business Incubator (BBIN) provides consultation and training services on incubation principles to entrepreneurs and SMEs in its office in Bujumbura (BBBIN, 2013). Larger firms emphasized an 'on-the-job' approach to training such as three-month apprenticeships with

experienced staff (Field Research, 2013). It is also not uncommon for private firms to engage NGOs to provide extension services to producers to ensure quality is achieved (Ntahe, 2013). In the sugar sector, internal training programs appeared to be more fully developed, although concentrated more on developing skills necessary for the processing and energy generation activities within the chain. For these trainings, the companies rely mostly on foreign expertise, either sending their staff aboard or bringing trainers to Burundi (Field Research, 2013).

Table 9. Burundi's Public and Private Education Institutions Providing Workforce Training in Agribusiness GVC

Level/Type	Organization	Programs	Degree/ Certificate	Number of Graduates (Total Students) in 2012	Location
Public University	University of Burundi, Faculty of Agronomy and Bioengineering (FABI)*	Agronomy Agro-food Industries Technology	Undergraduate	131 (1,003)	Bujumbura
Public University	University of Burundi, Higher Institute of Commerce	Management and Commerce	Undergraduate	89 (839)	Bujumbura
Private University	University of Ngozi	Agronomy	Undergraduate	3 (105)	Ngozi
Private University	*Insitut Superieur de Developpement*	Entrepreneurship and Project Management	Undergraduate	0 (50)	Bujumbura
Private University	*Universite des Collines*	Business Administration	Undergraduate	0 (14)	Bujumbura
Private University	*Universite du Lac Tanganyika*	Management and Applied Economics	Undergraduate	0 (483)	Bujumbura
Private University	International Leadership University - Burundi	Organizational Leadership	Undergraduate	0 (108)	Bujumbura
Public Technical	(*Institut Technique Agricole du Burundi(ITAB*) Kirika	Agriculture	A2 Diploma	51	Mwaro
	ITAB Kigozi	Veterinary, Agro-food Industries Technology	A2 Diploma	89	Kirundo
	ITAB Karusi	Agriculture, Veterinary, Agro-food Industries Technology, and Water & Forestry	A2 Diploma	112	Karusi
	ITAB Kigamba	Agriculture, and Water & Forestry	A2 Diploma	52	Cankuzo
	ITAB Gifuruzi	Agriculture, Agro-food Industries Technology, and Water & Forestry	A2 Diploma	56	Makamba
	ITAB Mahwa	Agriculture	A2 Diploma	32	Gitega
	ITAB Gihanga	Agriculture, and Water & Forestry	A2 Diploma	45	Bubanza

Level/Type	Program	# of Schools	Location
Public Vocational	Agro-pastoral	1	Bujumbura

Source: (MESRS, 2013; MEBSEMFPA, 2012)

*FABI was formed by merging the Faculté d'Agronomie (FACAGRO) and Institut Supérieur d'Agriculture (ISA)

As shown in Table 9, formal education in agronomy and other relevant areas is offered at both the high school and undergraduate levels. Agricultural education and training institutions include the *Institut Technique Agricole du Burundi* (ITAB) with several campuses across the country, including Karusi, Mahwa and Kigamba; *Institut Superior de Agriculture* (ISA)[22] in Gitega; the International Institute on Tropical Agriculture (IITA); the Agricultural Business Center run by an Italian NGO focused on vocational training for youth in agricultural production techniques, and two universities, the Faculty of Agronomy and Bio-Engineering (FABI) at the University of Burundi (UoB) and the Faculty of Agronomy at the University of Ngozi (UNgozi). ITAB offer four year technical A2 diplomas in agriculture at the high school level while ISA and the two universities offer Bachelor degree programs (Curtis, 2013; Stads & Ndimurirwo, 2011).

Currently, tertiary education institutions in Burundi only offer undergraduate degrees. Although the legislation was changed in 2011, aligning Burundi's educational programs with those of other EAC countries and facilitating the development of post-graduate programs in the country (Republique du Burundi, 2011), it will take some time for these programs to become effective. Due to shortage of qualified teaching staff, majority of full-time professors from public universities also teach at private institutes of higher education (Bayisenge, 2014; Gahungu, 2014; Hatungimana, 2014). Hiring a sufficiently qualified staff will depend on recruiting foreign faculty members or Burundians who have studied abroad. According to interviewees at UoB, several new faculty members were returnees who had studied abroad in North America (Field Research, 2013). Scholarship programs offered both by ISABU and donors managed through the Ministry of Higher Education are in place for a small number of students to gain further experience abroad (Field Research, 2013). Agribusiness is considered to be a priority area by the Ministry of Higher Education, and approximately one-third of the total scholarship funds available in 2011 to study abroad were for agriculture students (Curtis, 2013). Traditionally these have been to universities in Belgium, France, or the US, but an increasing number of post-graduate students are pursuing their studies in the EAC, particularly in Kenya, Tanzania, and Uganda (Stads & Ndimurirwo, 2011). While English is often a challenge for students to attend schools in the region, the integration of English into the primary education system and programs being launched through the Ministry of the EAC (Mpeberane, 2013) should help improve this.

No formal education programs are offered with respect to developing the professional workforce to support the development of agribusiness at the marketing and distribution level. These roles require training in branding and market analysis, management of retail and distribution operations and customer service. In addition, there are no programs directed at the development of human resources management skills. This problem, however, is not unique to Burundi. In the region, only Kenya's Jomo Kenyatta Unviersity of Agriculture and Technology offers a diploma in retail management. Most training is thus done on the job. This has resulted in slow adoption of modern retailing techniques such as merchandising, category management and just-in-time inventory management (Dihel, 2011).

[22] Under the ongoing education sector reforms, ISA and FACAGRO have been merged and named Faculty of Agronomy and Bioengineering (FABI).

C. Current Challenges for Human Capital

Given the country's current position in the value chain, analyzing field interviews and information from secondary sources, the following challenges have been identified with respect to workforce development initiatives in Burundi.

First, the fragmentation of production in Burundi and achieving adequate scale in training initiatives for farmers in the short to medium term are perhaps the most important challenges for workforce development for agriculture in ensuring productivity increases at a national level. This is combined by the significant degree of capacity building that is required at all stages of the value chain as a result of setbacks caused by years of conflict. Despite the wide range of initiatives (see Table 16, in Appendix), they are mostly short-term and reach a small proportion of the population engaged in the sector. Furthermore, development agency programs are unevenly dispersed across the country, and mostly of limited scope and duration, while at less than 3,000 agents for almost 1.56 million farming households, there are not enough trainers to effectively provide extension services to producers. Trainings thus most often take place for a large number of producers at once, with minimal follow up and monitoring, meaning that skills taught are often not effectively internalized into producers' farming practices (Curtis, 2013) and productivity has continued to decline despite these efforts. In addition, low government salaries mean DPAE extension agents are often poorly motivated, many of them lack the required skills to adequately serve farmers either as a result of lack of practical skills or limited experience in agriculture (USAID, 2013a). It is hoped that the recent implementation of compensation based on performance evaluation, together with several training opportunities from the government and partners will improve effectiveness of training (Republic of Burundi Senate, 2013). However, hiring of additional trainers is complicated by significant budgetary constraints (Republic of Burundi Senate, 2013), an unwillingness of trained agronomists to live or work in the rural areas, and low literacy rates in the rural areas mean that developing a "train-the-trainer" approach is not always an immediately viable option (USAID, 2013a).[23]

Second, there are several concerns regarding the basic preparation of producers, among whom literacy rates can be as low as 15-20% (Demeester, 2013). Low literacy rates make it very difficult to effectively convey training lessons and obtain results. Producers, as a result, are often unable to take advantage of more advanced skills training that they may receive (Brooks et al., 2013; USAID, 2013a). Training programs, such as that carried out by USAID between 2007 and 2012, reevaluated their approach once they began implementation to first focus on literacy issues prior to carrying out further training. This not only helped to generate buy-in for training but also improved uptake of information during training sessions (USAID, 2013a). The significant increase in enrollment in primary education in Burundi could serve to provide an important boost to the sector, as producers with more education tend to be more willing to adopt new techniques such as new seeds, land preparation and fertilizer use and tend to earn higher profits than farmers without schooling (Abdulai & Huffman, 2005; Besley & Case, 1993; Brooks et al., 2013; Foster & Rosenzweig, 1996; Huffman, 1977; Rosenzweig, 2010; Welch, 1970). However, maximizing on this expansion of participation in basic education will depend on the sector's ability to attract youth back to agriculture. As in many countries in Africa (Brooks et al., 2013), the youth in Burundi are less interested in pursuing careers in agriculture, even though employment alternatives in the country are limited (Field Research, 2013). The

[23] Low literacy rates also undermine the effectiveness of producing written field guides.

perspective that agriculture is not a viable economic activity is not surprising given that many producers continue to operate at the subsistence level. Box 6 highlights one forthcoming initiative by IFAD to engage youth in the sector.

Box 6. IFAD Youth Program: Engaging Youth in Agribusiness Value Chains

At the end of 2012, IFAD successfully proposed to the Burundian government to add a youth employment component to their ongoing Value Chain Development Program, PRODEFI. The new youth extension is aimed specifically at engaging young persons between the ages of 16 and 30 in commercially viable agribusiness chain development activities across two provinces, Bubanza and Ngozi. Total youth population between these two provinces is 85,000, of which 20,000 will be directly impacted by the program (IFAD, 2012a). Drawing on available talent, the program will incorporate both males and females with various levels of formal education and agricultural experience. The main goal is to generate youth employment and precipitate youth investment in agricultural microenterprises that can be integrated through upstream or downstream linkages to various value chains (such as rice, wheat and cassava, amongst others that require less land). The project also aims to provide training to youth on specific technical aspects related to agriculture value chain activities and to connect them with existing farmers' organizations, professional bodies for youth employment and financial institutions. The projected deliverables of the project are to train 18,000 youth to become microentrepreneurs; 250 youth will start their own small agricultural businesses in existing value chains; and 1,750 youth will join cooperative/farming collective groups connected to value chains (IFAD, 2012a). While no current implementation or impact details exist for this program, it can be seen as an important step addressing a growing concern of unemployment amongst Burundi's youth.

Third, both interviewees and secondary sources highlight a mismatch between skills provided by formal education schools and the needs of the private sector. In particular, agronomists with university degrees are criticized for a lack of practical experience (Field Research, 2013; USAID, 2013a) and that their knowledge is outdated as the teaching curriculum has not been updated in the past twenty years (Curtis, 2013). To overcome some of these challenges, several initiatives have already been undertaken, although the impact of these initiatives is unlikely to be seen for at least 2-4 years when the first graduating classes enter the labor market. At the TVET level, BTC have supported a nation-wide analysis to determine the technical skills needed to meet demand in different provinces across the country (Demeester, 2013). According to the Ministère de l'Enseignement de Base et Secondaire, de l'Enseignement des Métiers, de la Formation Professionnelle et de l'Alphabétisation (Ministry of Basic and Secondary Education, Technical and Vocational Education and Literacy, MEBSEMFPA), the new curriculum is to be developed in collaboration with the private sector and educational institutions, for each of the planned17 technical centers (high school) and 129 vocational training centers (post-primary), many of which will directly address agriculture (Nshimirimana, 2013). FABI are focused on increasing the practical aspects of training, placing more importance on skills taught on the school's farm and ISA graduates will now be required to spend a three month internship in their field prior to graduation (Cliff, 2013).

Fourth, although the MEBSEMFPA highlight joint curriculum development, there are few examples of actual linkages between researchers, educational programs, the private sector and extension services (Curtis, 2013; Field Research, 2013; USAID, 2010c). There are no incentives in place to encourage the private sector to engage with universities or vice versa. This can undermine the potential for a proactive approach to planning for skills for private

sector development in both formal education and informal training. In addition, the lack of an institutionalized feedback mechanisms to ensure that research outcomes are transmitted effectively to extension agents and then to producers limits the ability of the government to leverage new farming techniques developed to drive productivity and undermines the effectiveness of investment in R&D; while the absence of connections with the private sector continues to contribute to potential for skills mismatch, wasting precious resources. The new National Learning Team set up by eRAILs (Regional Agriculture Information and Learning System)[24] in 2010 (Habindavyi & Nkunzebose, 2013), which brings together actors from the government, research institutions, educational institutions and three large cooperative federations, including CAPAD, nonetheless could provide an initial forum for fostering increased interaction.

Finally, fifth, years of conflict, the ongoing presence of aid agencies in the country and years of state controlled economy appears to have undermined the competitive drive of economic actors. At the production level, one agency noted that lack of entrepreneurship drive among producers discourages commitment to workforce development, highlighting that this had acted "as a disincentive to individual initiative and competitiveness.... producers could not understand at first why they would spend time away from their households or fields to be trained, when previously humanitarian organizations were giving them per diem for attending meetings and free food" (USAID, 2013a). Furthermore, the lack of market competition meant that there were limited incentives to improve efficiencies through improving skills of the workforce. As a result, human resource management skills are weak; employees are not necessarily recruited based on a particular skill set, but rather through networks and company training programs focus on "on the job" training (Field Research, 2013). Furthermore, there are no diploma or degree programs offered at the tertiary level in human resources. A shift in this mindset towards skills development oriented to improved efficiency and quality is required to ensure that the labor market send correct signals to the educational sector and government regarding what types of training programs are actually needed.

VI. Improving Burundi's Competitiveness in Agribusiness Value Chains: Potential Upgrading Strategies

Based on the analyses of the structure and dynamics of the agribusiness GVC at a global level, Burundi's position within the chain, and a review of existing workforce development needs and structures, the following upgrading trajectories are recommended in the short and medium term.

A. Process upgrading in support of sustainable intensification.

B. Functional upgrading to establish processing capabilities in staple crops.

C. Functional upgrading to improve storage, processing and packaging in the FFV sector.

These strategies were prioritized due to their feasibility under the current post-conflict context, the existing state of the workforce and WFD institutions, and their potential to

[24] e-RAIL was established by the Forum for Agricultural Research in Africa and is funded by the African Development Bank. The goal of the organization is to improve opportunities for disseminating research lessons and foster opportunities for collaboration between different actors in the agriculture sector at both a local and regional level.

contribute to improved livelihoods via food security and increased incomes for a large portion of the population; while also offering select, higher skilled job opportunities. It is important to stress that while each strategy could be implemented individually, their combined effort will deliver a greater competitive purchase across various agribusiness chains. More specifically, concurrent implementation of these strategies will offer substantially more opportunities for a deepening of up and downstream linkages, employment and overall value chain sustainability. At this time, agribusiness upgrading strategies focused on exporting to high-value markets are not recommended given Burundi's weak economies of scale, inefficient farm-to-market capacities due to poor transportation infrastructure, low levels of chain coordination coupled by a geographically dispersed supply base, and an underdeveloped capacity to comply with strict buyer standards. Rather, emphasis is instead placed on upgrading the agribusiness sector to improve competitiveness in domestic and regional markets. In addition, specific upgrading strategies are not proposed for the palm oil and sugar value chains. While considered important, these upgrading strategies were not prioritized because both chains have exhibited signs of upgrading without additional interventions.

Each of the three proposed upgrading trajectories are discussed below. Drawing on case examples from other countries that have followed similar approaches in the past, the text highlights why it may be important to the country to pursue each strategy, how it can be achieved, and what the expected outcomes may be – with respect to productivity enhancement, increased food security, revenue improvements and job creation. Indeed, the commitment of important financial and human capital resources to achieve these upgrading trajectories in the current post-conflict, budget constrained context must be carefully evaluated with respect to these potential outcomes

A. Process Upgrading

Low productivity in the agricultural sector has been a major obstacle to economic growth and food security in post-conflict Burundi (World Bank, 2011a). With rapid population growth, low yields have meant that the volume of food production has not been able to keep pace, leading to a chronic food deficit in the country. As the different segments of the agribusiness value chain are inextricably linked, the profitability of activities at one level of the value chain depends critically on performance at other levels. Productivity enhancing process upgrades at the farm level are essential to drive demand for inputs in the upstream input segments of the chain. This helps to ensure an uninterrupted flow of raw materials to the downstream processing segments, which strengthens the competitiveness of the entire value chain.

The combined pervasiveness of smallholder agriculture in Burundi and that most cultivatable land is already under production, demands that growth must stem from process and product upgrades targeting sustainable intensification. Potential for this intensification exists as the prevailing farming practices are characterized by low use of external inputs and poor farming techniques. Specifically, these upgrades can include: low-cost microfertilization technologies; improved land preparation techniques using minimum tillage and direct planting equipment; small-scale private irrigation schemes; and land terracing on steep slopes for improved hillside agriculture. The farm level investment to adopt these process and product upgrades requires strategic investment and support by government and donors to stimulate demand and adoption of process upgrading techniques by smallholders. Financial and technical support through government and donor-funded

projects will be particularly critical for many recommended upgrades such as land terracing, for which returns on investment are negative in the short-term.

Each of the proposed upgrading strategies is consistent with the ongoing and planned strategies of the government and key stakeholders in the country. For example, sustainable intensification is one of the four strategic objectives of the government's strategy for agricultural development. Similarly, sustainable intensification is covered by the main components of the Agricultural Intensification and Value-enhancing Project (PAIVA-B) and PRODEFI by IFAD; the Food Facility Projects financed by the EU and agricultural development programs financed by the Belgium and Dutch cooperation agencies (Government of Burundi, 2012). These programs have prioritized controlling soil erosion, harnessing surface water and development of irrigation practices, as well as increasing access to improved agricultural inputs.

In general, while some projects have delivered significantly positive impacts for smallholder production, most projects have been too localized and have not enabled sufficient scaling and coordination to allow for the achievement of nation-wide impacts. To maximize Burundi's agribusiness potential, especially given its importance to economic growth, it is essential to scale up both the amount of investments and the coordination of such investments. In doing so, it is recommended that Burundi draws on and adapts some of the many innovative process and product upgrading initiatives that have/are being implemented in other EAC and SSA countries, as presented in the below sections.

A.1. Process Upgrading: Improving Productivity through Low-cost Microfertilization Technology

With the launch of the new national subsidized fertilizer distribution program in 2013 (see Box 2), increased land fertilization has been identified as an important entry point for intensification given Burundi's typical low levels of soil fertility (Vlaar, 2013). However, instead of promoting upgrading, this project continues to promote traditional practices of fertilizer application (ADISCO, 2012). An important missing component is how fertilizer should be used. Efficiency in use of fertilizer, as for other external inputs, combined with the adoption of land fertility management techniques by smallholders will be fundamental for profitability. An innovative approach which is consistent with Burundi's current use of 5kg/ha and which has proven to be efficient and successful with very low financial cost to smallholders is the use of microfertilization technology – based on fertilizer application rates equivalent to 3-8 kg/ha.[25] Microfertilization involves the application of small and affordable quantities of fertilizer with the seed at the time of planting. This technique is generally combined with 'seed priming', consisting of soaking seeds for eight hours prior to sowing. The combination reduces the risk of crop failure and offers the best results in terms of yield increases. As recently experienced in Mali, the microfertilization of staple crops, such as millet and sorghum, can result in yield increases of up to 60-100% (see Box 7). Due to the low investment required and significant associated yield impact, the technology generates very high cost-benefit ratios, and further it has also proven to improve disease-resistance and to reduce drought susceptibility (FAO, 2011).

The economic features of the technology also lead to lower financial risks, a critical factor in driving its popularity and increased adoption amongst many smallholder subsistence farmers. Accordingly, micro-fertilization can be seen as the first step in raising on-farm

[25] Depending on plant population density.

productivity and building the capacity of farmers to increasingly invest in soil fertility management. To achieve long-term soil fertility, microfertilization should be combined with compost or manure, and mulching to control soil acidity (FAO, 2011). If properly administered, the introduction of this technique across the country in combination with the existing fertilizer distribution program, can serve to better stimulate demand for the slowly liberalizing sector.

Rolling out this project offers opportunities to generate both more productive on-farm labor as well as off-farm employment through services promoted to sell small packs of fertilizer and teach producers how to use the technique. As the technique requires additional labor to yield higher results, on-farm family labor can be more productively engaged in applying the micro-doses during planting. In addition, rural business services in supply and distribution of small packages of fertilizer, perhaps eventually combined with supply of other agricultural inputs, will generate off-farm employment. Creating new entrepreneurial opportunities for youth and recent college graduates who possess or have the ability to be trained in the technical knowledge and business management skills is also needed to successfully roll-out the micro-fertilization technology in Burundi.

Box 7. Driving Yield Increases through Low-cost Microfertilization Technology in Mali

In 1998, in Mali declining productivity and soil fertility losses were key issues of national concern (Aune et al., 2007). Annual per capita income of the land-locked country was less than US$270 and agricultural sector represented approximately 46% of GDP (World Bank, 2013c). Deteriorating productivity and soil fertility were mostly related to poor land fertilization, particularly for major staple crops in the country. In addition, fertilizer use was limited at approximately 8kg/ha compared to 150kg/ha in Asia at the time (ICRISAT, 2006); this was attributable to high fertilizer prices, associated investment risks influenced by common crop failures stemming from drought patterns, pest attacks and crop disease (Aune et al., 2007). On the other hand, increased food needs, driven by rapid population growth – over 2% per year – had led to a general decline in the use of fallowing periods (ICRISAT, 2006). The combined effect of low fertilizer use and reduced fallow periods led to a cycle of declining soil productivity and overexploitation of soil nutrients to meet household food needs in the country (Aune et al., 2007). Tackling this productivity challenge, in 2002 International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) initiated the implementation of a two-year pilot project aimed at improving productivity through fertilizer micro-dosing (ICRISAT, 2006). Table 10 highlights important advantages of using this technique.

Table 10. Advantages and Disadvantages of the Two Micro-dosing Approaches

Lower dose technology (0.3 grams/pocket)
• No effect on plants if drought after sowing • Low financial risk in case of crop failure • Relatively modest productivity impact • No additional labor demand during sowing • Application has been mechanized, but also effective with manual labor • Increased off-farm employment opportunity

Sources:(Aune & Bationo, 2008; Aune et al., 2007; ICRISAT, 2006, 2009)

The project activities were carried out through farmer field schools (FFS), training of technicians and other stakeholders, and strengthening of farmers associations through the introduction of a warrantage or inventory credit system.

Technology dissemination through participatory approaches: Demonstration plots were

established using participatory approaches, involving lead farmers that the project selected, trained and to whom regularly provided technical advisory services. Farmers decided on the choice of crop in their respective demonstration plots. Similarly, fertilizer choice was driven by the availability of fertilizer type in the local markets. The pilot project provided training opportunity for farmers who managed the entire field operations from land preparation to sowing, weeding and harvesting. Follow-up extension services and exchange visits were organized to promote information and knowledge between researchers and farmers.

Training and capacity building: Training was the key element to successfully build and strengthen the knowledge of relevant stakeholders at multiple levels: individual farmers, farmer organizations, and local government and NGO project partners. The project used various appropriate tools, such as FFS, field days, handbooks and manuals, workshops, and exchange visits to develop and strengthen local knowledge on the effects of low-cost fertilization technology (ICRISAT, 2006, 2009). To ensure sustainability and access to inputs, farmer organizations were also trained and assisted with the establishment of a warrantage system involving management of village funds, warehouses, and input shops.

Outcomes: ***Increased productivity:*** Impact assessments indicated that millet and sorghum yields under the micro-dose technology were 61-90% and 60-107% higher, respectively, than control groups (no fertilization application) (Aune et al., 2007). Similarly, yield under micro-dosing exceeded those under the commonly recommended fertilization by 11-19% and 23-28%, respectively. According to the FAO, the benefits of using the micro-dose technology can outweigh costs by 3.5 to 12 times (FAO, 2011b).

Growing adoption**:** This simple technological package has become a popular technique amongst smallholders in Mali. Following the completion of the ICRISAT project, numerous projects by NGOs have also actively promoted seed priming and micro-fertilization. In 2009, the Alliance for Green Revolution in Africa (AGRA) funded a three-year project supporting 130,000 households in production of millet, sorghum and cowpea through a wide scale dissemination and adoption of the microfertilization and warrantage system in Mali. The project was implemented by Winrock International in close collaboration with *Institute d'Economie Rurarale* (Institute of Rural Economy, IER) in Mali. Field reports indicated that more than 50% of the adopting farmers are using the technology on their own initiative without external assistance.

Access to credit: Farmers benefited from the established 'warrantage' system in the project areas. During 2002-04 harvest seasons, the local storage system stocked approximately 74 T of millet, sorghum and rice. In return, it provided credit amounting to 10 million FCFA and 16 million FCFA, respectively, in the two harvest seasons during 2002-04 (ICRISAT, 2006). To ensure sustainability, farmers were charged a loan fee approximately at 3% of the amount, generating approximately 2.7 million FCFA benefit for the stock system.

A.2. Process Upgrading: Restoring Soil Fertility and Productivity through Minimum Tillage and Direct Planting

The prevalent hand-hoe-based farming system in Burundi has been driven by the small-scale and scattered farming structure, hilly landscape, low purchasing power of smallholders, and underdeveloped supply chain of farming equipment in the country. As a result, farmers are occupied with laborious land preparation activities, and given the time sensitivity of sowing, farmers generally fail to take advantage of favorable climatic conditions to grow three full seasons, undermining productivity of their limited land allotments (USAID, 2013b).While mechanized farming is currently only feasible on rice producing plains, the adoption of low-

cost farming equipment allowing minimum-tillage[26] could result in multiple advantages to support improved on-farm labor productivity, increased yields and downstream off-farm job creation.

First, given the available technology for land preparation, minimum-tillage equipment, such as jab planters or ox-drawn rippers and direct seeders, could reduce the labor burden of land preparation. In Ghana, for instance, users reported that using these practices were less physically demanding than traditional hand-hoe-based system; they reduced labor requirements for land preparation and planting by 22% while labor for weed control fell by 51%; overall reducing labor requirements from an average of 8.8 person/days/ha to 4.3 person/days/ ha (CIMMYT, 2002; FAO, 2011). By thus freeing up labor from these relatively unproductive activities, on-farm labor efforts can be redirected towards more productive activities during the planting season, such as employing the more labor-intensive microfertilization techniques described in the previous section.

Second, by contributing to reduced soil disturbance and increased soil porosity, minimum tillage equipment can lead to higher yields as it helps retain soil covered with organic matter, reducing surface water runoff, and allowing better rainwater harvesting (FAO, 2011). In doing so, these factors can contribute to restored soil fertility. Yield gains will vary overtime; initially these may be modest, such as a 10-20% increase, however, when minimum tillage is combined with appropriate levels of fertilizer use, a 100% yield increase is gradually possible after 4-5 years (FAO, 2011). This has been proven to work in a variety of agro-ecological zones and farming systems, but it is particularly suitable for steeper slopes, under both manual and animal traction, similar to farming systems in Burundi (FAO, 2011). Given the gradual on-set of its outcomes, successful adoption of the technology requires longer-term financial, technical and capacity building support to farmers, and other stakeholders – including private actors to promote the farming equipment supply chain. According to experiences in East Africa (see Box 8), training and capacity building modeled on the established approaches of FFS as well as networking and partnerships involving private firms supplying farming equipment were core drivers of success. Building on these lessons learned, Burundi has the potential to drastically enhance its adoption of improved farming equipment for land preparation countrywide.

Third, developing the supply chain for minimum tillage equipment, which is based on relatively low-cost, non-motorized, simple production technology could also potentially generate off-farm employment opportunities in both Bujumbura and rural areas in distribution and maintenance of imported equipment. Importantly, the low cost nature of the equipment would mean that small- and medium-sized local businesses would not require significant capital to begin their operations. Local supply of farming equipment at affordable prices has been found to be a critical factor influencing adoption of the technology.

Box 8. Restoring Soil Fertility Through Minimum Tillage in Tanzania

In Tanzania, agriculture is the lead sector of economy, accounting for approximately 30% of GDP (FAO, 2013b; World Bank, 2013c). As in Burundi, smallholder subsistence farming is pervasive and yields are generally low; for example, cereal yields are below 40% of the world average

[26] Tillage is the act of preparing land for planting. In conventional agriculture this includes plowing through which the soil in the whole field is cut, moved and turned. Instead of plowing the whole fields, minimum tillage rips or opens up only a planting line or a planting hole for seed placement.

(FAO, 2013b). Low agricultural productivity is partly attributed to declining soil fertility, soil and water loss through erosion, and erratic and unreliable rainfall. Conventional farming practices such as intensive tillage has only exacerbated the problematic soil fertility issues. Recognizing this challenge, local stakeholders, including the government and international development organizations have taken initiatives to demonstrate balanced objectives of mechanization and soil fertility management to support the agricultural productivity enhancement agenda. Between 2004 and 2011, minimum tillage and direct planting technologies were promoted in Tanzania through the Conservation Agriculture for Sustainable Agriculture and Rural Development (CA-SARD), implemented in two-phases (FAO, 2011a). In both phases of the project, support to mechanization was part of a broader package including training and extension services, input supply, and provision of tools and equipment to farmers in five targeted districts. In particular, the project approach emphasized: networking and partnerships between the private sector, the government and international agencies; training and awareness raising of long term benefits; and support to develop a local supply chain for minimum tillage and direct planting equipment.

Networking and partnerships involving private sector: Recognizing the significance of multi-stakeholder platforms in facilitating technology adoption, the project was designed and implemented with the involvement of numerous actors (FAO, 2011a; Shetto & Owenya, 2007). FAO, in partnership with the Ministry of Agriculture Food and Cooperatives (MAFC) and the African Conservation Tillage Network (ACT), coordinated the design and implementation of the project. As the lead technical agencies, FAO and ACT provided oversight and technical advice, knowledge and information management. MAFC delegated direct implementation of the project to Selian Agricultural Research Institute based in Arusha, and local facilitators based in the five targeted districts. The 71 facilitators – who proved to be more effective than the state extension agents, given their rapport with farmers in their respective villages - were trained through FFS established during the two phases of the project (FAO, 2011a).

Training and awareness building: Training the producers regarding the long term benefits of the approach was a key component of the project because the full economic advantage of no-or minimum-tillage is realized over a number of years, which is in contrast to the immediate benefits and short-term solutions often preferred by smallholders. To facilitate effective diffusion of the technology, the project engaged local farmers throughout the process of trial and demonstration through FFS. Practical learning and knowledge exchange through these schools provided the participant farmers with first-hand experience related to application and performance of minimum tillage and direct planting equipment.. Overall, the project established 228 farmer FFS, each comprising groups of 25-30 farmers (FAO, 2011a). Additionally, the project trained 71 facilitators and 154 state extension agents who provided post-training advice to farmers (FAO, 2011a).

Wider technology adoption through development of local supply chain for tools and equipment: The project combined training and awareness building with the development of the domestic supply chain. The project only supplied equipment packages (jab planters, ox-drawn rippers and direct seeders) to farmers' groups at FFS. Individual farmers were required to purchase their own equipment. The project, however, attempted to facilitate increased local supply of equipment through: i) engaging local manufacturers/ technicians, ii) promoting imports, and iii) encouraging leasing by equipment service providers (FAO, 2011a). These activities also involved facilitating three exchange visits of local technicians from eight equipment producers in Tanzania – including Intermech Company Limited, Nandra Engineering, and Saez Agricultural Equipment – to Brazil to encourage private sector investment in the development of local supply chains for the equipment needed in Tanzania (FAO, 2011a; Sims et al., 2012).

Achievements: ***Increased Awareness and Adoption:*** The project training component directly reached a total of 5,000 farmers, who demonstrated increased awareness of soil fertility relations to minimum tillage and conservation agriculture in general. The extent of adoption varied across

districts, however, potentially as a result of a lack of access to resources with which to purchase the equipment. A total of 3,113 farmers adopted the technology for their private fields, with an average landholding size of 0.2 to 1.2 ha. In general, approximately 74% of farmers using minimum tillage techniques received equipment supplied by the CA-SARD project, approximately 12% purchased their own equipment and 6% actually borrowed the equipment from neighbors or friends.

Increased productivity: The full potential impact of the technology on productivity and soil erosion, according to FAO is observed only after 4-5 years of continued application of the minimum tillage technology. This is because yield gradually increases, with an initial effect of only 10-20% (FAO, 2011b). Nonetheless, in Tanzania, where the minimum tillage technology was combined with appropriate fertilizer use and conservation farming practices, significant yield increases ranging between 93-100% for maize and 140-360% for sunflower were observed (FAO, 2011b).

Lessons Learned: While the project resulted in increased awareness and adoption rates amongst a large number of the producers who attended the training, direct equipment purchases by farmers following the program was limited. In general, the initial required investment, US$25 for jab planter, was not affordable to many smallholders (FAO, 2011a). Moreover, the absence of facilitated access to credit throughout the program resulted in suppressed local demand that, in turn, undermined the development of the local supply chain for the equipment. While the project facilitated connections between farmer groups and local equipment producers, the latter only received production orders financed by this project, and other institutions. Furthermore, the project financed transactions involved in production orders of small batches because it only provided equipment kits for each group participating in FFS. Exploring the potential for a credit facilitation mechanism to support equipment purchases, or the establishment of user associations to share the use of ox-drawn rippers, or through a tillage services system offered to producers in return to fees or shares of harvest could help to foster adoption and generate additional demand.

A.3. Process Upgrading: Increasing Productivity through Small-scale Private Irrigation Schemes

Agriculture in Burundi is almost exclusively rainfed, and as a result, it has increasingly suffered from frequent disruptions caused by localized excesses or deficits in rainfall patterns. With less than 1% incorporation of irrigation across all farms, Burundi has capitalized on less than 10% of the country's potentially irrigable land (NBI, 2011; World Bank, 2008b). Localized droughts, including some that last multiple years, have inflicted great economic deficits at household and national levels in Burundi (USAID, 2010b). For many farmers without irrigation systems, a late start to the rainy season can result in the loss of a full season, while for others, the recurrence of drought at the end of the rainy season results in acute declines in food production (USAID, 2013b). Access to year-round irrigation, besides reducing the risk of crop failure due to drought will also enable smallholders to produce off-season high-value horticulture crops (USAID, 2013b).

However, the simple fact that irrigation is technically feasible does not intrinsically correlate to economic profitability or institutional sustainability (see Box 9). Investments in developing irrigation in Burundi must be appropriately targeted in terms of location and scale (IFPRI, 2013). With the available water resources in the country and advances in low-cost small-scale irrigation technology, Burundi can leverage its opportunity to significantly expand farming under irrigated agriculture (Mati, 2004; USAID, 2013b). Available options include a wide range of technologies - rainwater harvesting, bucket irrigation, treadle and

pedal pumps, and motorized pumps - for which site-specific economic feasibility could be explored before promoting adoption (FAO, 2001, 2011; World Bank, 2011b).

Many of these low-cost technologies, which do not require extensive capital investment, can be installed by farmers working individually or in groups, without the need for extensive public investment. Demonstrative use of the treadle pumps, where surface water was available, and pilot construction of hand-dug wells have successfully been experimented with 20 associations in Burundi (USAID, 2013b). These piloted small-scale irrigation schemes have enabled 20 farmer groups to have more control and flexibility on the choice of crop, plots allocated to particular crops, and off-season horticulture production. The majority of targeted farmer groups adopted onion production, which have had a strong demand in domestic and regional markets (USAID, 2013b).

Even though small-scale irrigation technologies can be exploited at individual farmer level, mitigating environmental impacts, and resolving potential water-user conflicts, would also require training and institutional development at multiple levels; including farmer groups, provincial and national levels (see Box 9). Furthermore, training farmer groups on the physical concepts related to pump operations (such as how pressure valves work) and the maintenance and management of these schemes – for instance, related to establishing credit and savings groups – will provide the vehicle for increased adoption and sustainability of the interventions.

Box 9. Driving Productivity through Smallholder Private Irrigation in Nigeria

In Nigeria, smallholder private irrigation (SPIR) schemes have been the major driving force behind the expansion of irrigated agriculture (World Bank, 2011b); these schemes have also been widely adopted across SSA, including East Africa (Dauda et al., 2009). Smallholder irrigation in Nigeria was promoted in the 1980s and 1990s through two National Agricultural Development Projects (ADPs), and subsequently scaled-up in the 2000s by the three phases of National Fadama Development Project, financed by the World Bank (World Bank, 2011b). In all of these projects, SPIR schemes have been part of an integrated agricultural development package, including seed and fertilizer, extension services, rural infrastructure and access to markets. The main features from the Nigerian experience are presented below, including outcomes and key lessons learned.

Successful dissemination of low-cost irrigation technology: The success in promoting SPIR technology in Nigeria was determined by its simplicity and low cost, the ease with which farmers could take ownership of this technology, low operating costs, and subsidized productive assets. SPIR schemes based on motorized pumps and manual-drilling technology were widely adopted in the Fadama region. By 1992, the project had distributed more than 80,000 pumps, each irrigating between 0.5 ha – 1 ha (World Bank, 2011b). While the government provided loan packages under Fadama phase I (1993-1999), the subsequent two phases of the project, Fadama II (2004-2009) and Fadama III (2008-2014), provided matching grants to support farmers in acquiring SPIR technologies (World Bank, 2011b).

Demand-responsive approach in advisory services: As the project transitioned from phase I to phases II & III, the supply-driven approach of providing free advisory services to introduce producers to these technologies was replaced by a demand-driven approach (World Bank, 2011b). Since then, advisory services have been provided on request by users, who have the option of choosing their service provider from the government, NGOs or private consultants. During this transition period, users had to finance 10% of the cost while the remaining 90% was paid by a matching grant provided by the project (World Bank, 2011b). This ensured that the scope of services was tailored to match the specific needs of users and covered irrigation technologies, as well as processing and marketing.

Support to agricultural inputs, rural infrastructure and access to finance: More recently, the direct project support has gradually been phased out to ensure sustainability of the schemes. Under Fadama phase II, the project provided matching grants which covered 90% of costs for advisory services, 90% for rural infrastructure and 70% for productive assets (World Bank, 2011b). This contribution was then phased out by establishing the Fadama Users Equity Fund in phase III, the current phase of the project. In addition, the government has continued to help stimulate demand for inputs, it subsidizes 50 - 65% of the cost of fertilizer while also supporting access to finance for smallholders by subsidizing 40% of the interest paid on agricultural loans, usually charged at 15 - 22% interest (World Bank, 2011b).

Monitoring environmental impact: To assess and mitigate the environmental impact of the intervention, the project supported aquifer studies and establishment of a monitoring system. The latter included construction of observation wells, hydrological and meteorological stations, and soil sample measurements. Additional environmental mitigation measures included sensitivity awareness training to Fadama user groups, establishing community level planning committees, and training these committees on resolving water-use related conflicts at the community level.

Outcomes:

Economic Impact: Low-cost irrigation technology facilitated increased productivity and income. By the end of Fadama II, the benefit-cost ratio[27] for the targeted farming enterprises was the highest for pineapple orchards (4.3) followed by sweet potatoes (3.2), tomatoes (2.7), onions (2.2), peppers and vegetables (1.8), okra (1.5), maize (1.4), and rice (1.3) (World Bank, 2011b). The corresponding financial internal rate of return was highest for pineapple orchards (105%), followed by onion and tomatoes (70%), sweet potatoes and peppers (68%), and vegetables (55%) (World Bank, 2011b).

Employment opportunities: While little is known about the full employment impact of the projects, targeted studies report that 80-90% of producers interviewed stated that they now regularly used additional workers in their activities (World Bank, 2011b). Further, the project created both permanent and temporary employment opportunities in off-farm rural services sectors. These included employment opportunity for irrigation technicians providing advisory services on the techniques, technicians who regularly worked in shallow drilling as well as construction jobs in rural infrastructural development components.

Lessons Learned:

Low adoption of demand-driven advisory services*:* Farmers have not yet fully embraced the concept of demand-driven delivery of extension services. Farmers have been reluctant to pay because they have been used to free extension services as the state supply-driven system was still operating parallel to this project. As a result, involvement of private advisory-service providers (NGOs or private consultants) has remained generally low (World Bank, 2011b). In areas where free services have traditionally been provided, coordinated action between projects is required to begin to revive the entrepreneurial spirit among producers.

Variations in groundwater level: Although the project set up groundwater monitoring systems, poor implementation made it difficult to identify the causes of variation in water level and necessary actions to mitigate the decreases in water table (World Bank, 2011b). Projects promoting irrigation benefit from the engagement of strong institutional monitoring from national research operations with the technical expertise and mandate to provide these essential services.

Underdeveloped storage capacity: As a result of improved production, productivity increased

[27] Benefit-cost ratio refers to the degree to which the benefits outweigh or fall short of the costs of the intervention. Benefits and costs are expressed in monetary terms discounted at present value.

and became more reliable. Some producers benefitted from some processing equipment, such as cassava processing machines, groundnut oil extractors, maize shredders, and milling machines, but overall, a lack of storage facilities forced producers to take their product to the local markets – regardless of the demand and market price (World Bank, 2011b). Projects focused on improved productivity must take into account the downstream implications of increased supply in order for yield increases to effectively translate into higher incomes and improved livelihoods.

A.4. Process Upgrading: Increasing Productivity through Land Terracing

Several factors can be identified as major causes of land degradation and soil fertility loss in Burundi; namely: the composition of a predominantly hilly landscape, deforestation practices, and the pervasive expansion of non-terraced hillside agriculture on steep slopes. Although less common in Burundi, other East African countries have successfully adopted control measures for soil erosion for hillside agriculture. Ranked from the most to least costly, depending on land slope and site-specific conditions, the different types of soil erosion control measures for slope agriculture include: radical terraces, progressive terraces, earth bunds, stone lines, and vegetative strips (FAO, 2011). In Kenya, these techniques have been used since the 1950s, with rapid up-scaling in the 1970s and 1980s (FAO, 2011). In Rwanda, where land degradation is linked to similar problems faced in Burundi, such as high population density and farming on steep slopes, bench terracing has evolved to become a central objective of the government's agricultural intensification strategy (see Box 10). In addition to reducing soil erosion, terracing also eases land preparation and boosts productivity, albeit with varying results. Cultivation of beans on terraced lands in Tanzania, for instance, resulted in 10-85% yield increases (FAO, 2011). Furthermore, experience from terraced sorghum cultivation in Ethiopia has indicated yield gains up to 297% (FAO, 2011).

Besides soil erosion control and associated direct productivity gains, land terracing offers opportunities to generate more productive on-farm labor and significant off-farm employment opportunities. Declines in labor time required for land preparation and planting in terraced lands allow for the beneficial allocation of household labor in more productive off-farm and on-farm activities, such as the application of microfertilization and irrigation practices. Furthermore, constructing each hectare of bench terraces could generate, on average, 800–900 man-days of off-farm employment opportunities – representing more than 80% of the total investment per ha (FAO, 2011).

The most substantial challenge to wide-scale adoption of terracing is the high initial investment costs, ranging between US$210/ha and US$1,350/ha, and as a result, this usually requires external intervention by international development organizations or by public programs (FAO, 2011). Without this investment support, the initial baseline costs for terraces often exceeds its short-term benefits, making it financially unprofitable at the farm level in the short-term, even though the medium-long-term cost-benefit ratio is estimated to be profitable. In Rwanda, this was calculated to be profitable at a 13% internal rate of return (Bizoza, and De Graaff, 2012). Furthermore, while terracing has proven to effectively reduce soil erosion and increase land productivity, for optimal results, it should be complemented with the use of improved seeds, fertilizer, irrigation, and improved farming practices to ensure long-term profitability at the farm level.

Box 10. Increasing Soil Fertility and Productivity through Land Terracing in Rwanda

In Rwanda, agricultural development has been constrained by extensive soil degradation due to its very hilly landscape, high population density, and the improper over exploitation by smallholders to meet household food security needs. As 93% of Rwanda's total arable land is composed of hills, most farmable land is severely vulnerable to soil erosion from rapid surface water runoff (Bizoza, 2011; FAO, 2013b). Because of the topography and the heavy population pressure on the land, farming is constantly being pushed outwards onto steeper and steeper land; greatly contributing to the fact that Rwanda has one of the highest soil erosion rates in Africa. Approximately 40% (800,000 ha) of Rwanda's land is classified as having a very high erosion risk, 37% requires soil retention measures before cultivation, leaving only 23% of cultivatable land as more or less free from erosion (Government of Rwanda, 2009). Similar to Burundi, soil fertility is also a problem for concern in Rwanda. Given its high soil acidity, 75% of all farmable land is considered "highly degraded," resulting in one of the highest negative national nutrient balances in SSA. Rwanda is thus losing soil at the rate of 1.4 million T/year, equivalent to an annual decline in the country's capacity to feed 40,000 people (Government of Rwanda, 2009). To counteract these problems, bench terracing was introduced in the 1970s by both the government and NGOs. Although efforts were halted by the 1993-4 conflict, since the mid-1990s, investment in terrace construction has increased significantly (Bizoza, 2011).Three distinct phases with increasingly effective application of the technology can be identified.

First, between the mid-1990s and 2006, land terracing was mainly promoted through multiple interventions by NGOs implementing Food-for-Work (FfW) and Cash-for-Work (CfW) projects (Bizoza, 2011). These projects were primarily aimed at enhancing food security through rural employment generation. The newly generated income opportunities incentivized adoption, although little attention was given to the maintenance and future use of these terraces. In this phase, land terracing was generally poorly coordinated and developed by stand-alone interventions with little complementary agricultural-based development support.

Second, between 2006 and 2010, the Rwandan government increasingly became involved in leading and coordinating land terracing interventions in the country; incorporating the technique as a predominant component of the government's strategy for land conservation and soil erosion control in the country (Bizoza, 2011). During this period, programs focused on training and on involving farmers' organizations in the decision-making stages of terrace development to help accelerate adoption. In particular, farmers became more aware of the importance of complementary measures to make best use of terraces. During 2006-07, under the government performance contract '**Imihigo'**, approximately 7,600 ha of terraces were constructed, representing 44% of existing terraces in the country (Bizoza, and De Graaff, 2012). Through such contracts the construction of terraces were also combined with other agricultural development initiatives, improving coordination efforts.

Third, since 2010, land terracing has been incorporated as part of the integrated approach focused on increasing productivity and commercialization of hillside agriculture. Under its Strategic Program for Agricultural Transformation, in 2011, the Government of Rwanda, with primary support from the World Bank's Global Agriculture and Food Security Program (GAFSP), launched the US$76 million Land Husbandry, Water Harvesting and Hillside Irrigation (LWH) Project (Government of Rwanda, 2012). Under the direction of the Ministry of Agriculture and Animal Resources, the LWH aims to bolster land husbandry practices for hillside agriculture and hillside irrigation practices through a modified watershed approach. LWH is thus making significant investments in hillside development through land terracing, managing water run-off to reduce erosion and, in some sites, developing integrated irrigation systems as well as expanding the water harvesting infrastructure (such as valley dams and water reservoirs). Project deliverables promote agricultural sustainability through environmentally sustainable land

practices that reduce erosion and enhance proper catchment management; productivity gains through a mix of intensification practices such as improved seed varieties and fertilizers; upgrading horticulture value-added capture through a focus on organic farming; and overall improved capabilities and coordination of stakeholders through targeted trainings and regional awareness raising activities.

Outcomes:

Financial cost-benefit analysis at farm level: A plot level financial cost-benefit analysis found that costs of labor alongside cost of manure are the two most influential factors affecting profitability of bench terraces (Bizoza, and De Graaff, 2012).The results, based on the opportunity cost of these inputs at discount rate of 13%, showed that bench terraces are profitable. Although limited in scope, this analysis suggested that bench terracing could even be a financially viable option for land conservation, provided that either costs of labor and manure is reduced, or more intensive crop cultivation is achieved.

Soil erosion control and productivity enhancement: This experience also demonstrated significant yield improvements. Controlling for other variables, research carried out in Nyamagabe and Gicumbi districts indicated that bench-terraced plots had approximately 70% higher productivity rate for potatoes, the crop commonly cultivated in the study area, compared to non-terraced plots (Bizoza, and De Graaff, 2012). Furthermore, the effectiveness of bench-terrace to combat soil erosion and to maintain water and soil nutrients has been experienced in many other countries in SSA.

Increased off-farm employment opportunity in rural areas: Construction of terraces generates significant off-farm employment opportunities in rural areas, at approximately 800-900 man-days/ha. Furthermore, future maintenance will generate additional 10 man-days/ha of employment (FAO, 2011). At the farm level, however, these additional investments increase production costs, and thus need to be initially subsidized and later compensated by rising productivity.

Key Lessons Learned:

- Terracing entails significant investment during its initial phase of construction and subsequent maintenance, mainly to finance the labor costs (Bizoza, and De Graaff, 2012). However, this generates significant off-farm employment opportunities in the short term, and increases labor productivity in the long term.
- Terraces may reduce soil erosion and increase production but this should be complemented with other intensification elements in order to provide sufficient financial gains at farm level (FAO, 2011).
- Due to short-term costs and forfeited income during construction, it is crucial for wide-scale adoption that concerted efforts are made to sufficiently raise awareness of the year-over-year benefits terracing can deliver (Bizoza, 2011).

B. Functional Upgrading: Reducing Post-harvest Loss and Increasing Farmer Income through Processing

Burundi continues to experience acute food deficits, importing nearly 30% of its cereal requirements (FAO, 2013b). With persistent food deficits, dependence on food imports exposes the country to increased risk of food insecurity vis-à-vis price volatility in international food markets that diminish the country's limited foreign reserves. While food deficits stem from a multitude of factors (many of which have been covered in previous sections), an often overlooked aspect is that of post-harvest losses, caused mainly by poor processing and storage capacities within value chains (FAO, 2010). Cassava is prime example of post-harvest losses in Burundi. As a staple crop accounting for 14% of

household daily caloric intake, post-harvest losses are often as high as 50%; a factor much higher than for cereals. Cassava roots require processing within 48 hours to avoid spoilage, making the product particularly susceptible to post-harvest losses (Aloys & Ming, 2006). Moreover, without processing, cassava marketing is also constrained by uncompetitive transportation costs due to its low value-to-weight ratio (Aloys & Ming, 2006). Yet, cassava processing in Burundi is still based on rudimentary, inefficient and time sensitive methods, undertaken mainly at the household level, contributing to additional losses (Aloys & Ming, 2006). These post-harvest losses represent a substantial cost that reduces real income and food security for producers and consumers in Burundi.

Indeed, in certain cases, reducing losses could provide more cost-effective and environmentally sustainable means of promoting food security than investments focusing on increasing production (FAO, 2010; World Bank, 2011d). Due to the relative importance of cassava for food security in the EAC region and in Burundi, it is recommended that cassava be prioritized for processing upgrading. Reinforcing this argument, the FAO's recent prioritization of cassava processing as a proactive measure to counter rising global food prices, food insecurity and climate change (FAO, 2013d).[28] Examples of scaling up processing capabilities in cassava value chains can be identified in other SSA countries – including Nigeria and Mozambique – where donor and industry actors have invested in processing units that address common access challenges experienced by smallholders, improving competitiveness throughout the chain (FAO, 2013d). Particularly innovative processing units are mobile – meaning they are able to travel to rural farms and thus simplify traditional transportation challenges – and have the ability to convert cassava roots into cassava cake/flour at a rate of 4 T/hour. Although the Burundian government has recently been seeking private sector investment to promote the commercialization of the cassava processing sector in the country (API, 2013; RIA, 2013), to date no investments have come to fruition. Inadequate access to information on production possibilities, low existing productivity levels and challenges with disease are all contributing factors to low investment and low technological proliferation in Burundi's cassava value chain.

Through its many versatile uses, cassava processing quintessentially offers opportunities for the development of downstream markets beyond traditional foodstuffs, supporting the establishment of an integrated cassava value chain. For example, in Mozambique and Ghana, the introduction of mobile cassava processing units has provided farmers with an economic incentive to invest in productivity enhancement and product quality to meet the growing demand for cassava root being generated by the emerging beer markets (see Box 11). Furthermore, many governments in SSA have also promoted a blending of domestically produced cassava into a number of different products such as with wheat flours for bread production, animal feeds and wood products to name a few; all of which reduce dependency on imports and stimulate local demand.[29]

[28] Several varieties of cassava root possess uniquely robust properties that offer natural defenses against threats posed by global warming concerns (FAO, 2013d).

[29] In Nigeria, cassava flour has been used at a 10% mandatory blend with traditional wheat flour, with future plans to increase this to a 40% blend (DATCO, 2011). Moreover, the country has considered plans to substitute 10% of maize in poultry feed with cassava, which will increase annual demand for cassava roots by 480,000 tons (FAO, 2013d). In East Africa, the animal feed industry is also turning to cassava, as maize and wheat become increasingly unaffordable (FAO, 2013d). In Burundi, CNTA has recently begun testing for potential for the incorporation of 30% of cassava flour into traditional 100% wheat-based flour for bread making, but these results need to be disseminated for adoption (UNIOD, 2013b).

These downstream market developments serve as significant upgrades over traditional cassava cropping systems with the ancillary effect of spurring productivity enhancing activities across the production chain. In addition, as aggregators in the cassava value chain, processors can provide intermediate bulking, transport services and backend market linkages while ensuring compliance with the quality requirements of the end-market users. Under these arrangements, staple crop chains can provide a guaranteed market to farmers through license purchasing agreements and incentivize investment in improved farming inputs and technologies at the farm level to support the adoption of sustainable intensification. Furthermore, downstream employment opportunities as processing capabilities allows for the entry of a host of new products each of which will generate their own labor demand.

Box 11. Transforming Cassava Production from Subsistence to Cash Crop in Mozambique

SSA has led the world in cassava production averaging more than 50% of global harvest totals over the last 20 years (FAO, 2013b). Unlike many of the other cassava producing regions of the world where value chains extend into diverse consumer, industrial and livestock feed channels, in SSA approximately 90% of harvested product is used only for human consumption (FAO, 2013d). In Mozambique, while cassava is considered amongst the most important crops in the national agricultural profile, grown by more than 2.3 million small producers, it has largely remained a subsistence crop rather than a cash crop, and most produce is consumed with rudimentary processing at the household level (Benfica & Mather, 2013; FAO, 2013a). A number of critical challenges have negatively affected the economic viability of large-scale commercial cassava production in Mozambique, many of which are also faced in Burundi. The most obvious and crucial challenge to cassava production is its high perishability. This places intense pressure on farmers to transport, process, and sell their harvests before spoilage. As the vast majority of cassava farmers are smallholders living in rural areas with minimal access to transportation, advanced processing equipment and stable markets, post-harvests losses can reach as much as 30%. Traditional forms of cassava processing in Mozambique such as peeling and drying are far less effective than modern mechanized technologies, while also offering far fewer options for end product uses that could allow for the development of downstream activities.

In an effort to transform cassava into a commercial crop, Cassava+, a public private partnership (PPP) between the Dutch Agricultural Development and Trading Company (DADTCO) and the International Fertilizer Development Center (IFDC) was launched in the country. The project employed a revolutionary mobile cassava processing machine developed by DADTCO, the Autonomous Mobile Processing Unit (AMPU), and skills training on improved farming techniques and business services by the IFDC. Initial rollout of the Cassava+ project began in Nigeria, the world's largest cassava producer, in 2010. Following its near immediate success in improving farmer incomes, increasing food security, increasing productivity and expanding end market uses, the Cassava+ project was launched in Mozambique in 2011. In Mozambique, Cassava+ aimed to commercialize cassava production for 1,500 households (6,000 people) in the northern Nampula Province, linking farmers to markets through the creation of a sustainable operation for cassava. The project offered guaranteed baseline prices for farmers that were higher than existing informal and arbitrary spot markets, raising smallholder incomes and reducing poverty (IFDC, 2013).

Acting as the main catalyst of the project, the mobile unit has been able to travel directly to farms where cassava is produced and to convert harvested cassava root into cassava cake and flour. The AMPU's processing capacity enables it to turn 3.8 T of raw root into 2 T of cassava cake in one hour (DADTCO, 2013a). Once in cake form, cassava can be stored for up to two years and can be applied to various end uses. This has generated significant advantages to producers in ways of product security and inventory flexibility over non-processed cassava. Implementation and mobilization of the AMPU was coordinated through communication between DADTCO operators and cassava farmers in the

project's region. At the time of processing farmers are paid by DADTCO for their raw cassava root at a guaranteed price per/T. Contracted purchase prices have been offered by DADTCO at 1,500MZN/T ($50.5/T) to farmers who are selling on farms, and at 2,500MZN/T ($85/T) for farmers that arrange their own transportation to DADTCO's regional plant (Rockefeller Foundation, 2013).

DADTCO has been able to offer guaranteed pricing to any and all farmers wishing to sell their cassava due upstream partnership with a beer manufacturer, Cervejas de Mocambique (CDM), a subsidiary of SABMiller. CDM agreed to purchase all cassava cake DADTCO produces in Mozambique as a barley substitute for its regional beer, Impala (Rockefeller Foundation 2013). Taking a low-cost provider strategic approach in the Mozambique beer industry, CDM negotiated with the government for preferential tax reductions, allowing them to sell their beer at a 30% market discount. Similar preferential tax discounts were also granted by the Nigerian government in the flour industry, in addition to the added step of creating new legislation for wheat flour to contain at least 10% cassava flour (DADTCO, 2013b).

Project Impacts: DADTCO and IFC reported that more than 1,500 farms were reached in 2013 and farmers' incomes have risen by 22% as a direct result of project involvement (Rockefeller Foundation, 2013). Post-harvest waste has declined significantly, helping to increase both productivity levels and overall returns on investment. With a guaranteed marketplace to sell their product, farmers have also increased their land allocation for growing cassava. Trainings by the IFDC also taught cassava farmers how to best approach cassava farming, offering specific techniques that improved harvest robustness to climatic changes and disease and increase yields. These trainings specifically aimed to increase current yields from 4-5T/ha ranges to 20-25T/ha ranges over the next few years (IFDC, 2013). Drawing on success from Nigeria, such goals seem to be quite feasible in Mozambique. Expected increased demand between April 2013 – December 2013 by CDM owing to the success of its cassava beer was projected at 60%: from just under 1,000 T to roughly 2,500 T (DADTCO, 2013c), suggesting that the positive impacts on cassava farmers are likely to continue to increase.

Future Potential: It is clear that the incorporation of the new AMPU processing technology has been the key driver for rapid functional upgrading in Mozambique cassava production. Such upgrading is providing dynamic impetus for both upstream and downstream product upgrading. This carries with it large potential for future expansion of commercial opportunities for cassava producers. Nonetheless, future challenges also exist. While, DADTCO has plans for future expansion beyond contracts with CDM, no clear concrete partners have been identified. An overreliance on CDM carries with it great risk for cassava producers. Additionally, communication efforts between DADTCO and farmers need to be further streamlined to improve project efficiency and IFDC trainings need to continue to ensure that farming intensification is responsibly managed with proper soil and crop rotations to avoid unintended crop failures.

C. Functional Upgrading: cold storage, processing, and packaging of fruits and vegetables

While FFVs account for the largest share of gross value of agribusiness production in Burundi (FAO, 2013b; Sindayikengera, 2014), the lack of cold storage, processing and packaging capabilities are major factors causing high risk and price volatility, substantially undermining growth in the sector. As a major risk for investment in productivity and growth, post-harvest losses can range between 10-80%; mostly because of lack of these post-harvest capabilities that result in seasonal oversupplied markets during peak production periods (UNIDO, 2013b; USAID, 2013b). As a result, local wholesale traders, the main intermediaries connecting farmers and local markets, often offer price discounts to sell spoiling inventories before they are rendered useless. This has the net effect of suppressing price shocks further upstream the chain (Somera & Somera, 2013). Thus, the overall poor

performance of the sector, due to lack of storage capabilities, undermines potential gains for actors across the entire FFV value chain (USAID, 2013d). Although a few small-scale cases have already proven successful in the country, their impact is limited and in need of significant expansion. For instance, FRUITO's investment in cold storage, which has been very effective in reducing seasonality issues in access to raw material for the company, has directly impacted only the 1,800 farmers integrated in the company's supply chain. (USADF, 2008).

Similarly, the USAID funded BAP project has helped farmer groups in only its target areas to improve their packing techniques, which reduced waste and helped preserve produce quality during farm-to-market transportation. In this case, introduction of wooden boxes, adapted to the capabilities for local transport, has significantly reduced farm-to-market related spoilage for tomatoes; it also made transportation more flexible as the boxes could be loaded on the back of bicycles, cars or trucks (USAID, 2010a). Better product quality also resulted in fetching higher prices to farmers compared to the traditional packaging methods (USAID, 2010a).

Nevertheless, Burundi's FFV competitiveness within the region, including competition for imports in its domestic market, will essentially depend on upscaling these investments to build national capabilities in cold storage, processing, and packaging. Building these capabilities in Burundi will fundamentally enhance the potential for producers to leverage regional price differentials, promoting FFV exports to other countries in the region. According to 2009-2010 market data, average seasonal wholesale prices of tomatoes can vary by as much as 400% (US$0.2/kg – US$1/kg) (USAID, 2013d). Further illustrating this, price differentials for pineapples are approximately 80% between Kenyan and Ugandan markets. Poor packaging of these physically sensitive products, however, has created major impediments to scaling up regional trade in FFV. Due to the highly perishable nature of tomatoes, for instance, regional trade currently only represents 1.32% of total production (USAID, 2013d). In general, cross-border FFV trade, as in the case of passion fruit between Burundi and Rwanda, is currently seasonal and largely the result of proximity of production areas to borders rather than exploitation of maximum economic potentials (Karuretwa, 2013; Vrijlandt, 2013).

While regional trade potential exists in the medium-term, Burundi's FFV exports to high-value markets (e.g. the European countries) will continue to remain limited to exotic products, such as organic mangoes. This is primarily because adhering to strict market standards and certification requirements in these markets is both expensive and requires substantial chain capabilities and technical coordination. Additionally, high-value markets are marked by intense international competition, and given Burundi's current low export volumes compounded by high air freight costs, the country is not likely to competitively participate in these markets in short- to medium-terms (Somera & Somera, 2013; UNIDO, 2013b). It is important to recognize that there are no short cuts for entry into high-value FFV GVCs, and competitiveness in these chains requires capabilities that require long-term investments (see Box 12). Focusing only on certifications, without first making the necessary upgrades to establish cold storage, processing and packaging capabilities undermines the likelihood for establishing sustained export positioning in competitive high-value markets (World Bank, 2011c).

Box 12. Cold Storage, Processing and Packaging of Fruits and Vegetables in Kenya

In the EAC context, the evolution of Kenya's competitive positioning within the high-value FFV GVC in recent past is a particularly noteworthy case of how value chain actors have upgraded their packaging and cold storage capabilities to both drive competitiveness, and meet changing market dynamics. Between 1974 and 2004, Kenya's horticulture industry grew at over 6% - and was a key driver of national economic development (Minot & Ngigi, 2004). Currently, both the domestic market for FFVs and the export market are valued at over US$1 billion (Fernandez-Stark et al., 2011; Trienekens & van Dijk, 2012). To respond to changing industry dynamics, Kenyan producers have had to pursue packaging and cold storage upgrading strategies to both achieve and maintain their competitive market share in global export markets as well as more recently in the growing national and regional markets. While there is still great need for further diffusion of upgrading across the chain, investments made with respect to increased shelf life, quality, the consistency of products and an upgrading of workforce capabilities through the creation of new jobs and training (Jaffee & Masakure, 2005; World Bank, 2005). The following section highlights how investments in packing and cold storage have led to upgrading.

Packing Cold Storage and Workforce Upgrading: Beginning in the 1990s, Kenyan producers began to scale-up investments in packaging from the traditional wholesale structure where the need for detailed packaging was low, to an approach where supermarket buyers began to require variations in packaging type according to product type (Dolan, 2004). Due to high perishability and fragility of their products, Kenyan producers realized the added value that their packaging offered was not just in the way of achieving higher prices, but also in the increased longevity of their products (Danneberg & Nduru, 2013; Jaffee & Masakure, 2005). As a result, private sector investments in packing warehouses near the Nairobi international airport increased significantly. Such investments transformed packing warehouses from simple constructs to far more capable and sophisticated plants which allowed for important diffusion of capabilities to service national, regional and global markets (World Bank, 2011c). This allowed Kenyan value chain actors to supply these different markets with a diverse range of packing options based on market specific preferences; such as: pre-washed, pre-cut, pre-trimmed, pre-mixed, pre-labeled, and 'ready to cook/eat' products.

At the same time, upgrading by Kenyan producers has also extended into the incorporation of cold storage technologies throughout the chain, from smallholder production sites, to local and regional wholesale markets to large global exporters (Dolan, 2004, Jaffee & Masakure, 2005). This has allowed Kenyan producers to significantly reduce product spoilage rates, increase product shelf life, improve freshness, and increase logistical coordination and transport opportunities via land, air and sea; all of which strengthen buyer confidence and trust in product quality (Dolan, 2004). A growing number of medium-sized, and albeit fewer, smallholder producers have also invested in cold storage technologies to improve their participation and competitiveness within national regional and global value chains (Neven et al., 2009; Neven & Reardon, 2005). Accordingly, investments in cold chain technologies have ranged in both purposes of technology and capital requirements (Shitanda et al., 2011).

These upgrading strategies have also fostered increased employment and diffusion of knowledge generation. Direct impacts were felt with increased employment in packing warehouses (Dolan, 2004; Government of Kenya, 2012). Much of this employment growth also improved employment security for workers because the need for skills training for laborers working in packing and cold storage led employers to adopt employment contracts where labor informality used to dominate (Danneberg & Nduru, 2013; Jaffee & Masakure, 2005). While many of the new jobs created rely on lower skilled workers, a number of higher skilled positions have been created too; namely: first line managers, supervisors and technicians (Fernandez-Stark et al., 2011). Demand for these higher trained workers further spurred the development of several university degrees to be developed in Food Science and Processing Technology, Food Management and Nutrition Science, which can be linked to creating human capital spillover effects and driving workforce development initiatives.

National and Regional Upgrading – Challenges and Opportunities: There is still much more to be done, especially at the level of smallholder producer participation focused on the domestic market. Government reports from 2012 reflect post-harvest losses for non-export-based produce as high as 30-75% – citing increased packing and cold storage investments as national priorities (Government of Kenya, 2012). Similar to Burundi, in rural areas of Kenya, producers face low electrification rates (Lighting Africa, 2012), poor roads and inadequate access to packing materials, all of which create barriers to upgrading. However, evidence exists that shows smallholders' organizations are increasing their investments in cold storage and packing technologies increasing their collective competitive ability to sell their produce when market prices are higher (Lenné & Ward, 2010; Narrod et al., 2009). In addition, other examples in Kenya exist where these producers together with wholesalers are developing naturally cooling storage units that do not require electricity (Shitanda et al., 2011). While different technologies exist, most are often water-cooled and the materials are sourced locally for lower prices than traditional electric cooling systems. Although they are slightly less effective, they still provide innovate solutions that delay spoilage, decrease post-harvest losses, and improve competitive profitability (Shitanda et al., 2011). These experiences offer replicable and scalable examples because they are fit to local conditions and challenges faced by smallholder producers.

VII. Skills for Upgrading Burundi's Participation in the Agribusiness GVC

As Burundi's agribusiness industry adapts to the identified upgrading strategies, a revised set of skills and job profiles are needed to address the emerging challenges, develop new capabilities, and improve efficiency and productivity to encourage investment and growth. This section thus highlights the key new job profiles and improvements to existing job profiles that would be needed to support these initiatives (see Table 11). Majority of new job profiles identified, highlight in 'red font' (see Table 11), requires technical skills development combined with practical training. These profiles mostly cover key bottleneck positions within the chain. Existing job profiles, highlighted in 'green font' (see Table 11) indicate those job profiles that require both upgrading in skills and larger increases in the number of employees. Other positions (in black font) will need to improve their skills to facilitate recommended upgrading strategies in those chains. This is then followed by a brief discussion regarding how to go about building the skills required for each of these job profiles, drawing on the country case studies presented earlier in the paper, existing successful initiatives that have been carried out in the country, as well as additional best practices from other parts of the world.

Table 11. Job Profiles in Agribusiness Value Chain: Process Upgrading

Position	Job Description	Formal Education Requirements	Training/ Experience	Skill Level
Process Upgrading				
Agronomist	Conduct research to improve crop seeds, yield & disease resistance. Determine mineral composition of soil & fertility management requirements such as use of fertilizers, herbicides and pesticides for optimal quality & productivity.	Post graduate degree	Experience & Practical Training	
Extension Agents	Work with farmers, cooperatives and companies to improve productivity and product quality. Duties may include disseminating technical knowledge on good agricultural practices through training, consultation and developing manuals on improved varieties of seeds, micro-fertilization technology, small-scale irrigation, and maintenance of terraced land.	Bachelor's degree in agronomy	Experience & Practical Training	
Nursery & seed multiplication staff	Plant, cultivate, harvest, transplant seedlings, for grains, fruit & vegetables, and palm oil in nurseries and seed multiplication plots. Assist agronomists and or extension officers in monitoring plots for seed and seedlings quality or control pest. Inspect and label plots for data collection and for distribution to farmers.	May require high school diploma	Theoretical & Practical Training	

Producer	Cultivation and maintenance of healthy farms by managing irrigation, applying fertilizers, and controlling pests. Additionally, it may require pruning, transplanting, and timely harvesting of crops. Additionally, duties may include managing labor, buying inputs, keeping production records, dealing with clients, obtaining credits, and supervising crop calendars	No formal education required but literacy and numeracy skills will help	Training and experience	
Irrigation Technician	Provides practical training to farmers and farmer cooperatives, preferably through FFS, related to management of water resources, installation of small-scale irrigation systems, their maintenance, and dissemination of technology to promote adoption.	Technical education / Bachelor"s degree	Training and Experience	
Soil Erosion Control Technician	Works with extension officers to train farmer organizations and land owners on soil erosion control measures; oversees related implementation duties such as terracing; monitors their effectiveness and reports to supervising agronomist or soil conservation specialist. Duties include data collection, soil surveys, soil content analysis, & taking sampled measurements to inform planning for soil erosion control.	Technical education/ Bachelor's degree	Experience/ technical training/ certification	
Transporter	Transport products from fields to processing facilities, collection centers, or wholesale markets during the harvest season. Adequate transport will become essential as productivity increases and famers produce more for market, particularly, perishable products like cassava or fruits & vegetables for which delivery time is very important given lack of cold chain in the country.	Literacy and numeracy skills	Experience	
Cereal/Root Crops Processing				
Operations Manager	Duties may include managing central plant, planning operations of mobile processing units, market promotion liaising particularly with grain millers. Manages workflow and closely works with mobile unit operators, collectors and marketing personnel to coordinate activities along the value chain. Manages budget and troubleshoots any management, logistics and personnel challenges. Must possess strong organization, management and problem solving skills.	Bachelor's degree	Training and experience	
Mobile Unit Operator (Cassava Processing)	Responsible for transporting mobile unit between cassava collection points and operating the mobile processing to unit to convert cassava roots into cassava cake. The mobile unit supports washing and peeling, chopping, grating, and dewatering before producing cassava cake.	Technical education	Training and experience	
Collectors/ Aggregators	Regularly interacts with farmers and farmer organizations and trains them about post-harvest produce handling methods, pre-processing techniques, and quality requirements. Coordinates with quality controllers and business manager to close the communication loop to attain the required quantity and quality of raw material needed to run processing facility at its target capacity.	Literacy and numeracy skills	Training and experience	
Marketing/ Distributors (Cassava & Wheat Milling)	Liaises with grain millers, MINAGRIE, CNTA, and bakeries to promote use of cassava flour in bread making. Organizes image-building initiatives for cassava flour for rural and urban consumers.	Technical education/ Certification	Marketing skills/ experience	
Warehouse Manager	Manages rice, cassava cake, and flour storage at the central refinery or rice processing facility. Maintains inventory and delivery schedules. Ensures standard requirements at the storage facility to avoid pest infestations.	Certified technical education	Technical training/ experience	
Transporter	Responsible for transporting cassava cake to a central dryer and refiner where cassava cake is processed into cassava flour.	Literacy and numeracy skills	Training and experience	
Cold Storage, Packing and Processing Fruit and Vegetables				
Cold Storage				
Storage Unit Manager	Oversees rules and procedures for incoming and outgoing loads; manages service contracts and financial accounts; maintains inventory records, and controls hygiene and operation of the refrigeration equipment. Liaises with farmers, wholesale traders, and other service users to develop good customer relations, identify business opportunities and ensure maximizing customer service.	Technical education /undergraduate degree	Training and experience	
Operator/ Technician	Responsible for operation and maintenance of refrigeration equipment to ensure proper air circulation and changes, equal temperature distribution and relative humidity levels inside cold chamber.	Literacy and numeracy skills	Training and experience	
Packing				

Packer	Ensures appropriate packaging. For primary processed products the duties involve inspecting for defects, grading, washing, filling trays, wrapping the product, and packing boxes.	Literacy and numeracy skills preferable	Training and experience	
Processing				
Business Manager	Manages procurement and processing activities at cooperative or industrial plant level. Will particularly be responsible for: financial records (income and cost accounting, staff records, cash flow, tax records, bank statements); production records (recipes, inventory monitoring of raw materials and ingredients, wastages % at different stages of the process, production planning, and maintenance schedules); quality assurance records (target recipes, measurements at process control points, equipment cleaning procedures and schedules); sales records (inventory of customers, weekly and monthly sales volume)	Bachelor's degree	Training and experience	
Quality Control Technician	Ensures that the processing conditions meet domestic and regional markets quality requirements particularly related to food safety and hygiene during processing and packaging. Identifies potential sources of contamination and food safety risks, monitors risk control procedures, trains staff and develops appropriate monitoring and reporting procedures. Schedules cleaning of all equipment used and processing room to meet SPS regulations and practices.	Technical education/ Certification	Technical training/ experience	
Aggregator/ Buying Agent	Regularly interacts with farmers and farmer organizations and trains them about post-harvest produce handling methods, pre-processing techniques, and standard quality requirements. Coordinates with quality controllers and business manager to close the communication loop to attain the required quantity and quality of raw material needed to run processing facility at its target capacity.	Literacy and numeracy skills	Technical training/ experience	
Warehouse Manager	Keeps account of delivery and ensures proper storage of raw material, ingredients, packaging materials, spare parts for machinery and finished products.	Technical education/ Certification	Technical training/ experience	
Mechanics/ Machine operator	Has technical knowledge of processing machinery. Responsible for operation, repair and maintenance of processing machines and equipment at the processing facility.	Technical education	Technical training	
Line Worker	Activities vary depending on the desired final product (e.g., dried fruit, jams, pickles, juices, and sauces). Activities include several methodologies sun-drying, preparing concentrates, artificial dehydration, extraction, mixing, boiling, frying, and fermenting.	No formal education required	Training	
Packer	For secondary processed products it encompasses weighing, ensuring fill-weight, labeling and proper sealing of package. Packaging is important part of branding and direct marketing when it comes to package design, size, weight, and dimensions.	Literacy and numeracy skills preferable	Training and experience	
Distributor	In charge of the distribution and have to fulfill the following activities: keep records of clients, maintain a monthly schedule for delivery, prepare daily delivery schedules and ensure timely and quality delivery of products.	Literacy and numeracy skills	Technical training/ experience	
Institutional Support				
Regulator	Plan, coordinate and implement activities to comply with regulations and standard operating procedures to trade crops/products with domestic and regional buyers.	Bachelor's degree or higher	Training and experience	
Environmental Specialist	Responsible for establishing ground water monitoring system and necessary mitigating efforts to control environmental impact of small-scale irrigation schemes.	Bachelor's degree or higher	Training and experience	
SPS Certifier	Ensures that fruits and vegetables meet the emerging SPS requirements for export to regional markets	Bachelor's degree or higher	Training and experience	

Source: Duke CGGC.

Skill Level	**Low** 	**Low-Medium** 	**Medium** 	**Medium-High** 	**High** 
	No formal education; experience	Literacy and numeracy skills; experience	Technical education/ certification	Technical education /undergraduate degree	University degree and higher

A. Process Upgrading: Required Workforce Development Initiatives and Key Job Profiles

Key job profiles required to achieve process upgrading are:

Agronomists, extension agents, nursery personnel, irrigation technicians, soil control technicians, growers and transporters.

Reform initiatives are already underway in the education sector across the universities, technical and professional schools. In addition, *Commission Nationale de l'Enseignement Supérieur du Burundi* (National Higher Education Commission of Burundi, CNES), established in 2012, and authorized to oversee the higher education sector, has provided oversight of the reform process, requiring accreditation of all existing and new training programs delivered by both public and private universities in the country (Hatungimana, 2014). While these ongoing reforms focus on formal education sector, additional training programs will be required for the other job profiles. This is particularly important for extension agents and growers who, at best, have received only disparate training in the past and for new positions: irrigation technician, soil erosion control technician, quality controller and environmental specialist.

Recommendations for developing adequate training programs are provided below.

1. **Institutionalize practical training through 'Farmer Field Schools' to provide systematic training for large number of producers:** Coordinating skills training initiatives using project-based approaches can be very challenging. A common weakness of the skills training initiatives in Burundi has been lack of a systematic approach to institutionalize knowledge transfer and provide sufficient scale to reach the fragmented production base. At the national level, this lack of coordinated approach has constrained proper planning, monitoring and evaluation to assess impact and improve content and delivery. In order to achieve nationwide impact, this training approach could employ a "cascading model", in which knowledge is transferred step-by-step from experts, to local professors and universities, to extension agents, then to peer trainers drawn from the growing areas and finally to producer associations or groups of growers based on location. At each stage of the training, the ratio of theoretical to practical training should be adapted according to the literacy levels of the audience and appropriate teaching materials and tools should be developed. Each level of training should also include the development of facilitation skills to ensure that the knowledge and information is accurately and effectively transmitted from stage to stage.

   For training of farmers and groups of growers, it is recommended that Burundi scales up the FFS approach (see Box 13), which has widely been adopted in the EAC region but only recently been introduced through FAO and IFAD projects at rather small-scale in Burundi. The chief advantage of institutionalizing FFS approach is its flexibility, practical approach, and participatory nature. First, its flexibility supports to phase and organize training throughout the production cycle, allowing to sequence and/or combine inter-related areas of skills development for process upgrading – use of minimum tillage for land preparation, micro-fertilization technology, installation and management of small-scale irrigation system. Second, the training delivery will be based on experiential learning and does not require literacy or baseline formal education. Third, its participatory nature will allow extension agents and farmers to leverage existing local knowledge to ensure collaborative and sustainable learning, with the farmers themselves

involved in modifying training content over time to local needs and experiencing solutions to the problems of low productivity in the country. Fourth, these FFS can be leveraged to create producer organizations in the future. Two key actors can be leveraged to help coordinate these FFS, the DPAE extension agent program (as is now happening in Kenya and Tanzania, see Box 13) and CAPAD. Both organizations can then be leveraged to provide extension agents to lead trainings in these schools.

2. **Develop training curriculum and modules based on successful regional and in-country experiences:** Development of training material to be used in this institutionalized training operation should leverage the various successful but small-scale training projects targeting process upgrading for productivity enhancement in Burundi (see Table 15, in Appendix), and related regional experiences. Experiences from countries in the region, for instance, of Rwanda in land terracing, and of Kenya and Tanzania on minimum tillage farming will be particularly relevant. For the latter, Burundi should also engage experts at the African Conservation Tillage Network, headquartered in Nairobi, Kenya. This top-down approach should be balanced and properly combined with the bottom-up approach. Development of training material should be closely coordinated through Sectoral Working Groups for Education and Agriculture in Burundi. In particular, ISABU, UoB, UNgozi, CAPAD, NGOs, such as OXFAM, working in the agriculture sector should also be engaged. Considering the literacy and levels of education for the target group - farmers, farmer organizations, DPAE extension agents, and agronomists, the delivery mechanism should be designed based on appropriate training tools such as manuals, workshops, and exchange visits, while FFS should particularly be leveraged to train farmers.

   This training program should be institutionalized in order to support the scale required to reach the large number of producers in the country. The program should be hosted at the university level, and the teaching staff should draw on Professors, researchers from ISABU as well as private sector and NGO actors. In the short-medium term, the primary extension agents participating in the government should be those from DPAE and CAPAD. In the medium-long term, however, by creating an accreditation and certification program for participation of extension agents in the program, this curriculum can be rolled out to private training institutions.

   3) **Develop both technical training and degree programs for irrigation and soil control technicians:** Given that these strategies are relatively new to the country and have limited use, foreign expertise in close coordination with researchers at ISABU, will need to be leveraged to develop a degree program. In the short-medium term, Burundi should leverage degree programs on offer from regional universities including Sokoine University, that provide specific undergraduate and graduate training programs in these areas. Qualified agronomists and teachers from FABI and UNgozi can be awarded scholarship programs to study abroad at these institutions with the commitment to return to work in Burundi upon the completion of their studies, as is becoming standard practice in the region. In addition, exchange visits should be arranged for both these and other qualified staff, such as university faculty and ISABU researchers to observe how these practices are being adapted to the smallholder context in other countries in the region (e.g. Rwanda, Tanzania and Mali for soil control and management and Nigeria for irrigation.) In the long term, these individuals can be incorporated into teaching programs at the university and ITAB level.

Box 13. Farmer Field Schools: Kenya Tanzania and Uganda

In general, formal agricultural training approaches in East Africa have been insufficient in their ability to effectively reach the large numbers of smallholders that work in the agricultural sector. To address this challenge, FFSs have been introduced in Kenya, Tanzania and Uganda. In principle, FFSs are based on experiential learning that do not require literacy or any baseline formal education and consist of a small group of 25 – 30 farmers that are led by a facilitator who structures teachings based on self-help fundamentals (Soniia and Asamoah, 2011). By design, FFS is an informal method for reducing the associated transaction costs of formalized agricultural trainings for smallholders (Taylor, Duveskog, et al., 2012). FFSs allow for a greater proliferation of knowledge sharing about agricultural best practices in rural areas (Friis-Hansen and Duveskog, 2012), often at lower costs than formal extension services (Rural 21, 2010). FFSs are generally facilitated through weekly classes following annual or biannual crop cycles to allow participants to engage as a group throughout the production cycle. Facilitators offer infield demonstrations, allowing farmers to participate and ask questions (FAO, 2006). Operating through needs-based training, wide ranges of information can be taught through FFSs and no two are necessarily the same, although most instruction tends to center around productivity related issues. In brief, FFSs are adaptive and replicable across diverse geographies that require different farming techniques (Davis, Nkyonya, et al., 2012).

FFSs have gained traction in Kenya and Tanzania in particular. Implementation in these countries was originally initiated through FAO/IFAD pilot projects in the mid-late 1990s, later spawningd larger projects in the early to mid-2000s. It is widely cited that significant growth in FFSs has taken place in each country – in Kenya more than 12,000 FFSs were reported as being formed by 2010 (Rural 21, 2010) – however, due to the informality in nature of FFSs, and that these programs are often led by donor interventions, and as such still mostly continues to take place outside formal government education systems, aggregate numbers are hard to accurately identify (Duveskog, 2013). Recently though, government reports from these countries have taken note that some form of state approved FFS certification or standardization could allow for formal recognition of completion (Government of Kenya, 2012; Government of Tanzania, 2013). In both Kenya and Tanzania, FFSs have now been incorporated into government strategies for extension service policy, complementing the efforts of NGOs and other donors with extension service workers acting as facilitators (CUTS International, 2011; Government of Kenya, 2012). In Tanzania, a new extension service policy led to the creation of 6,700 FFSs, training over 70,000 farmers through coordination from Local Government Authorities (LGA) (CUTS International, 2011). Growth in numbers and frequency of adoption can be attributed in large part to the intended design of FFSs to scale outwards: facilitators tend to lead numerous FFSs and graduates often then start their own FFSs (Braun and Duveskog, 2008; FAO, 2006; Soniia and Asamoah, 2011).

Several recent studies analyzing FFS programs in Kenya, Tanzania and Uganda offer important insights to the developmental gains to be achieved. Across all three countries, FFS programs increased overall income levels by 61%, with some incomes in Kenya and Tanzania increasing by more than 100% (Davis, Nkyonya, et al., 2012; Lilleør and Larsen, 2013). Income and productivity gains are shown to be highest amongst the least educated, demonstrating robustness in areas with low levels of education (Davis, Nkyonya, et al., 2012). FFSs have also been shown to be 'transformative learning experiences' that significantly improve gender equality, community relations and economic development (Duveskog, Friis-Hansen, 2011; Duveskog, 2013) and the formation of 'FFS networks' is found to promote collective efficiencies by leveraging economies of scale through input purchasing, marketing, selling and policy advocacy (Braun and Duveskog, 2008; Duveskog, 2013). Furthermore, FFS learning directly contributes to farmers' individual and community food security levels and livelihoods, which ensures participation and class retention (Taylor, Duveskog, et al.2012). Recognizing these developmental gains, and the similarities in Burundi's national agricultural policy to these countries it is logical that FFS promotion in Burundi could generate similar significant benefits.

B. Functional Upgrading (Cereals/Root Crops Processing): Required Workforce Development Initiatives and Key Job Profiles

Key job profiles required to achieve functional upgrading in the processing of root crops are:

Operations managers, mobile unit operators/other technicians, warehouse managers, aggregators, marketing & distribution personnel and transporters.

1) **Promote the 'business case' for investment in cassava processing:** Processing techniques for cassava in Burundi are currently rudimentary and costly in terms of labor, time, and post-harvest losses. Upgrading in cassava processing would benefit from an assessment of the different available technologies as well as their associated costs and benefits when adapted to the country context. Given its mandate, this initiative should be led by CNTA, which leads research in food processing technology in its two well-equipped laboratories in Bujumbura and has already adapted 15 small-scale food processing technologies (Sindayikengera, 2014). In the short-term, this requires coordinating with private sector including grain millers, current cereal and cassava processors operating hammer mills to identify available processing technologies, and socio-economic analysis of marketing, processing and production of cassava-wheat flour in Burundi and determine which processing technologies would be most useful for the country. Staff from CNTA would benefit from exchange visits to other regional institutions to further understand the broad range of processing technologies that would be useful to Burundi's existing agricultural output. One option may be the AMPU technology employed in Mozambique and Nigeria (see Box 11). In order to leverage this, API, and MINAGRIE should initiate partnership discussions with DADTCO and IITA for rolling out mobile cassava technology in Burundi.

2) **Develop technical processing capacity in root crops:** Once the appropriate technologies have been identified, technical training modules should be developed together with CNTA and teaching staff at ITABs and ISA. These technical training programs should then be offered as certification programs subject to accreditation at the existing technical schools (see Table 9) and also planned expansion of these schools to all provinces. In the medium-long term, these training programs could also be offered by accredited private training institutions. According to preliminary assessments of needs in the country, all provinces have highlighted agribusiness and processing as top priorities for the technical training centers (Demeester, 2013).

3) **Develop management and operations training for processing facilities**: Given that this upgrading will depend on a development of a range of post-harvest skills, training will be required in management and operation of processing facilities/plants, improved methods in aggregating and transporting cassava roots, and proper storage and warehouse management. As there are no formal education programs at either a national or regional level to provide training, in the short-term, international experts from organizations such as IFAD and IITA and private actors, like DADTCO and practitioners from Nigeria, who operate cassava flour businesses, should be consulted to develop appropriate training program. Institutionalization of these trainings is recommended at both the ITAB and university level and the existing ISA

food technologies program in particular. In the medium-long term, this sub-specialty of agronomy could be developed into a stand-alone undergraduate degree program. These training programs can also be leveraged to support FFV processing.

4) **Strengthen value chain linkages:** As agribusiness is still dominated by large number of small-scale producers and processors, strengthening value chain linkages is essential to reduce transaction costs and improve market coordination. This requires training in communication, negotiation and marketing skills to build the capacity of farmer organizations and local aggregators/collectors who either work for processors or as individual local traders. In addition, local processors would need training on marketing skills, monitoring and management of supply chain, financial management, and inventory management. Supported by international agencies such as IFAD and FAO, national higher education institutions (see Table 9) and organizations such as CAPAD could improve their current entrepreneurship training programs and deliver these training services to local value chain actors. These training programs can be leveraged to support the FFV processing as well.

C. Functional Upgrading: Cold Storage, Packaging, and Processing of Fruit and Vegetables

Key job profiles to achieve functional upgrading for the FFV sector in cold storage, packaging and processing are:

Business manager, storage unit & warehouse managers, quality controller, refrigeration unit operators, machine operators, line workers and distributors.

1) **Needs assessment and feasibility analysis:** As Burundi currently lacks cold storage and related expertise, establishing cold storage capacity in the country requires detailed needs assessment and planning in terms of items to be stored, short-term versus long-term storage, location, scale, and possible ownership and management models. Each kind of product requires specific ranges of temperature and humidity levels, and cold units can be designed to specialize or be flexible. To assess Burundi's need for specific cold storage designs and conduct feasibility analysis, experts should be brought from abroad – preferably from countries in the region, for instance, Kenya. In the short-term, these experts should also develop training material related to financial cost-benefit analysis, market assessment, appraisal of available cold storage technology options, and analysis of scale alternatives. The training module could be taught at FABI, and UoNgozi , and ISA as well as tailored to the needs of potential investors and industry stakeholders – wholesalers, cooperative federations, and relevant members of the Agribusiness Chamber of Commerce and Industry - in the country.

2) **Develop technical and managerial capacity for installation, operation and maintenance of cold storage systems:** As each cold storage unit should be based on a business plan suited for its purpose, location and markets, it is required to train workforce to undertake these managerial and technical aspects. Once Burundi opts for a particular type of cold storage technology, in the medium-long term, foreign expertise needs to be brought in to develop training curriculum together with professors from the FABI on technical aspects of installing, operating and maintaining cold storage systems. These training modules may focus on technical

capabilities to assemble, disassemble, operate and repair cold storage rooms and compressors, and electrical installations, among others. These training programs could be coordinated with the ongoing reform program in the education sector across the country being implemented by the MEBSEMFPA, Universities and BTC. In the short-medium term, training subsidies can be made available to encourage the new private sector organization, IPE Fruits, to send technicians for training in established technical programs in neighboring Kenya.

3) **Strengthen producers and marketing associations of FFVs:** Due to the importance developing and strengthening producer-trader linkages for post-harvest capabilities and market knowledge, it is essential to train wholesale traders and producers on the potential business opportunities linked to seasonality of FFV markets, produce quality preservation using improved storage and processing technologies, increased income and potential market development advantages achieved by cold storage and organized FFV value chains. Together with donor support, the Chamber of Agribusiness could provide financial support or incentives to finance missions for medium-sized producers to visit neighboring Kenya and Tanzania to meet with successful firms operating in the sector. In the short-medium term, financial support should also be provided for agronomists with experience in FFV to study post-graduate marketing diplomas and pursuing internships in the region's leading producers, Kenya and South Africa. With their supermarkets leading the coordination and consolidation of supply chains in the EAC, studying marketing and getting firsthand experience on how these projects operate will be invaluable. In the medium-long term, marketing modules should be a requirement for all agronomy and business administration programs at the university level seeking accreditation. In addition, it will be important to identify and train product wholesale traders in each locality on communication skills, community mobilization, post-harvest produce handling, pre-processing techniques, and buyers' quality requirements in domestic and regional markets. National technical institutions and organizations such as CAPAD and NGOs could deliver these training services to local value chain actors.

D. Engage Stakeholders in Skills Development for Upgrading

Success in promoting competitiveness and upgrading in Burundi's agribusiness value chains will depend on coherent strategies and programs by the government, educational institutions, international development agencies as well as the private sector. While the government has traditionally been leading workforce development initiatives through formal education institutions, these lack the necessary resources and capabilities to deliver the comprehensive workforce development strategies described in the previous section. Nonetheless, the lack of coordination of these various actors in workforce development as described in Section V, suggests that strong leadership is essential in order to achieve the scale required to successfully roll out programs in the country. The Sector Working Group on Agriculture, led by MINAGRIE, but supported and guided by development partners appears to be the best positioned group to provide this leadership. Below, we list the major roles that each of these different stakeholders can play within this coordinated context.

MINAGRIE, through the Sector Working Group, needs to define the central strategy and action plan for the implementation of these skills development initiatives. WFD initiatives of all stakeholders need to be aligned with this central plan. In particular, due to the weak financial position and technical expertise of MINAGRIE, development partners will need to provide continued financial and technical support to implement these programs.

MINAGRIE in collaboration with the Ministries of Education and Labor needs to develop a labor market information system, while also ensuring the quality of training programs. The government, supported by its development partners, should first improve information gathering and dissemination on the demand for these different job profiles in the industry, publishing salary information; second, they need to gather and disseminate information on accredited training providers in the agribusiness sector and the number of graduates by areas of specialization for each of these institutions; and third, take leadership for the management of the quality of these training programs and assessing trainee skills on completion. It is essential to maintain relevant, reliable and disaggregated data at the provincial level to help identify changing demand and skills trends, and translate these dynamics into up-to-date curricula and skills development programs. This geographic disaggregation is important given the diverse agro-ecological zones in the country.

Industry associations need to engage with educational and research institutions to improve their curricula to ensure the skills needed by the private sector are provided. Skills development is more effective if the world of learning and the world of work are linked. Industry associations should be incentivized to closely work with education institutions to ensure graduates of both technical and professional programs develop both the theoretical and practical skills required by the industry. The Sector Working Group should create a skills development task force comprising of the Federal Chamber of Commerce and Industries, the dedicated Agribusiness Chamber of Commerce, lead firms, such as SAVONOR and Brarudi, CAPAD, education and research institutions, and relevant development partners to coordinate these efforts.

Tax incentives should be established to encourage private firms to invest in the skills development of their workforces. Given the size and small capital base of private sector firms in the country, the government and development partners should promote well-designed financial incentives to encourage private sector to invest in skill gap analysis, development and implementation of training programs. At a limited scale, local lead firms, such as SAVONOR and Brarudi, have already organized internal training for new recruits in processing plants but also need incentives to provide training for actors in their local supply chain. These firms provide the best opportunity for internship and practical training given limited practical training capabilities in formal education institution in the country.

Burundi's diaspora could be a potential source for transfer of knowledge with respect to higher value skills requirements and investment in agribusiness sector. The large number of Burundian professionals living both in other countries in the region and further abroad can play a potentially important role in the development of human capital, particularly, related to developing marketing and human resources management skills. Initiatives such as the Burundi Diaspora project, which has been launched to connect diaspora with local firms, and envisions the development of mentorships are innovative ways to tap into the Burundian expertise abroad and transfer important skills and investment back to the country.

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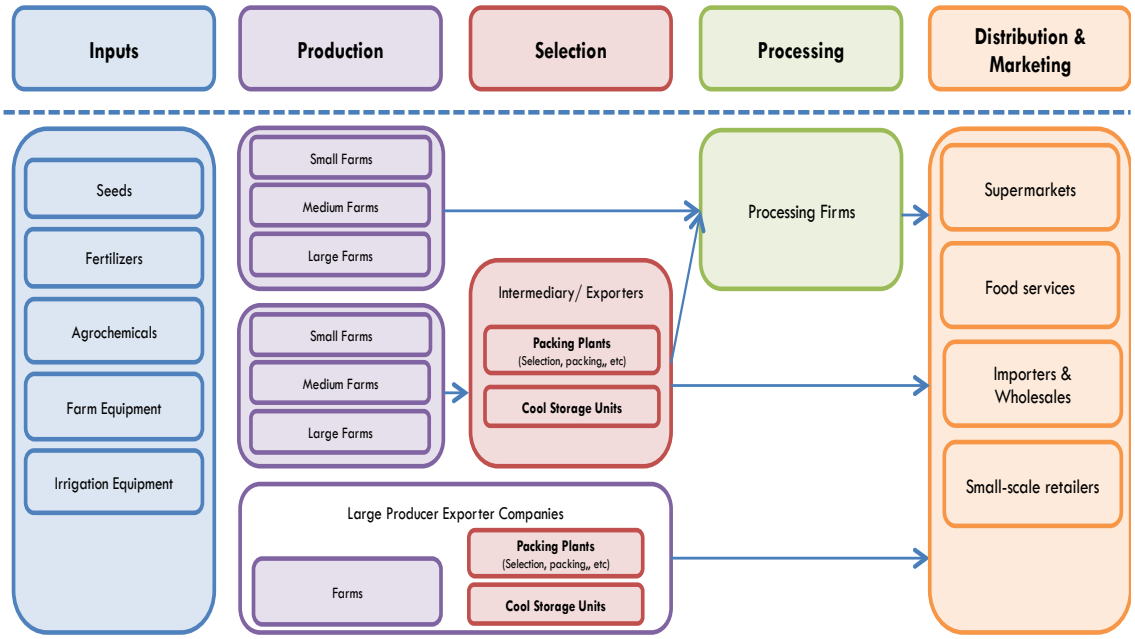
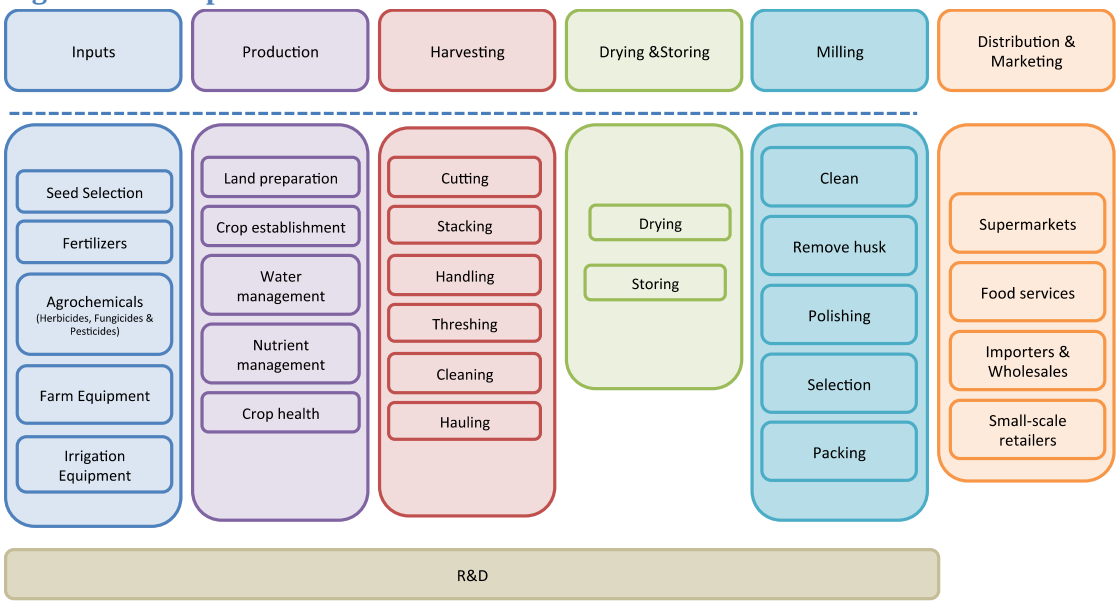
IX. Appendix

Figure 7. Example of a High-Value Agriculture Value Chain



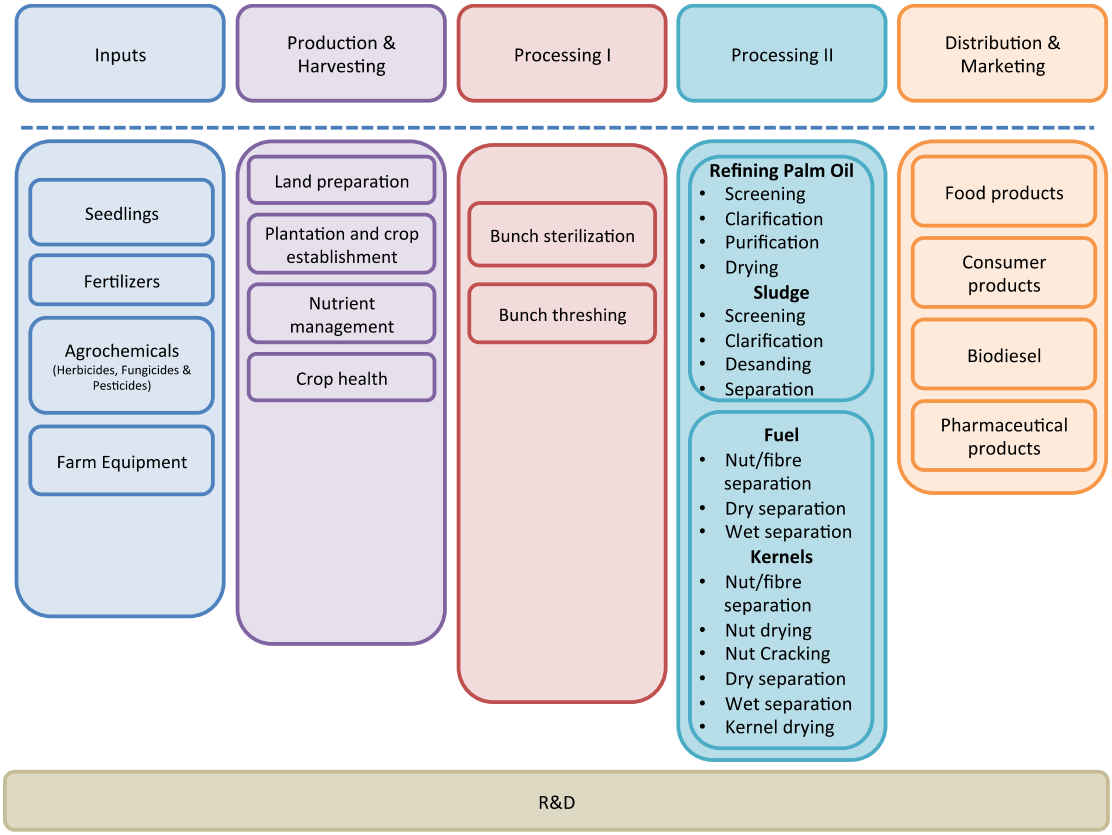
Source: Duke CGGC.

Figure 8. Example of a Rice Value Chain



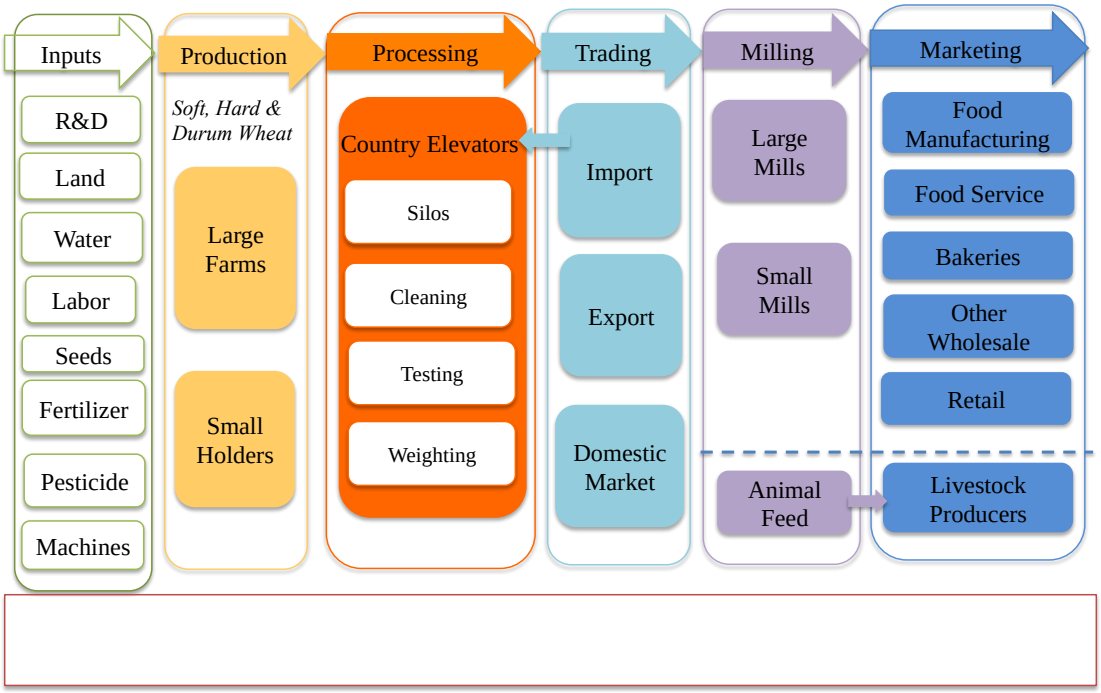
Source: Duke CGGC.

Figure 9. Example of a Palm Oil Value Chain



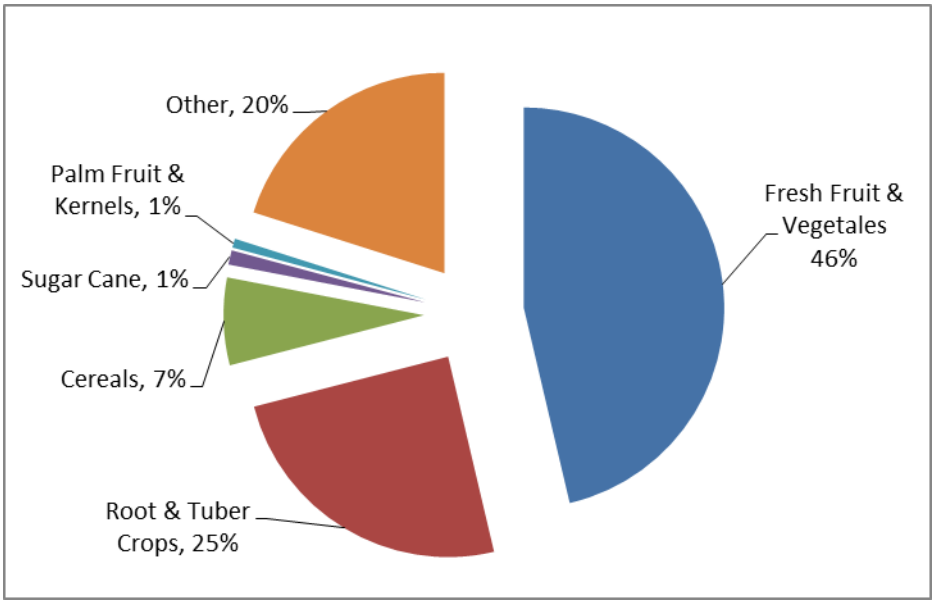
Source: Duke CGGC.

Figure 10. Wheat Value Chain Map



Source: Duke CGGC.

Figure 11. Burundi's Main Agribusiness Products in 2011



Source: Duke CGGC based on FAOSTAT.

Table 12. Palm Oil Imports into EAC countries (2011)

EAC Country	Rank in National Commodity Imports* (2011)	Quantity Imported (T)	Total Import Value (USD)	Unit value ($/tons)
Burundi	5	1,674	$2,706,858	$1,617
Kenya	2	165,702	$206,298,990	$1,245
Tanzania	2	227,171	$274,649,739	$1,209
Rwanda	2	30,642	$30,488,790	$995
Uganda	1	187,804	$224,613,584	$1,196

* Rank out of top 20 national commodity imports.
Source: CGGC based on FAOSTAT

Table 13. Palm Oil Exports from EAC countries (2011)

EAC Country	Rank in National Commodity Exports* (2011)	Quantity Exported (T)	Total Export Value	Unit value ($/tons)
Burundi	14	146	$40,004	$274
Kenya	19	9,727	$12,003,118	$1,234
Tanzania	10	12,905/89,650	$26,726,255	$2,071
Rwanda	Not in top 20	/	/	/
Uganda	7	31,468	$43,205,564	$1,373

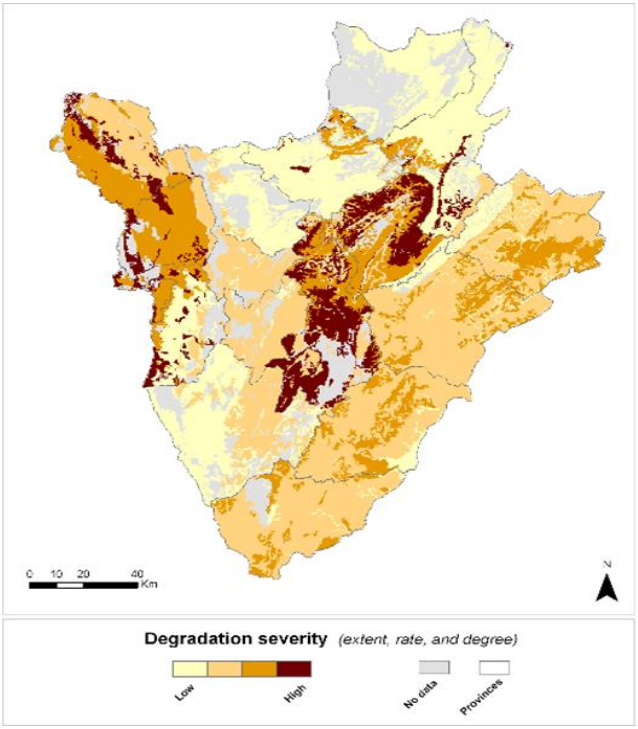
* Rank out of top 20 national commodity exports.
Source: CGGC based on FAOSTAT

Table 14. Evolution of Production and Import for Burundi's Main Cereal Items

Product	Production ('000 T)			Import ('000 T)		
	1990	2000	2010	1990	2000	2010
Maize	168	118	126	0	18	22
Rice	40	52	83	0	3	20
Sorghum	64	61	83	0	0	0.3
Wheat	9	6	9	13	12	14
Total	**281**	**237**	**301**	**13**	**33**	**56**

Source: Duke CGGC Based on FAOSTAT.

Figure 12. Severity of Land Degradation in Burundi



Source: (FAO, 2012)

Table 15. Training Initiatives in the Burundi Agribusiness GVC, by Segment 2006-2012

Inputs	Production	Processing	
Inputs & R&D	**Cultivation**	**Processing 1 & 2**	**Distribution and Marketing**
	Education Institutions Initiatives		
• University of Burundi/ ISA and University of Ngozi offer Bachelor degree programs in Agronomy. Both programs provide minimal practical experience including in programming. Curriculum has not been updated in 20 years (Field Research, 2013). No Masters or Doctoral programs are yet offered in the country. • The Burundi Institute of Agricultural Techniques (ITAB) awards A2 technical diplomas. • International Institute of Tropical Agriculture offers internship and post-graduate training and fellowships. • Agribusiness identified as priority sector for new technical training centers by Min. of Basic & Secondary Education and Vocational Training (Field Research, 2013).		• 2011: University of Burundi /ISA began offering specialization in Food Technology under the Agricultural Department.	
	Government Workforce Initiatives in Collaboration with Partners		
• 2006-2008: Training programs were run for seed multiplier groups by extension agents (IMF, 2010). • 2009-2013: PPCDR ran GIS technical trainings on how to operate read, record and electronically map and tag geographic areas for agricultural planning to 40 government participants from 20 different departments. Tailored trainings for farmers associations on use of improved seed varieties including: use, multiplication, care and storing. Developing nurseries / nursery farming including: construction, soil usage, sunlight, water and photosynthesis management, when and how to transplant into fields. • 2012-2013: PAIOSA BTC placed foreign research staff within ISABU to support capacity building.	• 2004-2010: World Bank PRASAB project working collaboratively with MINAGRIE provided training for 245,258 beneficiaries (total of 275,388 training days) in productivity enhancement techniques and operations management and leadership of producer associations (World Bank, 2012). • 2006-2008: 2,800 DPAE agricultural monitors were hired to provide extension services to farmers. (287 hired in 2006, 1,000 in 2007 and 816 in 2008 (IMF, 2010). Initial training of monitors was provided by FAO in improved farming practices (UNOCHA, 2008). 716 monitors in 4 provinces received training specifically on drought mitigation strategies (IMF, 2010). Agents ran capacity building programs for famers in fertilization techniques, production systems, packaging & preservation of seeds (IMF, 2010). • 2007: IITA led 27 policy makers and extension agents in a regional workshop on improving propagation of disease free cassava under the Crop Crisis Control Project (IITA, 2007). • 2007-2012: 334 DPAE extension agents trained by USAID in horticultural practices including step-by-step understanding of soil and plant nutrition; much of training was "on-the-job" with DPAEs "learning via collaboration with BAP team" (USAID, 2013a). • 2009 -2013: Through a PPCDR project financed by the EU, MINAGRIE provided additional training for agronomists, additional instructors and leader farmers. • 2009-2013: PPCDR farmers' association management trainings held to improve coordination, financing, economies of scale, post-harvest handling techniques, marketing and selling techniques, and recruiting/retaining farmers. Marsh (wetland) fortification trainings including how to seed, drain, soil and cultivate via marsh farming • 2011-2013: PROFEDI (IFAD in collaboration with MINAGRIE) established 15 farmers' schools focused on potatoes, soybeans, maize and groundnuts to train 450 farmers. It also included hiring an international consultant and 2 local consultants to train facilitators for the school, facilitators included 8 agronomists. 30 meetings attended by 3,378 beneficiaries were hosted to raise awareness of the need to strengthen the rice value chain in Ngozi, Muramvyu and Kizina Bubanza. 67 people were trained in rice intensification techniques, including 9 DPAEs, 10 agronomist technicians, and 40 rice producers amongst others. In addition, exchange visits with successful operations in Rwanda were arranged for some producers to observe SRI in practice & learn how to apply the techniques. Lead farmers were trained and encouraged to share with other farmers in their colonies (IFAD, 2012b). • 2013: Performance contracts were introduced with guidance and funding from BTWC to improve training performance (Republic of Burundi Senate, 2013).	• CNTA (established in 1998) mandated to research and disseminate semi-industrial food processing technologies to small and medium sized enterprises in order to reduce losses. Select training programs include pineapple preservation and supervision of passion fruit nectar and concentrate processing (IMF, 2010). By 2013, the institute had trained and supported a number of SMEs in rice processing (57) and jam, juice and nectar production (6), while 47 associations received training on tomato canning by CNTA as part of the USAID BAP program (USAID, 2013a). • 2009-2013: PPCDR Trainings on the technical aspects of constructing crop storage warehouses. Post-harvest storage management and care trainings on how to: properly handle various crops, and how to detect, prevent and remove disease.	• 2008: CNTA produced a training module on marketing processed food products and analyzing costs.

Technical Skills: • BAP (2007-2012): 6 interprovincial field days were held with ISABU, DPAE and producers to improve coordination & feedback mechanisms and identify best practices (USAID, 2013a). • 2010: National Learning Team set up amongst education, research institutions and producer associations to promote increased interaction between the different actors (Habindavyi & Nkunzebose, 2013).			
	Private Sector Workforce Initiatives		
Technical Skills: • *Ongoing:* Agrobiotec, supplier of in-vitro bananas, carried out training in banana production to expand company's capacity to mass produce disease free banana plants. 13 associations will receive training in secondary nursery management. Financed by USADF grant (USADF, 2013a).	*Technical Skills:* • 2012: Chamber of Agriculture provided training on "quality standards and good agricultural practices" to 40 members (producers/traders)- funded by EU and delivered by Kenyan consultants (Field Research, 2013). Only export oriented training program identified. • *Ongoing*: CAPAD provides technical training in production techniques for its members (Field Research, 2013). • *Ongoing:* Several processing firms provide technical assistance to their contract farmers (Field Research, 2013). Palm oil producers leveraged existing skills from DPAE agents to provide training. *Administrative & Management Skills:* • *Ongoing:* CAPAD provides training in leadership, organizational and financial management for its 81 member cooperatives (Field Research, 2013).	*Technical Skills:* • *Ongoing*: Large industrial firms provide on-the-job training for new employees working in processing operations (Field Research, 2013). *Administration Skills:* • 2012: Due to lack of local professional skills, one firm hired a foreign consultant to provide on the job training for human resources management (Field Research, 2013). • 2013: FRUITO undertook management training courses to improve operations. Financed by USADF grant (USADF, 2013a).	• *Ongoing:* AFAB regularly provides marketing training to members on issues such as regional reforms & regulations for cross border traders, and one on one support for computer literacy and use of internet (Field Research, 2013). • *Ongoing:* CAPAD provide market training to connect cooperatives to local markets such as hotels and restaurants (Field Research, 2013).
	Multi-stakeholder Workforce Initiatives		
Technical Skills: • 2007-2012: BAP worked with ISABU to identify best practices by region for 6 regions for the horticultural sector (USAID, 2013a). 24 successful nursery demonstration plots were established for the horticulture sector. Nurseries helped reduce risk and allowed for increased number of planting seasons. 80 horticulture nurseries received support in developing business plans (USAID, 2013a). • 2011-2013: PROFEDI supported 262 seed grower associations supervising handling of rice, maize & manioc, amongst others. Training on seed production techniques and organizational	*Technical Skills:* • 2007-2012: BAP project trained 5,718 famers in modern agricultural practices; 62% women. 902 were trained in "best production practices"; 4,176 field guides on horticultural production in Kirundi and French were distributed; 11 field days were attended by a total of 439 farmers (59% were women) and 47 Demonstration plots were established, and 31 passed on to DPAE agents at the end of the project. Some producers also provided basic technical introduction into concepts of water pressure and air valves to help improve understanding of irrigation techniques (USAID, 2013a). • 2012: BOAM trained 10 trainers in organic agricultural practices in Kenya (Field Research, 2013). • 2012: ACORD have also provided training for 294 people in contouring and 1,500 in vegetable gardens, run 16 information sessions on importance of water management, 7 workshops on efficient irrigation techniques and maintenance of systems and supported 3 exchange visits for farmers between regions (IFAD, 2012a). It has also translated and distributed 2,000 guides on SRI techniques into Kirundi. The organization also provided good governance and leadership training to community development centers. • Funded by IFAD, CAPAD have provided training programs to directly engage youth and women in agriculture. • 2011-2015: USADF made investments in 14 associations and SMEs in agriculture to provide training to improve their productivity in rice, potato, maize, vegetable, and fruit production (USADF, 2013a). • 2008-2013: Village Health Works supported by End Poverty Now runs a Women's Agricultural Training Program covering production and literacy trainings. 17 women graduated in the first class, the group is now on to its 5th (EndPovertyNow, 2013). • *Ongoing:* LVIA, an Italian NGO, established the Agriculture Business Center in 1973 to provide	• 2007-2012: BAP trained132 famers in 16 associations to use wooden boxes to protect products (USAID, 2013a); 503 farmers trained in post-harvest handling and conservation by CNTA. 55% were women (USAID, 2013a). Female students in agronomy from U. of Ngozi received training in value chain skills competencies and attitudes needed to establish private businesses in agro-processing sector (USAID, 2013a).	• 2007-2012: BAP provided 38 female entrepreneurs from AFAB with English language training to facilitate operations in EAC and help them to understand standards. 10 students in agronomy and economics at U. of Ngozi participated in BBIN enterprise development training (USAID, 2013a). • 2010-2012: PROFEDI organized 9 workshops on market analysis for agricultural products (IFAD, 2012a).

management was provided to 115 members of 10 associations, 63 of these were women. 1,205 nursery associations were established for tree seedlings to support reforestation; 600 members received training in nursery operations, 60% of whom were women (IFAD, 2012a) . ACORD offered a further 767 people training in nursery operations.	vocational training for youth in agricultural production techniques such as composting and soil management. After a period of focus on emergency activities the center has once again returned to agricultural issues (LVIA, 2013). *Administration & Management:* • 2007-2012: BAP trained 20 associations in savings & internal lending. In 2011, association leaders received training in production and management best practices to assist enterprise development (USAID, 2013a). • 2012: PROFEDI together with NGO Acord helped the establishment of cooperatives in the rice and dairy value chain. 14 training sessions were held on organization management of cooperatives and 495 members attended(IFAD, 2012a). Overall, Acord has worked with over 3,000 associations in the country to help them strengthen their organizational capacity. PROFEDI also developed 4 manuals to support associations ability to access to credit facilities (IFAD, 2012a). • *Ongoing:* OXFAM providing technical assistance for producer organizations including trainings in rice, groundnuts, beans & cassava (Field Research, 2013). *Literacy*: • 2007-2012: BAP trained 409 "Literacy" trainers.259 literacy centers opened and 5,230 individuals from 122 associations received basic literacy & numeracy training. Program passed on to local NGO at end of project (USAID, 2013a).		

Technical Skills:

- 2007-2012: BAP and CNTA staff trained 1,100 trained in Good Agricultural Practices & Good Manufacturing Practices (USAID, 2013a).

Administration & Management:

- 2007-2012: BAP trained 13,084 women cooperative leaders & members in organizational management, resource management, project development & governance of cooperatives, ensured women participated in exchange visits to Rwanda and Tanzania. 1,790 women trained in microenterprise development & financial management. 34 women's associations assisted in opening bank accounts & received basic literacy trainings (USAID, 2013a).

SPS Professionals:

- 2011-2012: TCBoost provided technical assistance & training to ISABU & Plant Protection Laboratory in Gitega through USAID, including needs assessment & drafting standard operating procedures and managerial documents. Training focused on good laboratory practices (GLP), SOPs, quality management and standards, and ISO 17025 standards in laboratory management. TCBoost together with FAO sent 30 officers from PPL to the Centre for Phytosanitary Excellence (COPE) at the Kenya Plant Health Inspection Services for training. 13 members participated in a one-week training on Introduction to the IPPC and Its International Standards for Phytosanitary Measures (ISPMs) to facilitate regional and international trade, 12 members were trained in Phytosanitary inspection and certification systems (FAO, 2013c).
- 2012-2015: UNIDO three year project for US$3 million under the EIF initiative, "Trade Capacity Building for Burundi", to provide additional ongoing support for SPS professionals (UNIDO, 2012).
- 2013: Bureau of Standards is currently receiving technical assistance and training from the Kenya Standards Bureau with respect to SPS standards. This is facilitated by Trademark East Africa (Field Research, 2013).

Table 16. List of People Interviewed by CGGC Researchers fall 2013 & spring 2014.

Contact Person	Organization
Abou Amadou	African Development Bank
Adijah Makangira	Farmers and Co.
Alain Karikurubu	Agribusiness Entrepreneur
Andre Phillip	One Acre Fund
Anthe Vrijlandt	Trade Mark East Africa
Baranyanduza Gerard	Chambre Sectorielle de l'Agribusiness au Burundi
Calixte Mutabazi	Interbank
Canisius Ntahe	Brarudi
Celine Demagny	United Nations Children's Fund
Christian Nkengurutse	Federal Chamber of Commerce & Industry
Dan Clay	Michigan State University
Director General	Ministry of Industry
Emile Kamwenubuza	Agribusiness Services
Human Resources Director	SOSUMO
Esaie Ntidendereza	Burundi Investment Promotion Agency
Francois Butoke	Chamber of Agribusiness
Gaspard Banyankimbona	Ministry of Higher Education
Gervais Nzinahora	Burundi Bureau of Standards
Immaculee Mpeberane	Ministry of Eastern African Community
Immaculee Nsegiyumva	The Burundi Association of Women Entrepreneurs
Jan Vlaar	Netherlands Embassy
Jean Marie Ndayishimiye	Confederation of Agricultural Producer Associations for Development
Kaat Matthys	Embassy of the Kingdom of Belgium
Kaboneka	Food and Agriculture Organization of the United Nations
Kaliza Karuretwa	International Financial Corporation
Kimba Dodo	APEFE
Luc Demeester	Belgian Development Agency
Stany Somera	IPEFRUITS
Nahum Barankiriza	Tanganyika Business Company
Ndereyimana Serge	Ministry of Basic and Vocational Education
Pascal and Neema	Ministry of Basic and Vocational Education
Olivier Bayisenge	Bakhresa Grain Milling Burundi Ltd
Paul Bitoga	International Fund for Agricultural Development
Pillar Duet	OXFAM
Prosper Kiyayila Ntema	APEFE
Rama Kant Pandey	SAVONOR
Serge Kasubutare	RUZIZI Palm Oil
Sindayikengera Severin	University of Burundi
Sindayigaya Martin	Superior Development Institute (ISD)
Steve de Cliff	University of Burundi
Tharcisse Niyungeko	Agribusiness Services
Thodomir Rishirumuhirwa	AGROBIOTEC
Valerie Claes	ISABU
Cooperative Members	Rice Cooperative