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RWANDA PRIVATE SECTOR DRIVEN AGRICULTURAL GROWTH (PSDAG)

HORTICULTURE VALUE CHAIN ANALYSIS

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HORTICULTURE VALUE CHAIN ANALYSIS

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I. HORTICULTURE VALUE CHAIN ANALYSIS

A. INTRODUCTION TO HORTICULTURE VALUE CHAIN IN RWANDA

Horticulture is grown by over half rural households in Rwanda. Rwanda's diverse geography has created unique agro-ecological opportunities for production of a wide range of horticultural crops. This horticulture analysis considers vegetable production, separate from fruits, nuts, flowers, and other types of specialty products. The main vegetable crops include eggplant, cabbage, carrot, and onion.[1] These are often grown in household gardens and on very small plots. Vegetables represent an estimated 2% of total GDP (see Table 1), and about 7% of total agricultural output in 2013, while only accounting for 3% of total cultivated land.

Table 1: Estimated Importance of Veg in Rwanda, 2013

	Area (ha)	Production (MTs)	Yield (MT/ha)	Value (RwF mill)	Value RwF/ha)
Vegetables	56,051	646,439	12	113,318	2,021,681
All Crops	2,147,913	13,502,607	6	1,606,000	747,703
GDP				4,819,000	
% Veg/All Crops	3%	5%	200%	7%	270%
% Veg/GDP				2%	

Source: 1 Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda. Michael Westlake. July 2014

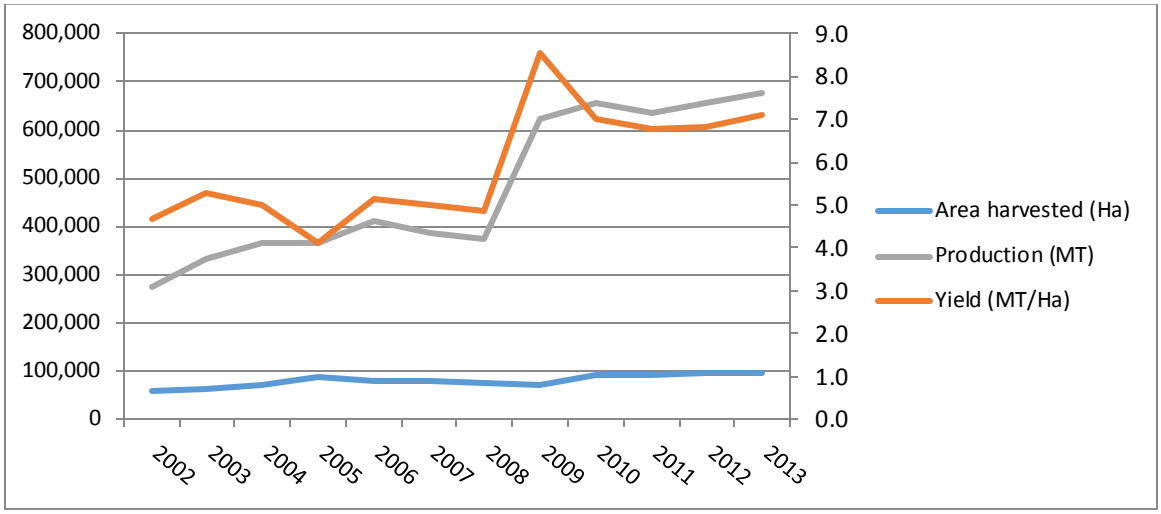
Vegetables earn 80% of revenue for Rwanda's horticulture organizations.[2] Vegetables range widely in terms of production characteristics, post harvest physical requirements, relative perishability, and the opportunity and/or sophistication of potential processing. This diversity also makes the analysis of the value chain complex. Time series data on seasonal and annual areas, yields, and production of each type of vegetable grown in Rwanda are lacking. A baseline survey was conducted in March of 2014 by MINAGRI and NAEB.

[1] Irish potatoes and cooking bananas may be considered horticulture in some instances but are not included in Rwanda as they are most often separated as key staple foods.
[2] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.

Production

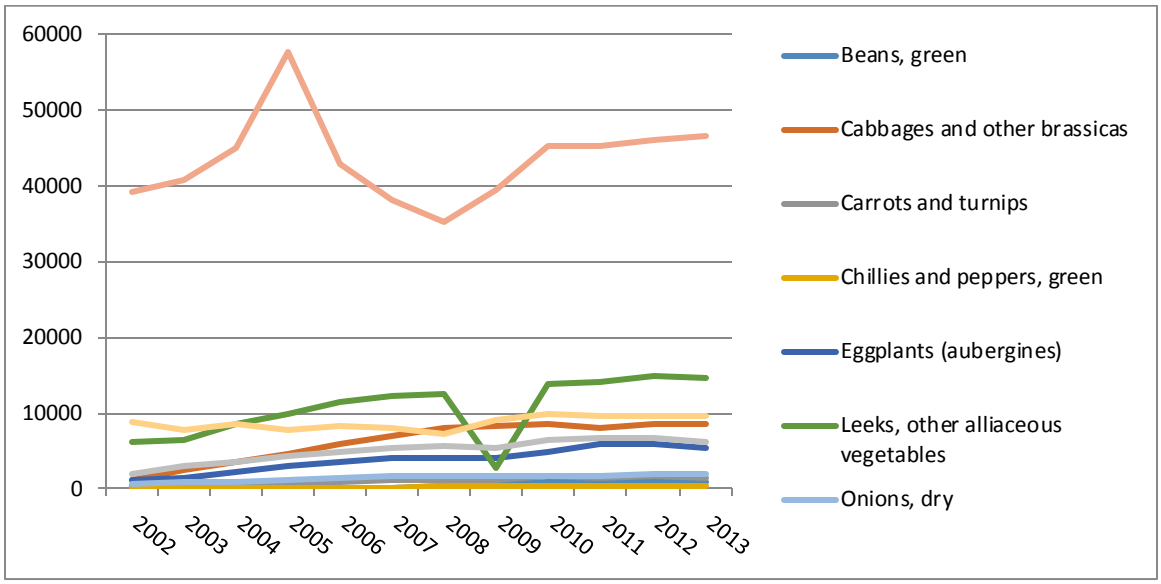
The area under vegetable production has increased about 60% over the past decade, while total production has jumped nearly 150%. There have been shifts in area under production between vegetables.

Figure 1: Rwanda Production, Area, Yield of Vegetables (combined) 2002-2013



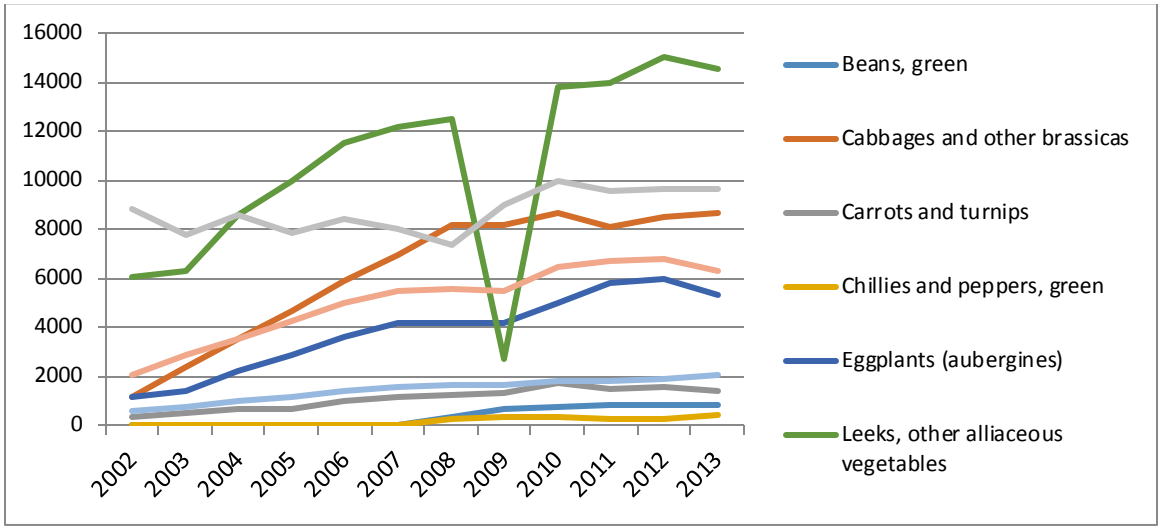
Source: 2 FAOSTAT

Figure 2: Rwanda Area under Production (ha) for significant vegetable crops



Source: 3 FAOSTAT

Figure 3: Rwanda Area under Production (ha) for significant vegetable crops excluding Pumpkins



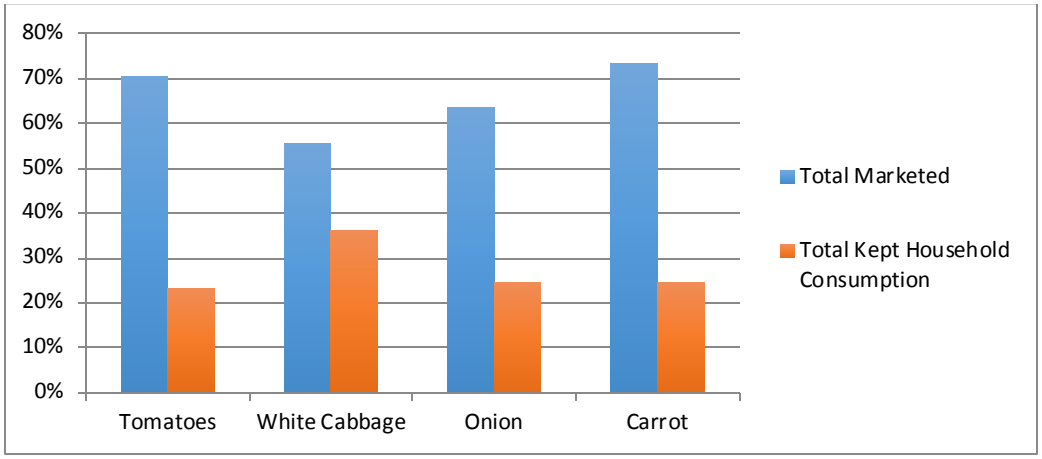
Source: 4 FAOSTAT

Pumpkins, squash, and gourds dominate the area under vegetable production according to official statistics. In 2007-2009, area under pumpkin and leek production experienced significant drops, which were subsequently regained. Cabbages and other brassicas, tomatoes, and eggplant all gained importance in area under production.

Most vegetables are grown on very small plots within household gardens. While household consumption is an important objective of these household gardens, a significant amount of the production is sold for cash, mostly by the women. Over half of the cabbage and more than 60% of tomatoes, onion, and carrots were sold into the marketplace for cash. When farmers do move into specifically producing horticulture for cash, they tend to dedicate a particular plot (still relatively small in size) for its production.[3]

[3] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.

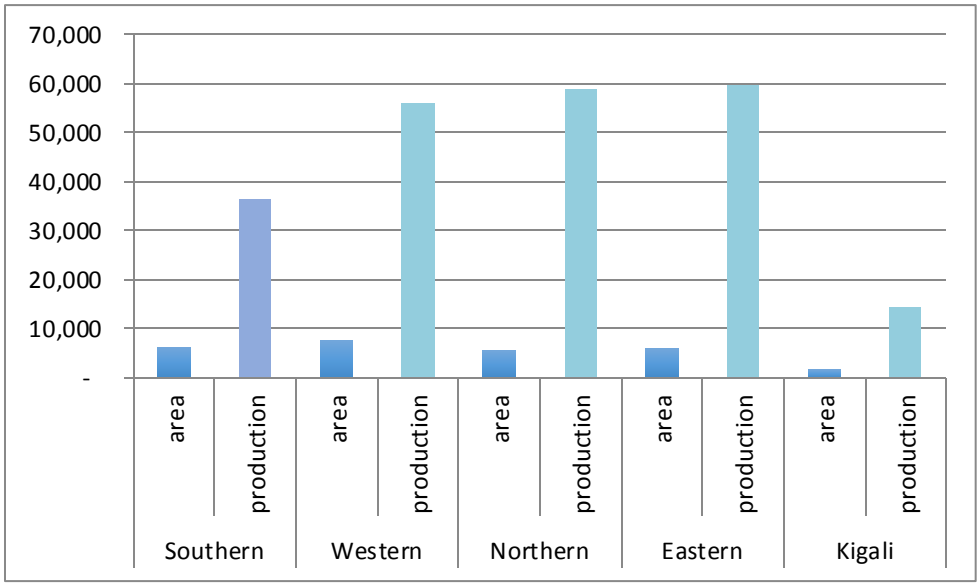
Figure 4: Use of Production - 2013



Source: 5 Seasonal Agricultural Survey 2013

Production occurs throughout the country. See Figure 5 below. While the areas under production between provinces are not significantly varied, the volume produced is; with significantly more vegetables produced in the Northern and Eastern provinces compared with the Southern Province. This relates to the distribution of vegetable type, mostly according to agro-ecological zone.

Figure 5: Rwanda Area (ha) and Production (MTs) of Vegetables by Province, 2013



Source: 6 Seasonal Agricultural Survey 2013

The Northern Province dominates national cabbage production, due to the relatively cool growing temperatures. Two-thirds of Rwanda's tomatoes are produced in Eastern Province (particularly Rwamagana district, just east of Kigali), with the remaining production divided between Western and Southern Provinces.

Eggplants are grown in Eastern, Western, and Southern Provinces, where temperatures are warmer. More than 85% of carrots are produced in Western Province.[4]

Tomato is Rwanda's second largest vegetable in volume produced and area cultivated (after cabbage), and is the largest in value. It is sold on the domestic market fresh and in processed form in last years. Rwanda is a net importer of tomatoes, mainly from the DR Congo and Burundi, although it also exports some to those countries and others in the region. There appears to be excess demand on the domestic market since some processors are anxious to obtain greater supplies of fresh tomatoes for conversion into tomato paste.

Processors, specifically SORWATOM, still suffer from competition with imported tomato paste subsidized by the Italian Government, but they feel that if they could produce sufficient volumes of processed tomatoes they would be competitive. It is believed that eastern DR Congo is a large potential market for Rwandan tomato paste since it is a common ingredient in Congolese cuisine. There is also some potential for exporting tomato paste to Burundi.

However, it should be pointed out that there are significant concerns about the quality of the tomatoes produced, at least as they are received at processing plants and supermarkets. This concern is attributable to both production practices (mainly disease control) and post-harvest handling.[5]

Consumption

As indicated in Figure 5, up to a third of vegetable production is kept by the household for its own food security and consumption. These household gardens provide an important source of micro-nutrients in the families' diets. More than half of all households have a vegetable garden. In addition to the household consumption, it is thought that the majority of the marketed vegetables are sold within the districts. This may mean that as much as 75% of total vegetable production remains within the producing district.[6] The domestic trade and consumption patterns warrant further analysis, particularly given the amount of concentration of particular crops between districts and Provinces.
The NAEB notes that vegetable demand is income elastic and that increased urbanization and continued growth in incomes will continue to drive domestic demand.[7]

B. BUSINESS ENABLING ENVIRONMENT

Government Policy

The Government prepared a horticulture policy in 2014, the Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda. The policy intends to radically transform the structure and function of the horticulture sector, with a particular focus on export earnings. Horticulture offers an

[4] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.
[5] Interview with NAEB, July 2015
[6] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.
[7] The National Horticulture Strategy, National Agriculture Export Board (NAEB), 2014

important high value production opportunity where population density requires intensive rather than extensive production. The challenge in an export focused strategy will be to balance that with the need to expand and improve the efficiency of the existing horticulture sector which serves the domestic market and could expand into the nearby regional market.

Analysis and planning related the horticulture sector is hampered by a lack of data and historic datasets. MINAGRI and NAEB conducted a baseline of the horticulture sector in 2014. The subsector data challenges are a result of the large number of varied crops within the sub-sector, the dispersed nature of production across the most rural households that serves both household consumption and cash sales, the clumping of vegetables in national agricultural surveys, and significant variability in weights and quality across the small lot transactions. While the baseline is an important first step, the lack of time series data and comprehensive datasets may unintentionally underestimate the importance of the domestic market trade.

As with other value chains, horticulture activities and market actors fall under the mandates and support of a number of different ministries and agencies, including MINALOC, MINAGRI, MINICOM, as well as various units within MINAGRI including NAEB, RAB, and MINAGRI Central. Each may have a slightly different perspective and prioritization of key opportunities and challenges (for example domestic trade versus international exports beyond the region.) The Government already has some initiatives to invest in upgrading rural market infrastructure, which should take into account the specific needs of horticulture including controlled environment storage, ventilation, shade, and cleanliness.[8] There have been previous public investments made outside of Kigali to invest in upgraded market infrastructure, including for horticulture trade. There have been mixed experiences with some never being utilized after construction (could be due to structure, location, accessibility. Potential private investors may be reluctant to invest upfront, alongside public backing.

The national objective is to develop horticulture and floriculture exports from a total of some US$10 million in 2013 to US$335 million in 2018. This 2018 export earnings target for horticulture compares with the 2013 US$145 million combined export value of Rwanda's three main export crops, coffee, tea and pyrethrum.[9] According to a study commissioned by the Dutch Embassy, "Horticulture in Rwanda, Possibilities for Further Development", the government is aiming to export 20% of local fresh produce, while retaining 60% for the domestic market and 20% for processing.

Meeting this target within five years, will require a 30-fold increase in the value of cross border horticulture exports. It will require national per capita earnings from horticulture and floriculture to exceed the current levels in Kenya, which have taken some 30-40 years to achieve.[10]

The Rwandan National Seed Law (2003) and subsequent Ministerial Orders (2010) laid the regulatory foundation for access to quality seeds for staple food crop production.[11] Despite this foundation, there are

[8] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.
[9] Ibid.
[10] Ibid.
[11] Rawanda Seed Sector Baseline Study, The African Seed Trade Association, September 2010.

still major challenges that remain to be addressed. The 2014 PSTA III recognizes the following challenges that remain:

- Strong public sector involvement in all seed sector components; further private sector involvement is needed;
- Inadequate quantities of seeds produced nationally for some crops which forces the Government to import seeds particularly for maize and wheat;
- Poor quality of internally produced seed; quality deterioration has occurred during seed production and storage.
- Poor sanitary status of seed; the prevalence of crop pests and diseases.
- Poor germination of seeds distributed under the CIP to date.
- Limited effective distribution.[12]

Currently RAB controls the import, production, and testing of all high quality seeds for staple food crop production (both hybrid and open pollenated varieties). In general, 'foundation' seeds produced by RAB are then sold to private seed multipliers (made up of both private companies and producer cooperatives.) 'Certified' seeds are then distributed to farmers for sale through a nation-wide agro-dealer network. For most staple food crop value chains, new varieties of seeds must go through official trials and testing for performance (value in cultivate in use – VCU) by RAB before they are released for sale to the general public. This process can take years, which means farmers are using old varieties. In the vegetable value chain, packaged improved varieties of high quality vegetable seeds imported from other countries do not currently require additional trials.[13] The 2013 National Seed Law is currently under review by MINAGRI and donors. Though the law has been harmonized in accordance with the COMESA Seed Regulations and African Regional Intellectual Property Organization Plant Variety Protection Protocol (ARIPO PVP), there are still concerns that law may impose restrictions on the import of seeds that would prohibit Rwandan farmers benefiting from worldwide international seed varieties.

Beginning in 2008, GoR began the process to privatize the system to import and distribute fertilizers, which are subsidized for farmers. From 2011 to 2015, the USAID Fertilizer Import and Distribution System Project (PReFER) project assisted with this program such that the import and distribution system has grown and the subsidy program has been extended from three to ten types of fertilizers, including micro-nutrients needed to boost the effectiveness of fertilizers. There are approximately 900 agro-dealers in the rural areas selling fertilizers, micro-nutrients and seeds that are connected to the subsidy and distribution system. [14]

Access to Finance

[12] Strategic Plan for the Transformation of Agriculture in Rwanda, Phase III, 2014

[13] Policies and Programs to Accelerate Rwanda's Agricultural Growth (internal memo), David Gisselquist, USAID PREFER, 14 June 2015.

[14] COMESA SEED TRADE HARMONIZATION REGULATIONS, 2014; Input from Dave Soroko, PSDAG Policy Consultant, June-July 2015; input from PSDAG staff Year 2 Work planning Workshop, July 2015.

In Rwanda, the share of access to financial services for those in the agriculture sector is minimal at about 4% compared to other sectors. The cost of credit is relatively affordable compared to other countries in the region and continent; however, access to formal financing for the actors in agricultural value chains is scarce due to a range of constraints discussed below. There are three active commercial banks including Banque of Kigali, Banque Populaire du Rwanda and KCB Bank, six microfinance institutions, and 416 Savings and Credit Cooperatives (SACCOs), one for each sector, lending to rural population including smallholder farmers and traders. In addition, the Rwanda Development Bank (BRD) has historically engaged in lending directly to borrowers in the sector, but recently restructured, divested its commercial banking arm, and developed a new strategy that would enable the bank to take on more of a facilitation role to empower and enable commercial banks. The bank has earmarked USD $170 million to assist in lending for agro-processing, mechanization, modernization, and input distribution and another USD $220 million to assist the export industry.

In general, lending in the agriculture sector for food crops remains challenging due to the following reasons:

Lenders:

- Limited understanding of agriculture value chain dynamics and market opportunities;
- Limited access to information about prospective borrowers;
- Lack of knowledge of appropriate financial product development;
- Limited expertise and tools to appraise loans, assess risk, and manage portfolios;
- Funds for lending are scarce because banks mainly rely on deposits and MFIs rely on external support such as grants.

Borrowers:

- Limited understanding of agriculture market opportunities and market information;
- Borrowers lack trust and knowledge of formal financial service providers and prefer the use of tontines (community lending);
- There is a general lack of borrower readiness – borrowers do not have formal financial records, are not formally registered, do not have a history of profitable operation or management of money, do not have a viable business plan, and/or do not have sufficient collateral;
- Lack of understanding of how to manage and use loans appropriately;
- Weak horizontal and vertical relationship between value chain players;
- Limited technical expertise in new investments, leading to higher than expected losses.

As a result, there are delays in loan approvals, which lead to cash flow issues for borrowers and lack of follow up on loan performance, creating high risk of mismanagement of borrowed funds and subsequent defaults. Commercial banks have focused more on well-established and reputable cooperatives, small and medium enterprises, and large agribusiness companies operating in thriving value chains such as maize, rice, dairy, tea and coffee. Financing to other value chains, such as potatoes, beans, and horticulture has been limited. Loans are given predominantly for pre-harvest working capital with limited loans given for investment or start-ups. In addition, the cost of borrowing is high - average interest rates are 18%- 20% per annum, collateral

requirements are 125%-200% of loan value based on fixed assets. Guarantee facilities exist, mostly through BDF Ltd., but both processing the guarantees for new loans and accessing the guarantees for defaults is slow.

Micro-finance institutions (MFIs) target smallholder farmers, cooperatives and traders in remote areas with micro to small loans. The cost of lending for MFIs is higher than commercial banks however their lending conditions are more reasonable.

Some value chain and embedded financing exists, but is limited. Horizontal and vertical relationships between value chain actors are weak and there is a lack of access to market information, which leads borrowers to 'side-selling' and defaulting on contract obligations to larger buyers. Financing for input agro dealers' trade has been sourced mostly from dealers' own funds (60%), with the remaining coming from institutional credit from input suppliers (21%), and financing from financial service providers (19%). Involvement of formal financial institutions (banks and MFIs) in financing agro dealers varies from region to region depending on the stability and profitability of fertilizer business in the area.

SACCOs in Rwanda are institutions that facilitate financial inclusion especially for the rural populations with low incomes. All SACCOs are legally registered and monitored by the Central Bank of Rwanda despite their cooperatives status. The main purpose of the SACCOs is to encourage a culture of saving and thereby raise the social and economic welfare of its members. This is achieved by pooling savings from members and providing credit based on those savings. The Central Bank monitors and grants licenses to lend to those SACCOs that have reached a minimum of 10 million RWF in savings. Once they begin to disburse loans, the Central Bank monitors the financial health of portfolios (portfolio-at-risk) and the organization's ability to properly manage the loans. SACCO's can lend a minimum of 20% of their deposits, once licensed and depending on their performance appraisal. There are about 479 SACCOs in total of which 416 are sector based, commonly known as UMURENGE SACCOs and 63 non-sector based, privately owned SACCOS. The privately-owned SACCOs have traditionally out-performed the UMURENGE SACCOs. SACCOs do not currently conduct much lending in the agriculture sector because 1) farmers do not typically provide consistent savings, and 2) like other financial institutions, SACCOS lack the capacity to assess risk and manage portfolios in agriculture, and lack products that are conducive to the needs of the agriculture sector.

Insurance is considered a vital financial service needed in order to reduce risk in agriculture lending. Three insurance companies, (SORAS, SONARWA, UAP), have started developing and testing agriculture insurance products, that include weather index insurance, crop area yield insurance, livestock insurance and disaster insurance. About 150,000 farmers have bought insurance to cover their loans, however, limited borrowers' knowledge on insurance operations and limited understanding of weather patterns and micro climates in Rwanda has negatively affected the success of such products.

C. END MARKETS

Nearly all of Rwanda's horticulture products are consumed fresh and sold in local markets. There is some evidence that the majority of the marketed vegetables are actually sold within the producing districts; that up to 75% of total production is consumed (both by producing households and sold through local markets)

within the same district.[15] Significant resources have been spent over the past decade analyzing horticultural export and processing investment opportunities in Rwanda. While these alternative end markets do exist, they have discounted the role domestic fresh markets play currently and the potential growth within Rwandan fresh markets for the majority of horticultural producers. The Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, developed in 2014, specifically highlighted the critical importance of domestic fresh markets and reinforced their prioritization over the medium term.

That said, the potential relevant markets for Rwanda's marketed vegetable production are roughly 4, although there are some overlapping characteristics between these market segments. The segments are:

- Domestic Market
  - Fresh markets which includes small lot retail through traditional market structures and small shops
  - Formal markets with international standards – including supermarkets, hospitality, and processors
- Regional Markets
  - Neighboring countries in EAC for fresh retail
- Global Markets
  - Formal markets, largely for highest quality fresh retail

Rawanda's National Agricultural Export Board reported the following exports of fresh vegetables and fruits for 2013.

Formal Exports of Vegetables in 2013		**Informal Exports of vegetable (kg)**	**Total exports made in 2013 (kg)**
Vegetable type	**Volume Net wt (kg)**		
Onions	537,716	938,649	1,476,365
Fresh beans	17,585,114	5,061,931	22,647,045
Egg plants	1,818	-	1,818
Cabbages	5,006	1,047,428	1,052,434
Green Pepper	4,236	-	4,236
Red /Hot Pepper	710	-	710
Carrots	15,676	39,491	55,167
Pears	300	-	300

[15] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.

Ginger Fresh	410	-	410
Okra Fresh	2,564	-	2,564
Pumpkins	4,680	-	4680
Garlic	2,243	-	2.2.43
Watermelons	350	-	350
Fresh Peas	100	266,148	266,248
Beet Roots	150	-	150
Cassava leaves	-	482,143	482,143
Other vegetables	38,784	3,866,788	3,905,572
Total Vegetables	18,199,857	11,702,578	29,900,194

Formal Exports of Vegetables in 2013		Informal Exports of vegetable (kgs)	Total exports made in 2013 (kg)
Vegetable type	Volume Net wt (kg)		
Passion Fruits	76,972	-	76,692
Lemons	1,079	-	1.079
Pineapples	313,739	36,076	349,815
Ripe Bananas (apple banana, big apple, etc)	39,071	136,977	176,048
Mangoes	300	-	300
Apples	2,985	-	2,985
Avocados	1,970	645,936	694,039
Orange and other similar	-	75,309	541,495
Other Fruits	6,562	508,291	594,853

Source: NAEB, (original source of raw data: RRA/BNR)

Some processed foods are available on market shelves in Kigali and elsewhere in Rwanda and some of them are produced in Rwanda. But most of those products are not locally produced, and fruit and vegetable products are few and far between.[16] Volumes, quality, consistency and predictability of supply, and post-harvest handling and packing requirements and expectations vary considerably between vegetable types and end markets.

[16] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.

Domestic Fresh Markets

Vegetable marketing mostly occurs in small lots by producers into the local spot market. The marketing is opportunistic and based on available surpluses from their small household gardens and vegetable plots. Much of the vegetable trade occurs with the producer traveling to the local market, unlike many of the staple crops where traders approach producers at their farms. This is most likely because diverse vegetable production results in more varied harvest windows and the relative perishability of the crop. Unlike maize which has a general harvest season for an entire producing area, tomatoes, eggplants, and even cabbages mature over a period of time and once harvested, must reach market quickly due to perishability. This requires the producers, often the women who are handling the household garden, to travel to the market and abandon her other household and farm work for marketing purposes.
The majority of the production is sold to retail traders. Wholesale traders do exist and aggregate production either from producers, local markets, or from cooperatives or other horticultural organizations for sale in larger markets, such as Kigali. There are three main wholesale multipurpose markets in Kigali that handle vegetables (.Kimirongo, Kimisagara, Nyabugogo.)The few processors and specialty buyers (such as institutional buyers and/or high end retail supermarkets and hotels) are more likely to buy from horticultural organizations or the larger wholesalers, than aggregate their own volume from individual producers or local markets.

No comprehensive dataset is available on vegetable volumes marketed into the Kigali market. Many of Kigali's peri-urban areas have households with their own vegetable gardens, which makes estimating overall urban demand in Kigali more complex. The lack of data on trade flows makes it more difficult for producer organizations to enter the Kigali market as periodic wholesale sellers and the planning for future market and logistical center growth. That being said, the baseline study produced by MINAGRI and NAEB in 2014 reported that the principle crops sold in Rwanda in order of volume are tomato, onion, sweet pepper, and passion fruit.

Price

Prices vary by end market. Prices to processors are the lowest prices received. This is a relatively small proportion of the total marketed production. The processors mostly operate on contract, thus offer a lower price, but a guaranteed off-take.[17] Producers report a preference for urban (Kigali) and regional markets, over their district markets based on a perception that prices paid within the existing fresh spot market is higher. Most of the international interest they noted during the Baseline for the National Horticultural Strategy was directed towards DRC, Burundi, and Uganda. The border areas near Goma and Bukavu, DRC, already have relatively high concentrations of horticulture focused organizations, which likely sell into those markets through informal channels.[18]

Standards

[17] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.

[18] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.

As noted, the prices paid by processor are often the lowest received by the producers. There is a perception that the processors take 'seconds', and thus have lower standards than the main horticultural trade. As the processors mostly work under production contract, it isn't clear how much (if any) production the contracted producers direct to alternative markets. The volumes are small enough that this should be relatively easily confirmed.

The local fresh markets and retail trade which dominates the fresh vegetable spot market and thus the domestic horticultural trade have few quality, volume, or standard specifications. The market prioritizes product size (70%), sufficient volume (49%), and product color (34%)[19], but no price premiums are available to incentivize particular production and handling practices.

Price premiums are paid by the higher-end quality opportunities that include domestic supermarkets and specialty markets along with international export markets. These standards include harvest and post-harvest handling to minimize loss of quality and value both before and after sale (bruising, packing, temperature management, pesticide residues, and similar standards.) The investment of international supermarket chains in the Rwandan market (including South African and Kenyan chains) have increased the domestic demand for vegetable products of these qualities, but the absorptive capacity of these markets remain low. This opportunity will grow, but will not be a market opportunity for the population of horticultural producers.

Exports

Rwanda is subject to the trade arrangements of the Common Market for Eastern and Southern Africa (COMESA) and the East African Community (EAC), which it joined in 2007. The majority of the regional trade occurs via informal unregulated trade and is likely under recorded. According to the available data collected by the Rwanda Revenue Authority and the National Bank of Rwanda, total formal and informal cross-border exports of fresh vegetables in 2013 amounted to an estimated 31,934mt, valued at US$9.5 million (Table 6). Cross-border imports of fresh vegetables were 11,996mt, valued at US$2.8 million. In 2013, exports of edible vegetables and tubers were an estimated US$3.5 million. The low unit value of these exports suggests that they comprised principally tubers.[20]

Since 2009, there have been four donor-funded studies that have sought to identify the Rwandan horticulture crops that are most suitable for international export. The list of crops that have been identified as possibilities is lengthy; and for any of the potential crops there is little to no experience leaving information gaps in terms of suitable areas, best agronomic practices, realistic yields, and obtainable FOB prices.[21] The NAEB intends to select a subset of 6-8 products and conduct detailed market analyses and develop strategies, pilot production with RAB, sell initial export lots with private exporters, and prove the viability of the opportunity to promote investment. Any donor program related to export value chains would be expected to incorporate horticulture piloting activities in support of the national strategy.[22]

As of July 2015, NAEB reports the following exporters of horticulture produce:

[19] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.
[20] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.
[21] Ibid.
[22] Ibid.

Exporter	Exported crops	Current export	Potential export (t/week)	Comment
KK Foods	Chilies (hot pepper and birds eye)	1.7T/ week	15	The shipment is done once a week
Fresh Park	Avocado, banana and Chilies	Average 3T/quarter	Not identified	The shipment is made at irregular frequency.
Proxy fresh	French beans and snow peas	8t/week	20t/week	The shipment is made twice a week (4tons per each)
LOTEC Rwanda	French beans and snow peas	Nothing on ground	French beans: 5 MT/week Snow peas: 3 MT/week	The exporter has left the country
PEBEC	Dried birds 'eye chili	32 T per annum	1,000T per annum	The shipment is generally done once a year

Processing

With the majority of Rwanda's vegetables marketed into fresh markets, there are only a few vegetable processors.
SORWATOM is a tomato paste and ketchup processor started in 1986. The company has struggled to source locally produced raw material. In 2011 the processor contracted 10 cooperatives in Kayonza, Ngoma, Bugesera, Kamonyi and Nyanza districts and pre-financed production. The farmers and the processor experienced severe crop failure due to heavy rains and flooding. The processor reportedly lost 60 million RWF and the company was sold. Currently the company imports and distributes tomato paste from China and is not utilizing the processing machinery. The owner is interested in trying to source raw material locally again, but is hesitant to pre-finance production. Mayaga Processing Company is currently piloting processing locally sourced tomatoes into ketchup.

PEBEC Ltd. is a locally-owned company started in 2004 with the goal of exporting dried chili (birds' eye variety). The company exports 32 tons of dried chili to Spain and India per year. The company is using an outgrowing scheme with 15,000 smallholder farmers working either as cooperatives or individuals located mostly in Bugesera and Nyagatare districts. Through this partnership, the company makes its own nursery and gives seeds to contracted farmers and pays them 1,000- 1,200 RWF per kg of dried chili. So far, the company has three collection centers which facilitate aggregation of produce and serve as drying facilities. (The drying ratio is 3:1 – 3 kgs of fresh chili yields 1 kg of dried chili). The company exports 90-95% of

production of grade A and grade B, while the final 5-10% of grade C is sold on local markets. The company was supported by USAID through technical. The main challenges faced by PEBEC are lack of long-term financing for working capital and for the construction of additional collection centers to expand. Once those challenges are solved, the company is expecting to export at least 1,000 tons per year and increase the number of farmers from 15,000 to 200,000. PEBEC aims to begin working with farmers located in Rusizi and Rubavu Districts and extend its current framework with new farmers located in existing areas. In the future, the company also wishes to have a processing unit to increase value addition of chili.

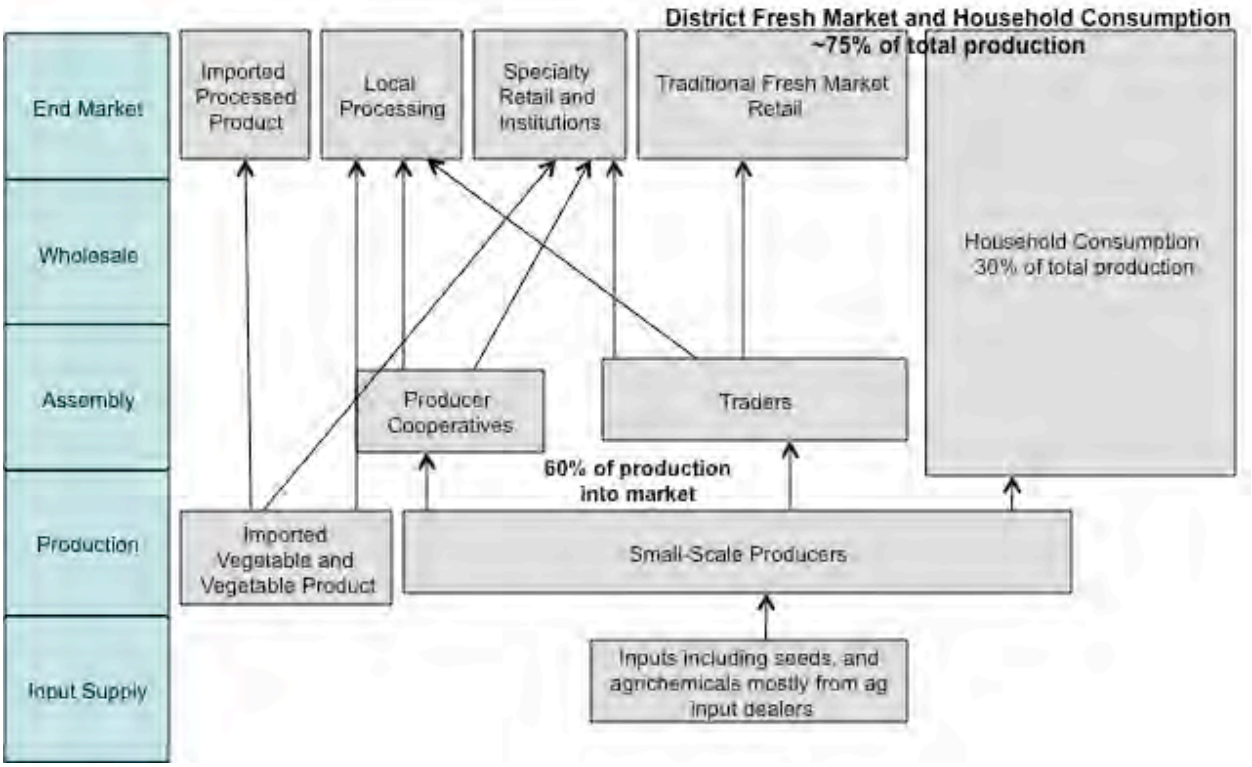
Artisanal businesses dry chilies and some produce jams and preserves, including cape gooseberry. The smaller scale artisanal processing occurs in rural areas, near the production. Some horticultural organizations and cooperatives are involved and own these cottage industries. The larger horticultural processors set up near Kigali, to facilitate access to the main end market and remain engaged in the relevant advocacy and enabling environment relationships.

D. CHAIN ANALYSIS

1. STRUCTURE OF THE VALUE CHAIN

VALUE CHAIN MAP

Figure 1. Horticulture Value Chain Map



Inputs[23]

Because of the very small vegetable plots, farm households require small amounts of seed and other inputs, including some ag chemicals. The package sizing is often smaller than the minimum available packaging and the agricultural input deals will open and breakdown larger packages and sell in whatever quantities the producer needs at a bulk unit rate. This can reduce the price of the input as the dealer offers a unit price equivalent to a larger volume package plus handling. But this also introduces potential quality and/or fraud potential as the producers are no longer able to identify quality based on sealed packages from the source. As previously noted, RAB controls the import, production, and testing of all high quality seeds (both hybrid and open pollenated varieties). In the vegetable value chain, packaged improved varieties of high quality vegetable seeds imported from other countries do not require additional trials. Future revision of the National Seed Policy and Seed Law may affect that, however. In addition, up until 2015, RAB supplied 100% subsidized seeds to farmers for the CIP program (RAB sold foundation seeds to seed multipliers and then bought certified seeds from them to distribute to farmers). In 2015, MINAGRI added seed to the list of inputs that are partially subsidized, whether locally produced or imported, however demand for seeds is currently low as the privatization of the market is nascent. There are three licensed private seed importers, Kenya Seed, Seed Co., and Paana, and MINAGRI is encouraging them to invest in local seed production. While a certification and testing mechanism exists, these mechanisms still fall under RAB and are not independent of foundation seed production. In order to commercialize vegetables, access to high quality, high yielding seeds is a requirement in order to ensure higher volumes and better quality.

[23] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.

As previously noted, MINAGRI, in partnership with the USAID-funded PReFER, has been working to privatize the fertilizer industry. As of 2015, there are eight (8) licensed fertilizer importers and investment in fertilizer stock increased by 16.6% from 2014 to 2015. In 2015, the subsidy program was increased to include micro-nutrients, seed, and compound fertilizers at 25%-35% subsidy rate. The PReFER project facilitated the establishment of over 900 rural agro-dealers linked to input suppliers and MINAGRI through a mobile phone-based application, mFarm. It has been noted that both input suppliers and agro-dealers still face challenges in fertilizer trade credit.

There are two designs of greenhouses that have been used by farmers in Rwanda: 1)Balton Rwanda and 2) BTC/RHODA. Both designs are small measuring 120m2 (Balton) and 320m2 (BTC/RHODA). According to interviewees, the greenhouse model from Balton is not suitable for the Rwanda climate because it lacks adequate ventilation, leading to high temperature. Average investment costs and returns of using a greenhouse to produce tomatoes are as follows:

Average investment costs:

- Purchase of greenhouse + installation: 7,000,000 RWF
- Purchase of inputs (seeds, fertilizers, chemicals and labor): 1,000,000 RWF
- Total costs: 8,000,000 RWF

Estimated revenues:

- Average yield: 8 tons per year
- Average selling price: 500 RWF per kg
- Total revenues: 4,000,000 RWF

Return on investment

- Estimated payback period: 2 years

Without green house, the average yield is estimated to 15 tons/ha. With green houses, the expected yield is estimated to be 240 tons per hectare. [24]

Improvements in mechanization and irrigation were key initiatives set out in the Strategic Plan for the Transformation of Agriculture in Rwanda Phase III (PSTA III). GoR has invested millions of dollars in these two sectors and is now seeking to transfer ownership and future investment to the private sector. However, due to low demand for expensive machinery and slow adoption of new technology, many machines (tractors and power tillers) remained on MINAGRI's balance sheet (in July 2015 GoR auctioned some machinery). There are 88 irrigation schemes covering 30,508 ha (5% of potential) with irrigation infrastructure provided and maintained by GoR at a cost of over USD $100 million, including the fixed investment and ongoing monthly maintenance. A variety of crops are produced on the land covered by irrigation, however, a recent study conducted by Africa LEAD suggests that farmers should shift production to high value horiticulture in order to privatize the schemes and make them more viable.[25]

[24] Based on average costs from NAEB and three producers utilizing greenhouses to produce tomatoes.

[25] Baased on internal reports of the Investment Support Unit of MINAGRI, August 2015; Africa LEAD presentation and report, August 2015.

Producers

Most vegetables are grown in valleys and almost half of rural households are involved in some level of horticulture production. Vegetable production competes with other production promotion programs for production area, including the main crops supported under the Government Crop Improvement Program (CIP.) This includes competition from maize, which is an important staple crop for the producing households. There are some large-holder horticulture farms (550 in 2013), and 2/3rds of them produce vegetables, although the plots remain relatively small. The main vegetable crops are tomatoes and cabbages.[26] The farmers receive extension from a very new farmer-to-farmer extension structure, 'Twigire', officially launched in 2014. Under this system, producers will be organized into groups of 15-20 and will agree on their own priority crops for training and extension. The system has the potential to provide extension to all producers and the selection of crops by group should be demand driven. In the case that horticultural crops are chosen, it will be important to ensure that production, post-harvest, and marketing of horticultural crops are given the attention and financial support needed and are not crowded out by the CIP crop priorities and expertise.

Because the marketing is largely spot market into the complex and decentralized fresh retail markets, there are very limited vertical integration opportunities for producers to access technology, expertise and training, or finance through the value chain.

Producers get nearly 80% of their information (inclusive of all relevant information from inputs through production to market details from person to person sources.) Market information provided by organizations and other producers represented between 20%-25% each; about 50% total of their market information.[27]

Assembly and Wholesale

Vegetables are diverse in their marketing related characteristics and handling needs. Long distances are often traveled by producers who harvest and market smaller volumes at a time. Relative perishability is one factor influencing price and negotiation between buyers and sellers. The existing market infrastructure is generally crowded with limited physical room for expansion. The markets do not have controlled climate storage available for producers, wholesalers, or retailers. Wholesaling typically occurs in the early morning, with retailing largely occurring the same physical space starting mid-morning, after the wholesalers have removed any unsold product.

Post-harvest losses are generalized to be significant, up to 40% of product leaving the farm for market. The World Food Logistics Organization conducted a survey of losses for select horticultural crops in Rwanda, published in 2010.[28][29] They measured losses along the value chains of tomatoes, pineapples, bananas, and

[26] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.

[27] Baseline Report on the Rwanda Horticulture Organization Survey, MINAGRI and NAEB, March 2014.

[28] Identification of Appropriate Postharvest Technologies for Improving Market Access and Incomes for Small Horticultural Farmers in Sub-Saharan Africa and South Asia, WFLO, Dr. Kitinoja, 2010.

[29] The WFLO study analyzed post-harvest losses of select horticultural crops in Rwanda, Benin, Ghana, and India only.

leafy greens. There are four main factors contributing to postharvest losses: lack of utilization of harvest indices, inadequate packages, lack of temperature management, and low market value.[30]

Post-harvest losses (sorted out before sale, not including reduction in value such as mechanical damage) in tomatoes amounted to 7.8% at the farm level, 10.7% at the wholesale level (18% experienced a reduction of sale value due to decay and mechanical damage), and 14.7% at the retail market level. Leafy greens, the other vegetable, is considered a highly perishable crop (tomatoes are moderately perishable.) Leafy greens experienced an average of 8.3% loss at the farm level, 2% at the wholesale level (27.5% experienced a reduction of sale value due to decay and mechanical damage), and 25% at retail.

The post-harvest losses measured in the tomatoes in Rwanda tended to be lower across the board than in Benin and Ghana where tomato post harvest losses were also measured. In particular the temperatures documented in Rwanda tended to be lower than Benin and Ghana. Rwanda also was found to utilize strong baskets that provide a medium amount of production, but do limit transport efficiency, as they could not be stacked. Rwanda had the lowest of the tomato post harvest losses measured across Ghana, Benin, and India.

Leafy green post-harvest losses were measured in Rwanda and in Benin. Low relative humidity levels were found in all of the Rwandan samples, contributing to loss of weight and condition. The greens were also not often graded or sorted at the wholesale level, which increased the cull at the retail level. Weight loss of amaranth leaves over 6 hours of daytime retail marketing was measured to be 11% in Rwanda.

Processing

While a small few horticultural organizations do some artisanal processing, the main processing of vegetables is SORWATOM, a tomato paste and ketchup processor. SORWATOM is currently importing Chinese tomato paste for packaging and processing for the Rwandan market. They were established in 1986 and have struggled to build a business model around local supply.
Given the importance of and price premiums to be offered by fresh market, a focus on grading, sorting, and packing for fresh market sales may offer higher margin entry opportunities to post-harvest than processing, although as production increases and market segmentation evolves, new processing opportunities may emerge.

Organizations

The Government has encouraged the development of horticultural cooperative and associations. This has been led by the NAEB and over 90% of existing organizations have been established since 2000. More than 50% are even younger, having been established since 2010. The NAEB conducted a baseline survey of the horticultural sector, focused on organizations and surveyed all 1,155 existing organizations. Of those, 607 are cooperatives, 193 are registered organizations, and 313 are unregistered. These horticultural organizations

[30] Identification of Appropriate Postharvest Technologies for Improving Market Access and Incomes for Small Horticultural Farmers in Sub-Saharan Africa and South Asia, WFLO, Dr. Kitinoja, 2010.

"In Rwanda, vegetables are traditionally perceived as women's crop because usually grown for home consumption (amaranths, cabbages, aubergines). The traditional trend may justify the outnumber of women in horticulture farmers cooperatives. But when some horticulture crop became market oriented like tomatoes, onions, men started getting more interests in decision making and also managing plots for tomato production. There will always be gender dynamics along horticulture development. As PSDAG, we need to think how to position women farmers' groups or cooperatives (generally including both men and women by nature) accessing to marshlands which are public assets. At household level, women remain the decision makers around the kitchen gardens." Marie Nizeyimana, PSDAG Value Chain Specialist.

include fruit, nuts, and specialty products in addition to vegetables. While the organizations do play a role in marketing, it is an insignificant role, which confirms the previous description of horticultural marketing dominated by local spot fresh markets. Only about 9.2% of all vegetable production (by weight, not value) in 2012/2013 were sold through these organizations. Women's membership in the organizations were found to outnumber men; and women dominated organizations tended to achieve higher outputs per unit of land but lower average returns (due to overall smaller plot sizes.) About 44% of the organizations received some type of external assistance including extension, inputs, or tools. The funding and assistance came from local authorities, NAEB, RAB, varied NGOs, and donors. About 2/3rds of the organizations are specifically vegetable focused; tomatoes representing the focus of 28%.

As they represent such a small percentage of the volume marketed, it isn't a surprise that they sell into smaller segments of the market. Often the organizations arrange contracts with retailers and/or wholesalers and about 8% of their sales are sold to institutions, including supermarkets, hotels, schools, prisons, etc. Some of the organizations have collective production that is marketed as an organization. There is some development of organizations closer to infrastructure, including roads and transport, particularly with links into Kigali, as well as along the border areas with Bukavu and Goma.

Vertical and Horizontal Linkages, Governance and Inter-firm Relationships

Vertical linkages:

Within the current horticultural sector, the majority of sales are spot market and trade is fairly localized. There are few vertical linkages within this spot market. The few processors and specialty buyers (such as institutional buyers and/or high end retail) are more likely to buy from horticultural organizations or the larger wholesalers, than aggregate their own volume from individual producers or local markets. This is where vertical integration through contracts or agreements may exist.

Horizontal linkages:

Horizontal linkages are largely at the producer level in the form of horticultural organizations, which have been characterized in the previous section describing the value chain actors.

Other Programs and NGOs supporting the Horticulture Value Chain

IFC – A member of the World Bank Group, IFC is the largest global development institution focused exclusively on the private sector in developing countries. Through their Governance for Competitiveness program, IFC has been engaging with NAEB to improve the enabling environment for the export of horticulture. Among their initiatives to be released in late July, early August 2015 are identifying land suitable for horticulture development, piloting of a private sector feedback tool, and the inauguration of a Horticulture Working Group that functions outside of the current public/private dialogue system supported by the Private Sector Federation. In addition, IFC is supporting several initiatives to improve / create important policies that

Land, Husbandry, Water Harvesting and Hillside Irrigation Project (LWH) – This is a five-year project ending in 2015 funded by The World Bank, Canadian International Development Agency (CIDA), United States Agency for International Development (USAID), Global Agriculture and Food Security Program (GAFSP) and the Government of Rwanda (GoR). The project is supporting horticulture producers through provision of training on good agricultural practices, building post harvest facilities like charcoal coolers, and linking farmers to potential exporters.

The Dutch Embassy (EKN) and SPARK - The Dutch are very interested in facilitating horticulture for export due to demand for imports in the Netherlands of high value crops. They are therefore heavily involved in improved seed production (potatoes), introduction of new technologies (greenhouses), and business-to-business matchmaking.

2. SYSTEMIC CONSTRAINTS IN THE VALUE CHAIN

As noted earlier, access to finance for working capital and investing in new technology is a constraint for the entire agriculture sector. While the National Seed Law is under review, currently, there is a lack of liberalized policies, laws, and regulations that fully support the privatization of the seed sector, which then limits the lack of access to a wide variety of improved seeds. Identification and acquisition of consolidated land suitable for horticulture is also a constraint, though this is a high priority for GoR, specifically the Investment Support Unit (ISU) of MINAGRI. MINAGRI is the custodian of all public marshlands set aside for agriculture and animal husbandry. In 2015, the ISU created an electronic database using scanned land titles issued on registered parcels. The database will enable the Ministry to monitor the use of the public land under its custody and to ensure optimum productivity by the current and/or future users. Currently, the database only includes the size and location of the mapped land. The ISU would like to conduct a physical verification of the land and provide more information about the land that would be useful to the investment process, such as current land use, who is using the land (natural or legal person), what types of user/ownership rights do the current users have, what types of crops are grown on each parcel and confirm if the parcel is under the land use consolidation scheme, and the physical and GIS address of each parcel including district, sector, cell and village. Traditionally, Rwandan farmers have been subsistence farmers, which means they lack knowledge about market opportunities and skills to produce commercially viable volumes that meet minimum criteria and standards. Rwanda is landlocked, which means accessing foreign markets relies on transport over roads and air. Airfreight is comparatively expensive in Rwanda for transport of horticulture due to several issues – lack of sufficient and consistent volumes means rates are relatively high for exporters, lack of cold chain in rural areas, high dwelling times at the airport, higher landing fees for airlines, higher customs and storage fees for exporters, and lack of inexpensive 'legal' packaging materials.[31]

With the complexity of the various horticultural products and lack of historical datasets, it isn't clear if there is a significant yield gap that could be closed to increase productivity and margins at the producer level with the existing portfolio of crops. As noted previously, there are ranges of agricultural input dealers selling the necessary supplies, but they are breaking down larger packages of seeds and inputs that reduce a customer's confidence in quality.

[31] Draft study on Airfreight Competitiveness in Rwanda, IPAR August 2015.

With new crops that might be targeted for piloting under the export horticulture initiative, there will likely be the introduction of new crops, which could require the importation of new planting material and seeds for production. It is likely that many of these potential crops will have been grown elsewhere in East Africa and the policy intends to prioritize utilization of genetic material already proven in the region.[32]

One of the highest cost inputs for horticulture is labor. Most vegetables are high labor, intensive production. While the plots are small, family labor may mostly be used, but further intensification may subject horticulture, both for domestic and regional markets as well as international export markets, to increased hiring of labor. The National Horticultural Strategy[33] notes multiple times that Rwanda is a relatively low cost labor country. Given the critical component labor holds in the cost of production and competitiveness, benchmarking labor costs, labor efficiency and productivity, and ensuring labor saving technologies, both at producer and post harvest points will be important.

There is little market intelligence available particularly for domestic and regional vegetable, in part because of the challenges generally related to horticulture sector and market data. Esoko collects indicative prices from 61 wholesale markets weekly. This indicative market price data is available via text message for a small price. The development of additional market related data (trade flows), and market intelligence (correlation and trend analysis, news and enabling environment analysis in domestic and regional markets) will require capacity building of producers to best utilize the new information and intelligence. There is more global market intelligence and data available, and is mostly accessed by larger traders, processors, and association.

Post harvest handling and logistics are constraints to improving domestic market function and efficiency. There are four main factors contributing to postharvest losses: lack of utilization of harvest indices, inadequate packages, lack of temperature management, and low market value.[34] Harvest and post-harvest constraints start at the producer level. There are few current market signals or premiums available for particular post-harvest practices and thus farmer utilization of the best available technology (even basic technology, such as use of harvest indices) are minimal.

More analysis and work is necessary to identify the specific constraints, starting with the retail and wholesale trade and then assisting them to establish the capacity and incentives up the chain.

To access international markets, Rwanda must overcome

- Scattered and unorganized production,low yields, which limits volume;
- Unsuitable varieties for destination export markets
- Lack of appropriate harvest and post-harvest practices and technologies to maintain quality and reduce loss

[32] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.
[33] Development of a National Horticulture Policy and Strategy for pro-poor growth in Rwanda, Michael Westlake, July 2014.
[34] Identification of Appropriate Postharvest Technologies for Improving Market Access and Incomes for Small Horticultural Farmers in Sub-Saharan Africa and South Asia, WFLO, Dr. Kitinoja, 2010.

- Potential challenges due to cost and productivity of labor[35]
- Inadequate or non-existent logistics facilities including cold chain and packing infrastructure
- As a landlocked country, Rwanda lacks any sea freight options in comparison with regional neighbors, Kenya and Ethiopia.
- As with any new industry, Rwanda lacks market connections and global horticulture is a fairly mature market.

E. OPPORTUNITIES AND INCENTIVES FOR UPGRADING

Horticulture is produced by most rural households and while it represents an important household food and provides important micronutrients, about 60% of this very small-scale production is sold into the cash marketplace. While horticulture occurs across Rwanda, there are areas of specialization for production in particular districts and Provinces. The vegetable sector is highly diverse and supplies an important domestic market with regional and global opportunities.

Market data and the development of useful and relevant market intelligence offer the first opportunity to upgrade the value chain. Active market actors and prospective investors will be able to make more efficient and rational decisions with improved information and intelligence. Affordable systems to better capture trade flows (volumes) and seasonality of trade across Rwanda's wholesale markets should be possible. A stakeholder association could develop relevant market intelligence products to meet active actors from producers through retailers.

In addition to more detailed data regarding trade flows, more analysis of market segmentation, products, traders, and any potential premiums which might improve quality and/or reduce loss is needed. The focuse has been largely on export oriented crops, while there are still significant knowledge gaps about the domestic market. Trade appears to be quite decentralized with little to no premium for quality and/or improved handling and packing practices by producers and/or wholesalers. Further understanding of domestic market function could identify opportunities to improve efficiency, reduce loss, and potential premiums and market signals to encourage producers to adopt harvest and post-harvest best practice to increase their margins.

Relevant to domestic, regional, and global horticultural markets, it is important to benchmark Rwandan production. While many of the products identified for potential global export will likely be new, labor is a critical cost of production component for new as well as existing vegetable products. Benchmarking Rwandan existing production against the region could identify other opportunities to better position Rwanda for competitively diversifying horticultural markets.

Export into the global horticultural marketplace will require upgrading adaptive research for crops new to Rwandan production to identify not only varieties, but also best agronomic practices for the agricultural context. Certification capacity both within the public sector and the private sector will be necessary to meet

[35] Labor was specifically mentioned as not a problem in the National Strategy, but was not supported through international benchmarking. Labor cost and productivity are key components of the cost of production for vegetables. This warrants benchmarking.

global standards and market demands. Finally the global market requires specific packaging which may include various plastic products currently banned by public policy. Alternative packing may unduly inhibit Rwandan's competitiveness and specific exceptions could be pursued, particularly as the packed product would be exported and the packaging would not remain within in the country (such exemptions have been obtained for other exported products or of particular technical significance, such as the PICS hermetic crop storage bag used in some grains.)

The emphasis on global exports should be balanced with the growing domestic market that is currently absorbing the horticultural production of millions of Rwandan producers.