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RWANDA

ASSESSMENT OF POST-HARVEST OPPORTUNITIES IN RWANDA

USAID Post-Harvest Handling and Storage Project (PHHS)
PROJECT # EEM-I-00-07-00006-00, Task Order 09



Bugarama rice paddies



Akanyaru maize cooperative with rudimentary drying and shelling facilities

March 2010

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This publication was produced for review by the United States Agency for International Development and prepared by CARANA Corporation

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ACRONYMS & ABBREVIATIONS

ACDI/VOCA	Agricultural Cooperatives Development International/Volunteers in Overseas Cooperative Assistance
AGF	Agriculture Guarantee Facility
AMIR	Association of Microfinance Institutions in Rwanda
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
BAIR	Bureau d'Appui aux Initiatives Rurales
BNR	Banque Nationale du Rwanda
BOT	Build-Operate-Transfer scheme
CAADP	Comprehensive Africa Agricultural Development Program
CAF	Caisse des Affaires Financières
CBS	Center for Business Solution
Centre IWACU	Center of Training and Research Cooperatives
CIP(1)	Cassava Initiative Platform
CIP(2)	Crop Intensification Program
CLECAM	Coopérative Locale d'Épargne et Crédit Agricole Mutuelle
CMV	Cassava Mosaic Virus
COAMV	Coopérative des Agriculteurs des Maïs dans la Zone des Volcans
COGEBANK	Compagnie Générale des Banques
COIMU	Koperative Ibukwa Muhinzi ("Remember the Farmer" Cooperative)
COMICOKA	Coopérative pour la Mise en Commun de Kanama
COMPETE	USAID Competitiveness and Trade Expansion Program
COOPEC	Coopérative d'Épargne et Crédit
COPRORIZ	Coopérative de Producteurs de Riz
CORIMI	Coopérative de riz de Mirenge
CSC UGAMA	Centre de Services aux Coopératives
CODERVAM	Coopérative de Développement Rizicole des Vallées du Mutara
COPROVAB	Coopérative pour la Promotion et la Valorisation du blé
DCA	Development Credit Authority
DERN	Diocese of Ruhengeri Northern Rural Development

DRC	Democratic Republic of Congo
DUHAMIC-ADRI	Duharanira Amajyambere y'Icyaro (Grassroots Integrated Development Action)
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy USADF
FDI	Foreign Direct Investment
FUCORIRWA	Fédération des Unions de Coopératives Rizicoles au Rwanda
GDP	Gross Domestic Product
GoR	Government of Rwanda
ha	Hectare
IFC	International Finance Corporation
IFDC CATALIST	International Center for Soil Fertility and Agricultural Development Catalyze Accelerated Agricultural Intensification for Social and Environmental Stability
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
IMF	Institution de Microfinance
IPM	Integrated Pest Management
ISAE	Institut Supérieur d'Agriculture et d'Elevage
ISAR	Institut des Sciences Agronomiques du Rwanda
KOAGIMITA	Koperative y'abahinzi no Gukusanya Imisaruro ya Tare ("Tare Production and Crop Collection Cooperative")
KOARU	Koperative Iharanira Amajyambere Rusange (Cooperative for the Promotion of Community Development)
KIST	Kigali Institute of Science and Technology
LDI	Local Direct Investment
MFI	Microfinance Institution
MIGEPROF	Ministry of Gender and Family Promotion
MINAGRI	Ministry of Agriculture and Animal Resources
MINICOM	Ministry of Commerce
MLI	USAID Market Linkages Initiative
MT	Metric Ton
NEPAD	New Partnership for African Development
NGO	Non-governmental Organization
NUR	National University of Rwanda

NYAMIG	Nyagatare Maize Investment Group
P4P	Purchase for Progress
PASAB	Projet d'Appui a la Sécurité Alimentaire du Bugesera
PASTA II	Plan Stratégique pour la Transformation de l'Agriculture II
PHHS	USAID Post-Harvest Handling and Storage project
PMP	Performance Monitoring Plan
PMP	Performance Monitoring Plan
PSTA	Strategic Plan for Agricultural Transformation
R&D	Research and Development
RADA	Rwanda Agricultural Development Authority
RATIN	Regional Agricultural Trade Network (of the East African Grain Council)
R&D	Research and Development
RDB	Rwanda Development Board
RDI	Rwanda Development Investment company
RDO	Rwanda Development Organization
REIC	Rwanda Enterprise Investment Company
RIF2	Rural Investment Facility 2
RIM	Reseau Indiocesain de Microfinance
RIU	Research Into Use
ROPARWA	Reseau des Organisations Paysannes du Rwanda
RSSP	World Bank Rural Sector Support Program
RWF	Rwandan Franc
SOPAV	Société de Production d'Aliments de Végétaux
SWOT	Strengths, Weaknesses, Opportunities and Threats
UCORIBU	Union des Cooperatives Rizicoles de Butare
UNDP	United Nations Development Program
UNR	Université Nationale du Rwanda
USAID	United States Agency for International Development
UVA	Umutara Veterans Association
WFP	World Food Program
WRS	Warehouse Receipt System

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I. Executive Summary

Since starting in September 2009, the USAID Rwanda Post-Harvest Handling and Storage (PHHS) project has focused on an assessment of market linkages, potential for promotion of post-harvest investments, and post-harvest management of the project's seven targeted staple crops: rice, maize, beans, cassava, Irish potato, wheat and soybeans. For each of the seven value chains, the PHHS team assessed current performance and post-harvest potential through interviews with major commodity buyers including large, medium and small-scale processors, traders, storage operators and producer cooperatives and their supporting organizations. The team also held discussions with members of Rwanda's Ministry of Agriculture and Animal Resources (MINAGRI), local and regional partners, and representatives from Rwanda's investment finance community. With this information, the team compiled value chain maps and prioritized opportunities for project intervention.

The objective of the PHHS project is to mobilize private sector resources to address post-harvest inefficiencies upstream in the supply chain for each of the target staple crops. Specifically, the PHHS project will work from the market backward to stimulate investment, construction and management of any post-harvest equipment or warehousing. Key players that will be engaged to meet these objectives include the millers, brewers and other processors, as well as commodity traders that purchase surpluses and are intimately familiar with domestic and regional market requirements. A close link with the banking system is also expected, given the importance of financial intermediaries in stimulating investment. The overall results of the Post-Harvest Handling and Storage project will be (i) a reduction in post harvest losses of selected staple crops in targeted areas, (ii) an increase in the number of storage facilities constructed/purchased in the country, (iii) an increase in the number of Rwandan farmers using storage facilities, (iv) more private sector funds flowing into post-harvest infrastructure projects, and (v) selected higher percentage of staple commodities stored in improved storage facilities.

Priority Value Chains

The first priority value chain, rice, presents the greatest opportunity for benefiting from PHHS project assistance, particularly in partnership with rice unions in southern and northeastern Rwanda, together with affiliated microfinance institutions and milling facilities. There is a strong need for rice conditioning and primary storage facilities at the cooperative level, as well as solid intermediary or longer term storage facilities.

The maize value chain ranked second in terms of priority for PHHS project assistance, due to large production volumes, a high level of organization in some of the cooperatives and supporting institutions, and strong market demand. The Ryabega grain drying and storage facility close to Nyagatare city, funded by the United Nations Development Program (UNDP), is another excellent opportunity for PHHS intervention. Once the facility becomes operational, both quantitative and qualitative losses will decrease in the large volumes of maize produced.

The third priority value chain, beans, is not an organized value chain compared to the other crops. However, demand for beans in Rwanda is high, from large scale buyers such as the World Food Program's Purchase for Progress (WFP P4P) initiative to the village market level. The possibility exists to work with partner projects to organize and strengthen bean producer cooperatives, and facilitate the provision of technical and material assistance to reduce post-harvest losses.

Cassava plays an important role in both farming systems and marketing in some parts of eastern and southern Rwanda. This value chain, ranked fourth, suffers from a lack of adequate processing facilities; providing assistance to renovate abandoned cassava processing facilities and training processors on improved processing techniques could have a great impact on reducing post-harvest losses.

Irish potatoes are important in northern and northwestern Rwanda, but much less so in other parts of the country; assistance to reduce post-harvest losses should be primarily at the capacity building level to improve production and post-harvest handling practices. Potato storage facilities are mainly important for seed tubers, and some material assistance should target the rehabilitation and expansion of seed tuber storage facilities.

The wheat value chain, while warranting some project assistance, was identified as the weakest due to difficulties in producing the quality required by millers. The ex-Gikongoro province offers the greatest potential for PHHS impact in wheat post-harvest activities, for both technical – including training and capacity building – and material – crop conditioning and primary and secondary storage facility training – assistance to reduce post-harvest losses.

Finally, soybean production in Rwanda is small and on the decline. This value chain classified as not warranting project assistance unless a proposed initiative to set up a large scale soybean oil and cake processing plant in Kayonza is realized during the project's lifetime.

Investment Partners

Two banks, the Rwandan Development Bank (Banque Rwandaise du Developpement, BRD) and the Banque Populaire have facilities set aside for financing agricultural initiatives. While these finance initiatives have primarily supported export crops, particularly post-harvest processing of coffee and tea, there is the possibility of accessing bank financing for staple crop post-harvest handling facilities.

The assessment also identified potential project partners in the finance investment sector, with micro-finance institutions (MFIs) offering the greatest potential for addressing the financial and marketing constraints encountered by producers of staple crops. The MFI CAF ISONGA is already very active in supporting the rice and maize sectors, including post-harvest operations, as is COOPEC COMICOKA working with potato, maize, and bean producing cooperatives in northwestern Rwanda.

The project anticipates leveraging private sector investment in post-harvest activities by cost-sharing grants provided by regional partners, including the Market Linkages Initiative (MLI) project and the Competitiveness and Trade Expansion (COMPETE) program, both based in Nairobi.

Implications for PHHS Project

The inception assessment revealed a significant lack of reliable data on 1) the extent of post-harvest losses for staple crops in Rwanda, and 2) existing post-harvest infrastructure in the country. The study therefore concluded that research and development institutions must work to address data collection and regular monitoring needs, most likely to be implemented by MINAGRI in conjunction with the National Institute for Statistics. The inventory of existing post-harvest infrastructure, led by WFP P4P and MINAGRI, will provide an updated needs-assessment that will inform the project in its ongoing identification of highest potential interventions.

However, a number of viable opportunities have been identified as a result of this assessment study, prioritized according to their feasibility on a number of factors discussed in section V. These

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Inception Assessment

opportunities, as laid out in Tables 5 and 6, will be implemented by the PHHS project in the upcoming two years.

II. Methodology and Strategy

Assessment Goals and Objectives

The first six months of the PHHS program focused on an assessment of the current situation in Rwanda with respect to market linkages, promotion of post-harvest investments and post-harvest management for the targeted staple crops. Given the project's market-led, private sector driven approach, along with its goal of leveraging private sector resources, one of the key activities of this assessment was the identification of existing and potential investors in targeted commodities, such as processors, exporters and traders who could undertake catalytic investments to improve supply chains.

Similarly, the study identified potential partners and financial institutions with resources and interest in lending to viable post-harvest management businesses. The PHHS Team focused on opportunities with the greatest growth and impact potential and actors most likely to achieve success within the project lifetime and beyond.

Value Chain Performance and Post-Harvest Potential: Methodology

For each commodity, the PHHS team conducted a value chain analysis based upon interviews with stakeholders and a review of existing data. Each analysis is found as an Annex in this report. The analysis examines the constraints encountered by all actors in each value chain, and the resulting inefficiencies and losses. The Team started by identifying and interviewing both large, such as the WFP P4P, processing companies such as Bralirwa and Minimex, and small scale buyers. Relevant interviewees/stakeholders included traders, transporters, small to medium processors, any storage operations, and wholesalers.

PHHS visited high production regions and met with producer cooperatives and unions to determine (a) what they perceived to be the largest constraints in terms of marketing, access to credit and post-harvest handling and storage, and (b) which partners showed the greatest growth potential given additional technical and/or financial assistance. The Team also gathered information from intermediaries about their role in the value chain to determine whether or not there are issues related to price fixing, transport monopolies, etc. Throughout the course of the assessment, the PHHS team met with umbrella organizations, service providers and other supporting organizations in order to gather information on supporting marketing, harvest and post-harvest handling, as well as access to finance for producers.

The results of the value chain mapping exercise (see Annex A – Value Chain Assessment) enabled the PHHS team to identify the key marketing distribution channels for each commodity, and served as a basis for value chain actors' selection. Interviews with buyers provided information to determine how PHHS intervention can help producers both meet market requirements, and become more competitive in Rwandan markets. This information, together with information gleaned from other projects in the region (USAID funded COMPETE and Market Linkages Initiative projects, both based in Nairobi) helped the PHHS team identify the high-value channels where actors on both the supply and demand sides of the value chain have the greatest incentives to invest in technologies for reduction of post-harvest losses, and more reliable supply systems, such as “warrantage” schemes supported by micro- and other finance institutions.

This inception assessment also served as the source of baseline data for the Performance Monitoring Plan, which was “To Be Determined” (TBD) for all indicators at the time of the PHHS First Year Work Plan submission. The First-Year Work Plan set many targets based on established partner projects in Rwanda. The Inception Assessment provided PHHS the opportunity to evaluate and tailor those targets to better fit project objectives.

Sources of Data and Information

The PHHS team primarily collected data through interviews with various stakeholders (see Annex F – Questionnaires) including the major buyers of and traders in staple food crops in Rwanda; such as the WFP P4P program, Minimex, traders ENAS Nkubili and PEMBE wheat milling factory, and the staff working for the rice milling company, ICM. The team also met with small to medium-scale processors such as Maïserie de Mukamira, SOSOMA Industries, and the soy processing cooperative ABAHUJE. PHHS visited their facilities to better understand their needs in terms of staple food crop supplies, as well as market and other constraints.

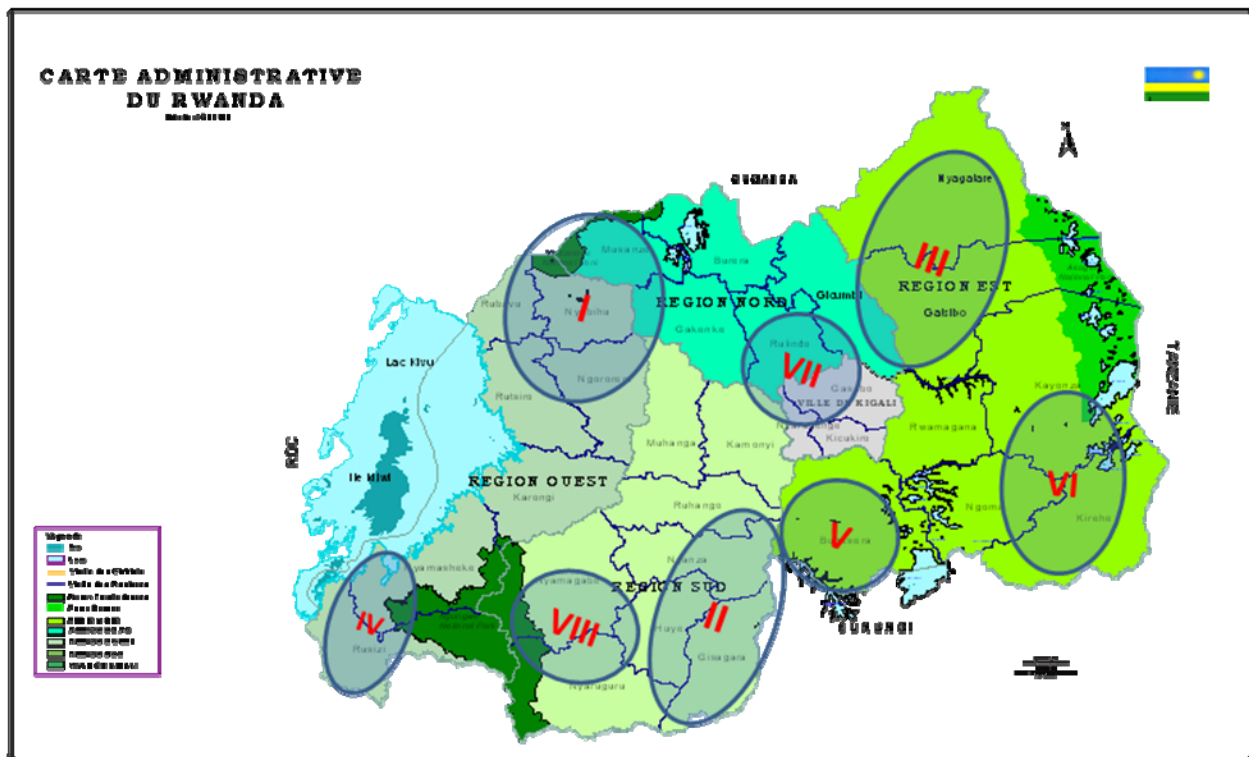
Additionally, the team met with Rwandan umbrella and other support organizations working with producers of the targeted staple crops (national initiatives such as Centre IWACU, Rwandan Development Organization, ROPARWA, and regional organizations such as UGAMA CSC, INGABO, BAIR) as well as staple crop unions (ex. UCORIBU, UNICOOPAGI) and numerous cooperatives. The team interviewed individuals in the Ministry of Agriculture involved in post-harvest activities, as well as staff from the National Agricultural Research Institution (ISAR), international organizations and projects such as HarvestPlus’ bean initiative, IFDC CATALYST project and Rabobank (working in conjunction with the local Banque Populaire).

The assessment also included meetings and discussions with individuals working on regional projects targeting post-harvest, market linkages and investment finance interventions for staple crops, such as the Market Linkages Initiative (MLI) and COMPETE, both funded by USAID. Relevant reports and other sources of secondary data were also reviewed.

III. Background

Figure 1 below shows the major production zones of staple crops in Rwanda, based on the PHHS team’s findings. Zone I, the north/northwestern part of Rwanda, is the major site of Irish potato production, and also has significant production of wheat, beans and maize. Zone II, in central-southern Rwanda, is characterized by large volumes of rice, cassava, maize, and a small amount of soybean production. Zone III, in northeastern Rwanda, produces large amounts of maize, cassava and beans. Southwestern Rwanda, Zone IV, has significant rice production, as well as some maize. Zone V, Bugesera, produces maize, cassava and beans, while southeastern Rwanda, Zone VI, produces large amounts of maize and some beans as a rotation. North-central Rwanda, Zone VII, produces Irish potato, beans, wheat and some maize. Finally, the south-central plateau, Zone VIII, produces wheat, beans and some maize.

Figure 1: Major Production Zones of Staple Crops in Rwanda



Overview of Rwanda’s Agriculture Sector and Staple Crop Value Chains

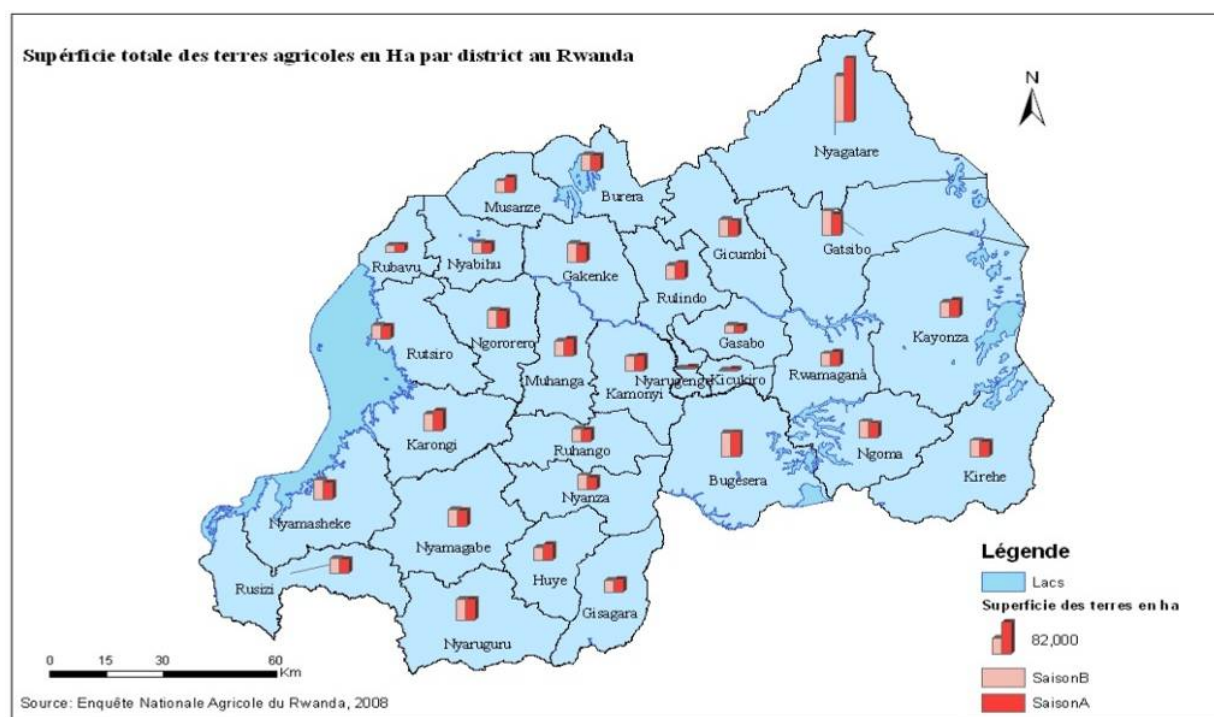
Rwanda’s Vision 2020 Strategic Plan targets, among other objectives, 1) a 6% growth in the agriculture sector to the level of production of 2200 kcal/person/day, 2) only 50% of the total population dependent on agricultural production for their livelihood, and 3) utilization of 15 kg of inputs per hectare per year. An agricultural survey conducted in 2008 found that 84% of Rwanda’s population depends on agricultural production for a living. One of the consequences of having so many Rwandans dependent on primary agricultural production is the reduction in the size of land area available for cultivation on a per household basis, as is shown in Table I below.

Table 1: Proportion (in %) of Agricultural Land Area Cultivated per Household (in hectares)¹

Surface area (Ha)	Percentage	Cumulative %
<0.20	26.3 %	26.3 %
0.20 – 0.49	30.5 %	56.8 %
0.50 – 0.99	23.2 %	80.0 %
1.0 – 1.99	14.0 %	94.0 %
2.0 – 2.99	3.6 %	97.6 %
3.0 – 3.99	1.2 %	98.8 %
4.0 – 4.99	0.6 %	99.4 %
5.0 – 9.99	0.5 %	99.9 %
10.0 – 19.99	0.1 %	100.0 %
20.0 – 49.99	0.1 %	100.0 %
50.0 – 99	0.1 %	100.0 %
Total	100.0%	

Availability of agricultural land varies significantly from one part of Rwanda to another, as is shown in Figure 2.

Figure 2: Total Agricultural Hectarage Available in Rwanda, 2008



The following solutions have been proposed, along with others, by the GoR to overcome the limited agricultural land available and to increase agricultural productivity:

¹ Source : Enquête Agricole Nationale du Rwanda, 2008 (Tableau 4.2.2.)

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- The Crop Intensification Project (CIP) works to increase productivity by increased application of subsidized inputs and promotion of regionalized crop production. Producing a single crop on large land areas is more efficient than the traditional practice of small, intercropped plots. This program also promotes the utilization of improved seeds, particularly hybrid maize.
- Improving land management: land consolidation and radical terraces in order to expand the area under production and provision of land to individuals on a long term lease basis - facilitating farmers' access to finance.
- Large scale rehabilitation of swamplands for crop cultivation, rain water management and protection of water resources.
- Intensified livestock production, particularly via distribution of cows to farming households (called the "One Cow per Family" program), in part to increase the amount of organic fertilizer available for crop production.
- Mobilization of private sector finance, especially for the privatization of agricultural operations previously owned by the GoR. For example, selling rice mills to the Australian company ICM.

These new agricultural initiatives have resulted in an increase in agricultural production, particularly in the PHHS targeted staple crops. Crops such as beans, sweet potato and sorghum may have lost their importance as official priority crops, but are supported by non-governmental programs. Table 2 lists the volumes of crops produced in Rwanda in 2008; it is anticipated that production will be even higher for 2009, particularly for rice, maize and cassava.

Table 2: Crop Volumes Produced in Rwanda, 2008²

Crop	Quantity (MT)			Percentage		
	Season A	Season B	Total	Season A	Season B	Total
Sorghum	25,775	87,371	113,146	22.8%	77.2%	100%
Dry maize (grains)	49,508	29,927	79,435	62.3%	37.7%	100%
Wheat	2,133	6,114	8,247	25.9%	74.1%	100%
Rice	11,854	19,539	31,393	37.8%	62.2%	100%
Sweet cassava (fresh)	94,055	80,316	174,371	53.9%	46.1%	100%
Bitter cassava (fresh)	396,924	407,246	804,170	49.4%	50.6%	100%
Sweet Potato	626,599	507,687	1,134,286	55.2%	44.8%	100%
Irish Potato	301,907	324,602	626,509	48.2%	51.8%	100%
Bush Beans	103,784	81,696	185,480	56.0%	44.0%	100%
Climbing Beans	51,874	44,961	96,835	53.6%	46.4%	100%
Soybean	5,850	5,622	11,472	51.0%	49.0%	100%

Concurrent with the increase in crop production, Rwanda has seen a shift toward more commercial agriculture.

Table 3: Proportion of Crop Sold as a Percentage of Total Production³

Type of Crop	Saison 2008A	Saison 2008B	Total
Cereals	32.06%	58.18%	48.14%
Roots and Tubers	30.56%	29.63%	30.10%

² Source : Enquête Agricole Nationale du Rwanda 2008, (extrait du Tableau 4.3.7.)

³ Source : Enquête Agricole Nationale du Rwanda 2008, (extrait du Tableau 4.3.8.)

Grain Legumes	9.89%	7.74%	8.92%
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Prices of agricultural products continue to show large fluctuations, although the overall tendency has been for prices to increase.

Table 4: Crop Prices in Regional Markets of Rwanda, 2009⁴

Crops	Kigali City	East	North	South	West	Rwanda
	Price (RWF/kg)					
Maize	242	205	273	229	234	234
Rice	608	574	579	606	606	594
Wheat	350	--	298	333	318	320
Beans	318	319	337	312	349	329
Soya	370	360	425	328	417	381
Irish potato	191	201	151	188	169	179
Cassava (cossettes)	193	181	234	184	193	191

Evolution of Crop Post-Harvest Activities

The large increases in crop production in Rwanda have resulted in recognition of the urgent need to increase and expand crop post-harvest operations, as the infrastructure developed for the traditional cropping practices is sorely inadequate for the current volumes of production. Post-harvest infrastructure for drying, grading and storing staple crops lags far behind the current needs across Rwanda. Several programs have been launched to address the post-harvest infrastructure deficit, with varying degrees of success:

- Distribution of hermetically sealed grain storage cocoons in the Eastern Province, in general without adequate provision of training, which has resulted in significant storage losses
- Construction of storage silos with donor assistance (ACDI/VOCA, UNDP, WFP, IFAD, etc).
- Rehabilitation of the pre-1994 strategic storage facilities previously under the ownership and management of OPROVIA-GRENARWA

Various value chain actors, including IFDC CATALYST and MINAGRI, have attempted to conduct a census of existing post-harvest infrastructures, but the results are conflicting. Two comprehensive studies were subsequently launched so as to establish a reliable database of existing staple crop post-harvest infrastructure: One study was lead by the WFP (draft report still to be released) and another by MINAGRI, which is to be used to elaborate a National Strategic Storage Plan.

⁴ Source: SNIAR FAO-MINAGRI Bulletin, September 2009

IV. FINDINGS

Post-Harvest Handling Constraints

A common constraint at the producer level for all staple crops included in the PHHS study is the need to improve producers' harvest and post-harvest handling techniques. Many losses could be reduced if farmers were not only trained on better harvesting and post-harvest handling practices, but also shown how much their profits could be increased if they were to follow the recommended techniques. The project is likely to partner with the local Rwanda training firm, DMS, for provision of training on improved post-harvest techniques.

Experience working with Rwandan farmers in the past has shown that they often know they could improve their practices, and in many cases do have access to knowledge on the techniques they should employ. Their failure to adopt such techniques results from a lack of incentive to invest the additional effort required, because they are unaware of how they stand to benefit from applying improved practices. One of the major grain traders met during the course of the inception assessment cited as an example his experience of trying to convince producers of the importance of meeting market requirements in terms of quality standards, including percentage moisture and impurities. Producers felt that he was imposing these standards on them so as to "cheat" them into selling their grain at less profitable prices. The trader said that it would take a neutral party, such as the PHHS project, to show to the producers how their profits would actually be increased by investing the additional effort required to meet market requirements.

Another common constraint for all of the staple crop value chains included in the study is the lack of adequate and appropriate primary processing and storage facilities. For example, maize, rice and wheat all suffer post-harvest losses due to insufficient drying and primary storage facilities. Rwanda's climate is such that rain can fall at any time of the year, including the short and long "dry" seasons, which means that if not provided shelter, harvested products risk being exposed to the elements at all times, with subsequent negative impacts on product quality and useable quantity.

Innovations to address these common constraints need to be extended and/or developed. Institutions such as ISAR, ISAE and KIST have in most cases experimented with development of appropriate technology post-harvest equipment, such as solar dryers, manual threshers and shellers. More effort is needed to test these at the producer and cooperative level, and to refine the design to make the equipment suited to the target beneficiary's needs. There also is a need to replicate the practice and expand dissemination on a large scale.

Cooperative support organizations such as IWACU, BAIR and IMBARAGA need to review their successes and failures with respect to capacity building of producers. They also must use "lessons learned" to develop and expand training programs which have a positive and sustainable impact in the long run.

Based on the value chain mapping exercise (see Annex A), the following technical as well as material constraints in each staple crop need to be addressed to reduce post-harvest losses.

A. Maize

Training on improved drying, shelling, grading and storage techniques. Farmers need to understand how to as well as the importance of drying and shelling maize in a manner which reduces contamination by impurities, as well as bringing the grain down to the required moisture level and grading out clean from infected/infested/contaminated grain prior to putting it into storage. Additional training is needed on good storage techniques such as proper aeration; cleaning facilities between each harvest; preventing insect and disease infestation; and not storing pesticides or other toxic products in the same facilities as the grain.

Provision of adequate as well as appropriate drying, shelling and primary storage infrastructure. The Burera cooperative COAMV has succeeded in providing its members with manual shellers and Nyagatare's maize platform NYAMIG has identified transit storage facilities at the sector level. While both organizations have facilities for further drying, storage and processing of maize post delivery, these are inadequate to meet the volumes produced, and there are losses during transport of moist grain due to rotting.



Bugarama maize drying

B. Rice

Training on improved drying, grading and storage techniques. These include: drying the grain down to the required level; sorting/grading so as to remove impurities; and separating the clean, undamaged paddy from poorer quality paddy prior to storage. Other training on proper storage practices as described above for maize should also be provided.

Appropriate and adequate drying and storage facilities were established at the field level. To reduce losses during threshing and winnowing, appropriate technology equipment should be developed, tested at the producer level and the results monitored so that adjustments needed to make the equipment suited to the producers' needs are made, and the refined models disseminated to a large number of producers/cooperatives.

C. Beans

Training at producer level and targeting women. This includes: improved threshing as well as grading and sorting prior to storage, protective measures to reduce/eliminate weevil infestation in storage, importance of and measures to prevent temperature and relative humidity fluctuation in storage. Grading according to coloration to add value is also advisable.

Provision of drying facilities. In addition, appropriate threshing equipment and storage facilities are also required. The provision of packaging for beans sold on the market is required.

D. Cassava

Training at producer level on processing techniques. Training on proper cleaning, soaking and drying are necessary. For cooperatives involved in production of cassava flour, training is needed on quality control. The PASAB Bugesera cassava processing and storage initiative is an example of good practice.

Provision of washing, soaking and drying facilities, appropriate processing facilities. Take examples from PASAB Bugesera cassava processing and storage initiative.



Old cassava dryer in Gatsibo

E. Irish potato

Training at producer level about disease management. Training is needed at the field-level on sorting clean from disease infected and/or wounded tubers prior to storage in order to reduce post-harvest losses. Techniques to reduce damage to tubers during harvest, packaging and transporting are required. Training of traders/transporters on improved post-harvest handling such as exposure to elements and packing and unloading. Training of managers of tuber storage facilities on importance of disinfection of facilities between lots; monitoring and removing tubers showing signs of disease/rotting; storing tubers in “single layers”; controlling light exposure to reduce “greening” of tubers, provision of adequate aeration to reduce sprouting in storage. Training is needed for wholesalers on the method to achieve value addition with washing, grading and sorting of tubers prior to sale.

Provision of appropriate packaging to reduce damage to tubers during harvesting and transport, such as wooden crates rather than large, polyethylene bags. Producers also need improved storage facilities, especially for seed tubers. More attractive packaging should also be explored.

F. Wheat

Training at producer level. Training in rouging out rust infected wheat plants in the field to reduce the likelihood of rust-induced storage rots, as well as graded out rust infested from clean grains prior to storage.

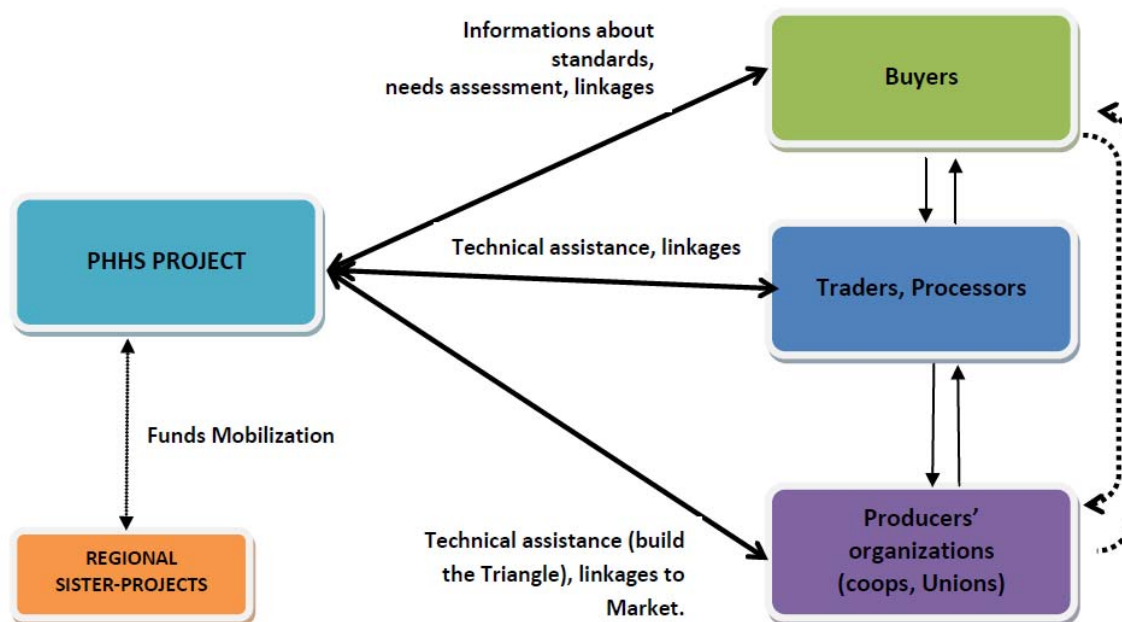
Appropriate and adequate drying and storage facilities established at the field level, similar to infrastructural needs in the rice value-chain.

G. Soybean

Training of producers on techniques to reduce losses arising from pod shattering. In addition, producers require training on improved threshing techniques, and grading and sorting.

V. Opportunities in PHHS Value Chains

Through its Inception Assessment, the PHHS team identified a number of opportunities in the priority value chains to address the technical and material constraints outlined in Section IV. Tables 5 and 6 summarize the main opportunities to be implemented by the PHHS project. The value chains themselves, and the identified opportunities within them, are prioritized based on a number of factors (see Annex A), including 1) the level of organization of cooperatives; 2) production volumes; 3) market demand, 4) links with support institutions, 5) links with buyers, 6) achievable results, and 7) impact on farmers and households.



The study revealed that all instances of successful and sustainable market linkages had the following characteristics:

1. One or more well organized crop-producer cooperative;
2. A supporting organization providing processing and trading services, technical assistance and training
3. A financial partner

This triangle can be very simple, extremely complex or somewhere in between; having all three elements is the key to success. Some examples which were identified during the study include:

- Rice value chain: Cooperative MUKINGURI – Support organization CSC UGAMA – Financial Partner CAF ISONGA
- Maize value chain: Cooperative COAMANYA – Support organization CENTRE IWACU – Financial Partner CAF ISONGA
- Wheat value chain: Cooperative KOAGIMITA – Support organization CARITAS – Financial Partner RIM

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Examples where one of the corners of the triangle is missing, with the result being failed attempts to establish sustainable market linkages, were also identified during the study. One such case is the poorly organized rice cooperatives in Bugarama, with no support or financial partner.

Based upon this methodology, following is a table of identified opportunities in each of the seven targeted staple crops.

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Table 5: Identified Technical and Material Opportunities in PHS Value Chains, Ranked by Priority

Value Chain		Identified Opportunity	Timing	Justification
No. 1 : Rice	1	UCORIBU: Drying and primary storage infrastructure for the union's cooperatives, along with acquisition of quality control equipment and training in improved post-harvest handling	Immediate: Before the 2010B harvest (starts in June 2010), duration TBD	UCORIBU is extremely well organized and has put in place an excellent working relationship between its member cooperative and the ICM Ginkonko rice milling factory; financial partnerships with CAF Isonga and the Banque Populaire
	2	UCORIVAM: Drying and primary storage infrastructure for the union's cooperatives, along with training in improved post-harvest handling. Assistance with acquisition of a new rice milling factory with a much larger processing capacity	Short to medium term: Activities to commence some time in 2010	Rice production is high and on the increase in the Nyagatare District (18,000 MT/year at present and will increase when an additional 1500 ha are ready for rice production in just over one year). The union is fairly organized, but the District has only one rice milling factory which is extremely old and has a very low processing capacity. A business plan has already been developed by the union, and construction of a new factory, with COMPETE assistance, would increase profits of all rice VC actors in the region.
	3	BUGARAMA: Drying and primary storage infrastructure for the union's cooperatives, along with training in improved post-harvest handling.	Medium to long term: some time in 2011	The cooperatives are not organized into a union and their negotiations with the rice miller ICM appear to be complicated. The lessons learned from the example of UCORIBU could be used to help improved the cooperatives structure into a union, and the reported installation of a new rice milling facility in Bugarama by the company SOPAV would provide an alternative buyer for the rice producers, and stimulate healthy competition. Collaboration with the support organization Center IWACU is possible as they are already active in the region.
No. 2 : Maize	1	NYAMIG: Assistance with the completion of the Ryabega drying and storage facilities so that they can become operational; setting up quality control measures and a management team for the facilities. Drying and primary storage infrastructure for the Initiative's cooperatives, along with training in improved post-harvest handling.	Immediate: April 2010	A semi-completed site, containing a dryer with a 12 MT/hour capacity (not yet operational) and long term storage of 3,000 MT exists but cannot be put into use until the remaining works are completed. An estimated \$50,000 is needed to complete the works, and the facility would serve as an important means of adding value to the large volume of maize produced in the district. MLI has indicated an interest in supporting this

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				initiative.
	2	3 Cooperatives in the Akanyaru River Valley with large maize production are in need of drying, shelling and storage infrastructure as well as training in post-harvest handling and cooperative capacity building	Immediate : infrastructure should be in place and training provided before the 2010 Season B harvest (June), duration TBD	The volume of maize produced by the cooperatives is large, their needs for drying and storage facilities far from met and an initial study just completed by a PHHS consultant recommends that immediate action be taken to ensure infrastructure is in place and training provided before the next harvest.
No. 3 : Beans	1	Cooperatives working in partnership with WFP for bean (as well as maize) supplies for the P4P program need improved drying, threshing and storage facilities as well as training in improved post-harvest handling of beans.	Immediate to long term: before the 2010B harvest in June if possible, later if not (duration TBD)	The WFP has identified cooperatives in the Eastern Province who have the greatest potential for supplying their P4P program with beans, and have requested PHHS assistance with provision of post-harvest infrastructure and training in post-harvest techniques and storage management.
	2	Cooperatives working in partnership with IMBARAGA and HarvestPlus in the Northern Province need drying/threshing/storage infrastructure and capacity building	Immediate: before the 2010B harvest in June (duration TBD)	The bean value chain is not yet organized into any sort of structure. Several farmer groups are participating in HarvestPlus' research and development project on iron-rich beans. The PHHS project could link up with this initiative and assist with the formation of viable bean cooperatives and the provision of post-harvest infrastructure and training so as to turn the research project into a long-term self sustaining activity. Collaboration with Urugaga IMBARAGA would facilitate the activity.
	3	In the NYAMIG intervention zone, promote the bean-maize intercropping and/or rotation	Medium term : during Season 2011A preparatory activities (September 2010)	Nyagatare has become an established zone of intensive maize production. Nevertheless, to sustain maize production, soil fertility management must be applied, and inter- or rotation cropping maize with beans (or soybeans) would boost soil fertility through the nitrogen added via nitrogen fixation which occurs from the symbiotic relationship between beans and the bacterium <i>Rhizium</i> which hosts itself in the roots of beans, and converts atmospheric nitrogen into a form useable by plants. The technical production aspects would be under the mandate of RDO/RDI, with PHHS assisting with training in post-harvest handling and provision of post-harvest infrastructure to discourage producers from selling beans (at a low price) immediately after harvest.

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No. 4 : Cassava	1	Gatsibo Cassava Innovation Platform (CIP) : Assistance with rehabilitation and re-starting operations in the abandoned Rugarama cassava processing factory, including elaboration of a business plan for CIP	Immediate : before June 2010, duration TBD	A cassava processing factory was built in the Rugarama Sector, Gatsibo District, with USAID funding in 2005. It has since been abandoned but still contains most of its equipment, and with the assistance of CIP (to whom the District has handed over the management of the facility), the facility could be renovated and resume operations, which would provide a much needed market for the abundant cassava produced in the district. Partners would include CIP and the Banque Populaire de Rwanda.
	2	Cooperatives already in partnership with the Syndicat INGABO : provision of technical assistance in the production of dry cassava chips and good, consistent quality cassava flour with long shelf lives	Short to medium term : between June - August 2010, duration TBD	The central plateau of Rwanda (Kamonyi, Muhanga and Rhango Districts) is the largest producer of fresh cassava roots. Several initiatives have already been launched for the production of different cassava products (both artisanal and industrial processing plants), but the technologies applied remain rudimentary and their products of poor quality with a short shelf life. PHHS could provide training of technicians (both staff working in processing plants and agronomists affiliated with cooperatives) on improved post-harvest handling and processing techniques to enable to achieve higher quality cassava products. Partners would include INGABO and CAF Isonga
No. 5 : Irish Potato	1	Cooperatives working with BAIR, as well as those formerly assisted by ACDI/VOCA : provision of training on integrated pest management to reduce losses of tubers in storage, improved harvest and post-harvest handling to reduce injury-related losses and improve value, provision of post-harvest collection and storage infrastructure	Immediate : before the next harvest (June-July 2010), duration TBD	The potato value chain is well established in northern/northwestern Rwanda. Cooperatives, however, have always found it difficult to negotiate a favorable selling price due to the relative perishability of tubers, especially when not properly handled during harvesting and post-harvest operations. ACDI/VOCA had begun a program to build potato storage facilities (especially for seed tubers), but were unable to meet all the needs. Training of local technicians on improved harvest and post-harvest handling of potatoes was not included with the provision of storage facilities. Potential partners could include BAIR, CLECAM
	2	IMBARAGA and its partnering cooperatives :technical assistance and market linkages development to strengthen and build up their program for value	Immediate : before the next harvest (June – July 2010), duration	The Rwandan NGO IMBARAGA initiated a project to add value to potatoes by washing, grading, sorting and selling in improved packaging before selling, and

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		addition to marketed potatoes (cleaning, grading, sorting and improved packaging, targeting high end markets)	TBD	targeting the high-end supermarkets. This value addition exercise (particularly important given the perishable nature of potatoes) resulted in a three-fold price increase, but to date is on a very limited scale due to lack of infrastructure as well as technology (all operations are performed by hand). PHHS assistance could enable the initiative to grow so as to benefit from economies of scale. Potential partners could include IMBARAGA, BPR, CLECAM
No. 6: Wheat	I	UNICOOPAGI/UNICOBLE/ KOAGIMITA (and other partnering cooperatives): provision of drying and primary storage infrastructure, technical assistance (capacity building and strengthening of market linkages), training in improved threshing, winnowing and drying techniques along with grading/cleaning and improved storage techniques.	Immediate : before next harvest (June 2010), duration TBD	The wheat value chain in Nyamagabe and Nyaruguru Districts (ex-Gikongoro) is just starting to become organized, but remains handicapped by the fact that the local wheat mill (Nyungwe Wheat Miller) operates on an irregular basis and does not offer a profitable price to producers. Relations between the miller and wheat cooperatives could be improved by improving the drying/grading/primary storage infrastructure for wheat in order that higher quality wheat is delivered to the miller. Capacity building of the different actors is also needed for this value chain to become more strongly organized. Potential partners could include UNICOOPAGI, Microfinance TWIZIGAMIRE, RIM

Table 6: Identified Investment and Finance Opportunities

Entity Identified	Opportunity Identified	Timing	Justification	Type of Institution
COOPEC COMICOKA	COOPEC is actively involved in assisting cooperatives to identify post harvest activities financing. PHHS will assist the MFI with its grant application with MLI to establish a credit facility and credit guarantee to help in post harvest financing for the staple crops under PHHS study producing in the Northwest region	Immediate duration TBD	An extremely well organized MFI with already established contacts with farmer base organizations. It is willing to assist farmer base organization access financing for post harvest infrastructures investment.	MFI
CAF ISONGA	CAF is currently providing warehouse base lending to a major rice farmer base organization (COPRORIZ MUKUNGURI). Access to Credit enhancements will help CAF and its members mitigate the storage constraints. PHHS will assist the MFI with its application with MLI to establish a credit facility and credit guarantee to help in post harvest financing for maize and rice	Immediate Duration: TBD	CAF is a MFI that has substantial experience developing the “warrantage” scheme with farmer base organization. The availability of credit enhancement for the construction of storage infrastructures will allow more farmer base organizations to participate in the scheme and reduce post harvest losses.	MFI
CLECAM WISIGARA	Wisigara is currently seeking a financing solution that will permit the construction of storage facilities for the farmer base organizations seeking to contract with local processors in the Gysenyi district. The PHHS project will assist the MFI with its grant application with MLI to establish a credit facility and credit guarantee to help in post harvest financing for the staple crops under PHHS study producing in the Northwest region	Immediate Duration: TBD	Wisigara is active in developing new distribution network for its members. The availability of storage facilities will assist farmer base organizations to access new market outlets and decrease post harvest losses.	MFI
Ecobank	The PHHS project will work with Ecobank to identify viable projects by introducing suitable farmer base organizations and enterprises seeking post harvest financing	Immediate Duration: TBD	Ecobank is seeking to increase its participation to the RIF2 and AGF program. It is therefore seeking viable post harvest activities to finance	Bank
BRD	The PHHS project will work with BRD to identify viable projects by introducing suitable farmer base organization and enterprises seeking post harvest financing	Immediate Duration: TBD	BRD is a government agency mandated to promote investment in the agriculture sector. It is one of two leading financial institutions with substantial expertise in agriculture financing.	Bank
Banque Populaire du	The PHHS project will partner with BPR to develop business plans for the farming groups seeking post	Immediate Duration: TBD	The bank is currently working with the RSSP program in the Akanyaru region and	Bank

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Rwanda	harvest financing in the Akanyuaru region and rice cooperatives supplying Gikonko Rice mill		rice cooperatives supplying Gikonko Rice	
MLI	The PHHS project will identify viable grant candidates meeting the MLI grant funding requirements	Immediate Duration: TBD	The MLI grant is a source of funding for post harvest projects in the staple crops sector, i.e. funding for storage facility improvement and for capacity building of producers in storage conditioning to ensure quality and minimize storage losses.	USAID-funded partner
COMPETE	The PHHS project will identify and assist with preparation of grant applications for agricultural organizations that qualify for funding under the Partnership Fund	Immediate Duration: TBD	COMPETE, via its Partnership Fund grant of \$24.6 million, awards grants to cereal grower associations to help promote food security by focusing on creating post harvest infrastructure for farmer base organizations.	USAID-funded partner
CBS	The PHHS project will work with CBS to provide training in post harvest investment, sales and marketing to entrepreneurs and heads of farmer base organizations.	Medium to Long Term: Once the PHHS project has identified enough training participants	CBS is a business solution center, created by the World Bank, to provide business trainings.	Service Provider

VI. ANALYSIS OF VALUE CHAINS

For each of the targeted PHHS crops, the team conducted a value chain assessment; the analysis has identified promising opportunities that will have a major impact on priority value chains.

1. Rice

In terms of both the strong degree of organization and the existing as well as future volumes of production, the rice value chain offers the greatest potential for benefitting from PHHS assistance. In particular, the rice union UCORIBU which has a solid working relationship with the ICM rice mill, Gikonko Rice, was identified as the priority target for PHHS project assistance in the near future.

UCORIBU has already prepared a list of their needs in terms of drying and storage post-harvest infrastructure, and if funding is availed through the MLI grants mechanism, a combination of training in improved post-harvest handling as well as provision of post-harvest infrastructure would most likely bring about a significant improvement in both quantity and quality of rice produced by the union.

Other initiatives which have strong potential for impact in the rice value chain include the Nyagatare rice union UCORIVAM, which is also in need of expansion of its primary drying and storage facilities. The existing rice mill in the district ideally should be replaced, possibly with funds from the COMPETE project. Both needs will become particularly acute when the additional 1500 ha in the valley are put into rice production in one year's time. A third opportunity in the rice value chain may be to provide the Bugarama rice producing cooperatives with drying and primary storage infrastructure. This, however, would only be recommended in the rice mill planned to be installed by SOPAV in the district does indeed materialize, and the cooperatives are provided technical support, including in strengthening their organization.

2. Maize

The maize value chain also offers great potential for benefitting from PHHS project assistance, particularly in light of the increased volumes of maize being produced in Rwanda, and the large demand for maize (WFP P4P, MINAGRI, Minimex). The maize platform, NYAMIG, based in Nyagatare is well organized, and the volume of maize produced in the District is large. An extremely useful intervention would be for the PHHS project to assist NYAMIG to develop a business plan for the management of as well as provision of financial and technical assistance to complete the drying and storage facilities at Ryabega. The cost would be around \$50,000, which is well below the maximum set by the MLI grants program, and would provide long term storage as well as drying for 3000MT of grain. NYAMIG's maize producing cooperatives would also benefit from provision of primary drying and storage facilities, as well as training in improved harvesting and post-harvest handling techniques.



NYAMIG RDO-RDI clean maize storage

Three maize cooperatives in the Akanyaru River Valley would also benefit from immediate PHHS project assistance, as confirmed by a study conducted by a PHHS project sponsored consultant in

February 2010. The volumes of maize produced by the cooperatives are large, yet they lack solid storage facilities, as well as drying and shelling facilities. The post-harvest infrastructure, funded by the MLI grants program, should be in place before the 2011-A maize harvest, and the cooperative members provided training in improved harvesting and post-harvest handling.

3. Beans

The value chain ranked third in terms of offering potential for PHHS project intervention is beans; there is a large demand for beans from the WFP P4P, as well as future demand for strategic storage by MINAGRI. However, little in the way of improved threshing, drying and storage of beans exists in Rwanda. Cooperatives who are likely to be providing the WFP P4P program with beans are already organized, and the WFP is eager to have PHHS project assistance in terms of training in improved threshing, drying and storage techniques as well as provision of post-harvest infrastructure either from COMPETE or with MLI grants funding.



Maize and bean intercrop in Nyagatare

Another bean initiative which would benefit from PHHS project intervention is the HarvestPlus/IMBARAGA iron-rich beans program; cooperatives have been organized by this joint venture, and provision of both training (including capacity building and post-harvest infrastructure) could have a significant impact.

Another possibility in the bean value chain would be to provide training and some post-harvest infrastructure for the cooperatives grouped under NYAMIG; inter-cropping or rotating maize with beans is highly recommended, and if the cooperatives are to be targeted for assistance in the maize value chain, incorporation of bean post-harvest activities would be relatively easy to implement.

4. Cassava

Cassava is the staple crop value chain ranked fourth in terms of potential for benefitting from PHHS assistance, and the initiative most likely to have immediate impact (with assistance) is the Cassava Initiative Platform (CIP) in the Gatsibo District. Cassava processing facilities exist, which could be renovated with MLI grants funds, and the PHHS project could work with CIP to develop a business plan for the group to ensure that the initiative is well grounded and financially viable. A second target for assistance in the cassava value chain is the syndicate INGABO and cassava producing cooperatives already working in conjunction with same. Production of cassava chips and flour is already undertaken by the syndicate, however the quality and shelf life of both are poor. Provision of training in improved cassava processing techniques could enable INGABO and its affiliated cooperatives to achieve higher quality cassava products.

5. Irish Potato

The value chain ranked fifth from the PHHS project assessment is Irish potato, which is only of significant importance in northern and northwestern Rwanda. The cooperatives in northern and northwestern Rwanda which are working with the support organization BAIR, as well as those previously assisted by ACDI/VOCA, are well organized and could benefit greatly from training in both improved production practices as well as harvesting and post-harvest handling techniques which can reduce post-harvest losses. These cooperatives would also benefit from provision of post-harvest collection infrastructure, as well as renovation or expansion of post-harvest storage infrastructure. A

second initiative of interest to the PHHS project is the local NGO IMBARAGA and its partnering potato cooperatives who have started to add value to the potatoes they market via washing, grading and packing the tubers in bamboo baskets. Provision of technical assistance as well as market linkages would enable the initiative to grow so that more potato producers benefit from selling a higher value product.

6. *Wheat*

The wheat value chain was ranked sixth by the PHHS project assessment, due to its relatively lower volumes of production and limited market potential. The wheat initiative most likely to benefit from PHHS project assistance is the combined wheat unions (UNICOOPAGI and UNICOBLE) working in conjunction with KOAGIMITA and other partnering wheat cooperatives. Provision of PHHS project assistance to improve the drying, grading, and primary storage infrastructure for wheat so that higher quality grain is delivered to the miller (Nyungwe Mill), as well as strengthening the market linkages and capacity building of all actors in the wheat value chain in the ex-Gikongoro province could build upon the efforts already invested in wheat in the region by ACDI/VOCA and other organizations. Additionally, since the PHHS project will be working with the cooperatives supported by BAIR (North-West), and many of these produce wheat as well as Irish potato, it would be easy to incorporate training in improved wheat production, harvest and post-harvest handling practices, and, where possible, assist the cooperatives to procure appropriate technology threshing and winnowing equipment as well as storage facilities.

7. *Soybean*

Soybean is not included as a value chain with potential for the PHHS project to have any impact at present. This is due to the small and declining levels of production in Rwanda, which are further constrained by the lack of the *Rhizobium* inoculum with which the seed must be sown in order for good crop growth and yield. Should new initiatives come into being such as the proposed CATALYST/COMPETE assisted soybean oil and cake processing plant at Kayonza, the PHHS project will reconsider what interventions the project can undertake to address post-harvest constraints which may arise in the soybean value chain.

Value Chain Illustrations

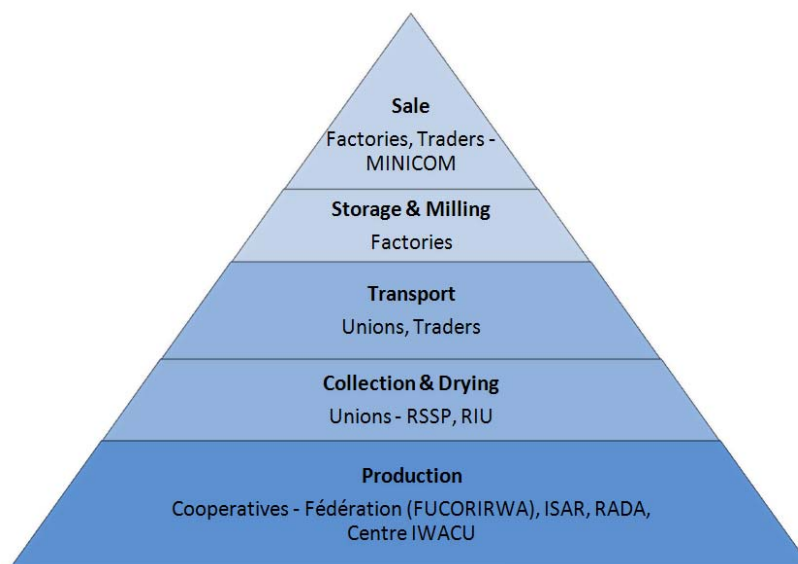
Vertical and horizontal integration within the targeted value chains are integral to ensure properly functioning market linkages. Improving integration within the value chain can be achieved in a number of ways; past strategies in Rwanda have included both top-down and bottom-up approaches that have not always been successful.

In a top-down approach, principal buyers such as the WFP, Minimex, grain millers or cassava processing factories attempt to guarantee supplies of raw materials by signing contracts directly with producers for the purchase of their crop at harvest time. However, producers often do not respect these contracts by claiming they were never consulted when setting the buying price. The study identified situations where this sort of conflict was avoided through an advance three-way negotiation of the selling price. For example, in the wheat producing area of Nyamagabe, each season all partners – wheat producer cooperatives, the wheat union, the support organization, the financial partner and the District authorities – convene a meeting to discuss and fix the terms and conditions for the price of wheat.

In a bottom-up approach, producers attempt to reduce the number of transactions in their distribution chain in order to cut costs and increase their profit margin. The main constraints in this situation are the lack of adequate post-harvest infrastructure and financial means for producers to justify long storage periods that would increase the selling price of their crop.

Figures 3 through 9 outline the various levels of integration, along with the strengths, weaknesses, opportunities and threats identified for each PHHS value chain.

Figure 3: Rice Value Chain



Strengths

- Abundant rice production
- Potential for high quality finished product
- Strong, well organized rice unions and cooperatives
- At least one good working relationship between union of rice producers and millers (UCORIBU and ICM – Gikonko Rice)
- Linkages between rice cooperatives and microfinance institutions enables producers to store rice after harvest until prices are high

Weaknesses

- Lack of adequate drying and storage facilities at the field level, resulting in losses in quality and quantity of paddy rice
- High labor requirements for harvest and post-harvest handling and hired labor very expensive
- Long distances between production and milling sites, leading to high transport costs, reducing price paid to producers
- Old mills which result in poor quality finished product, inadequate capacity to process paddy in timely manner and possibly losses during milling
- Lack of trust between producers and millers in some instances (e.g. Bugarama rice producers and ICM, Rwamagana rice producers and ICM)

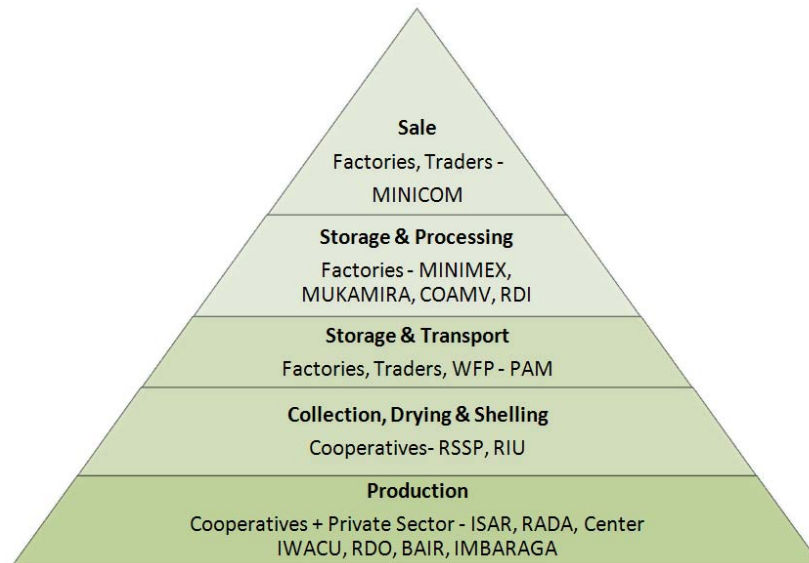
Opportunities

- Installation of new rice milling facilities to increase quality of finished product as well as offer producers a choice for example increased competition for paddy, higher price paid to producer – in planning stages in Nyagatare, beginning implementation in Bugarama
- Increasing post-harvest infrastructure at field level such as simple drying and storage facilities could reduce losses in quantity as well as quality
- Cooperatives well organized, geographically clustered in same area and can be easily reached for technical assistance. Examples include training in improved harvest/post-harvest handling, training in business skills.
- Rabobank/Banque Populaire’s interest in providing financial and capacity building assistance to rice cooperatives supplying to ICM/Ginkonko Rice mill
- Symbiotic relationship between rice cooperatives and MFI could be replicated across more sites in Rwanda
- Possibility for regional trade of rice, especially if “branded”. An example is the superior quality Bugarama rice.
- Development and use of threshing and winnowing equipment to reduce quantitative as well as qualitative losses.

Threats

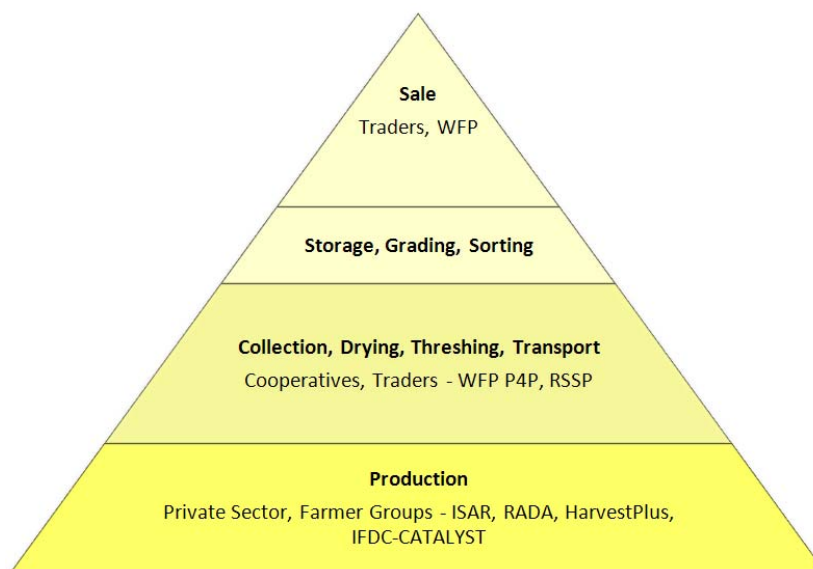
- Lack of improvements to marshlands results in inadequate water for production at times, flooding at others – GoR slow to respond to requests for assistance
- Less expensive imports from Asian countries – could resume on large scale, implying need to make Rwandan rice more competitive
- Failure to resolve disputes between rice producers and millers could result in breakdown of rice value chain
- Risk of cross border export of paddy for processing into and re-importation of white rice if milling capacity not increased

Figure 4: Maize Value Chain



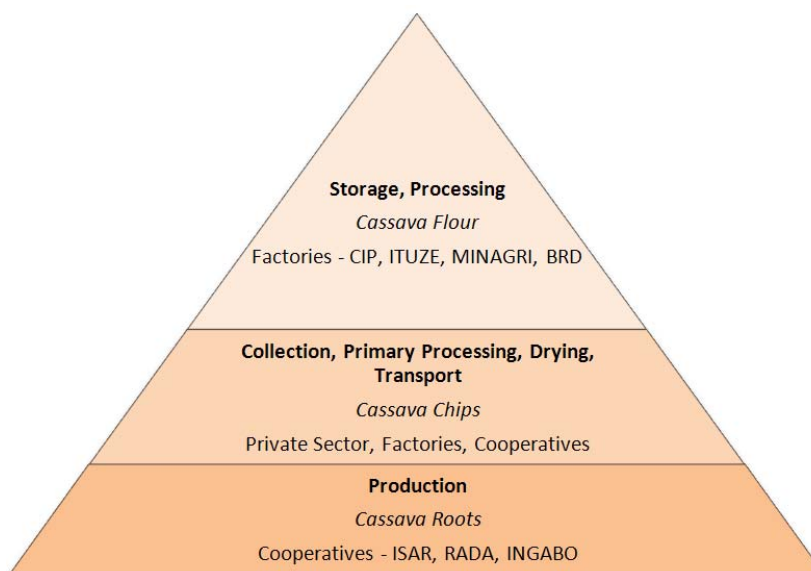
<p>Strengths</p> <ul style="list-style-type: none"> • Demand in Rwanda far exceeds supply • GoR assistance (RADA provision of subsidized inputs) strong, resulting in high yields at present • Strong maize organizations exist in parts of Rwanda (e.g. NYAMIG,BAIR and Centre IWACU assisted cooperatives, Kirehe WFP P4P cooperatives) 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Inadequate and insufficient drying and storing facilities – losses in value and quantity • Price of Rwandan maize not competitive with that from Uganda and Tanzania • Good market for fresh maize makes it difficult to convince farmers to wait for harvest of dry product, especially in high altitude areas where period from sowing to harvest is extremely long, and drying of maize is difficult • Drought in eastern Rwanda can seriously reduce production, with resulting impacts on buyers, processors and farmers • Production and drying at high altitude locations hindered by (1) extremely long period between sowing and harvest (6 – 8 months) and (2) difficulty of drying down to required moisture level under cool temperatures and high relative humidity • Poor road infrastructure reduces price received by producer because transport costs are high
<p>Opportunities</p> <ul style="list-style-type: none"> • WFP P4P potential collaborative activity with COMPETE and PHHS for construction of maize post-harvest infrastructure in Kirehe, training in harvest and post-harvest handling and linkages with buyers • NYAMIG linkage with and use of Ryabega drying and storage facilities (if ownership issue resolved) – significant trade opportunity with Uganda as well as WFP P4P • Akanyaru cooperatives • MINAGRI's plan to re-establish strategic grain storage facilities; for Season 2010 A harvest, total of 7,000MTmaize, eventually plan construction of two silos of 25,000MTeach 	<p>Threats</p> <ul style="list-style-type: none"> • Lower priced maize available from neighboring countries • Lack of trust between producer organizations and buyers • Farmers in high altitude zones discouraged by long period from sowing to harvest • Drought (esp. in east) and flooding (in swamplands needing further improvement) • Increased production enhances likelihood of pest and disease outbreaks which could seriously reduce yields/supplies • Slowness of GoR to respond to requests for assistance/intervention (e.g. failure of Nyagatare District to submit proposals from NYAMIG and other organizations to RSSP, Ryabega facility completion delayed yet farmers counting on use of same for Season 2010A harvest)

Figure 5: Bean Value Chain



<p>Strengths</p> <ul style="list-style-type: none"> • Cultivated by large majority of Rwandan farmers, who have long tradition of and strong expertise in bean cultivation • Large per capita bean consumption in Rwanda: 20.47 kg/person/year • Excellent rotation crop for other staples: same cooperatives producing maize and potato also produce beans. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • No organization of bean producers into cooperatives/associations • Little/no input or extension support from GoR • No organization of seed production and distribution • No formal marketing except for WFP P4P initiative • No improved post-harvest techniques or infrastructure – current shelling techniques lead to losses • High losses in storage can occur due to weevil infestation if not protected • Not included in most recent GoR PSTA, indicating its low ranking within the Ministry of Agriculture
<p>Opportunities</p> <ul style="list-style-type: none"> • In demand by large scale buyers such as WFP P4P, UNICEF, Murenzi Supply • Important source of protein and micronutrients, especially for rural population – nutritional importance recognized by GoR • HarvestPlus program to promote iron rich beans, including adding a price premium with “branding” • Possibility of improving market value by grading and selling as single variety • Number of research institutions and programs are targeting the crop – ISAR, RIU, CIAT, HarvestPlus – and developing new varieties 	<p>Threats</p> <ul style="list-style-type: none"> • Replacement by soybean if large soybean processing factory established in Kayonza • Pests and disease outbreaks if single-variety and mono-cropping production encouraged

Figure 6: Cassava Value Chain



Strengths

- Drought resistant crop which can be stored a long time in soil before harvesting
- Abundant production of roots in south and eastern Rwanda

Weaknesses

- Rapid physiological deterioration of roots once harvested if not processed
- Need for both clean water and protected drying facilities for production of chips with long shelf life not susceptible to rapid rotting
- Processing is labor intensive; mastery of artisanal production of flour with good, consistent quality characteristics is difficult

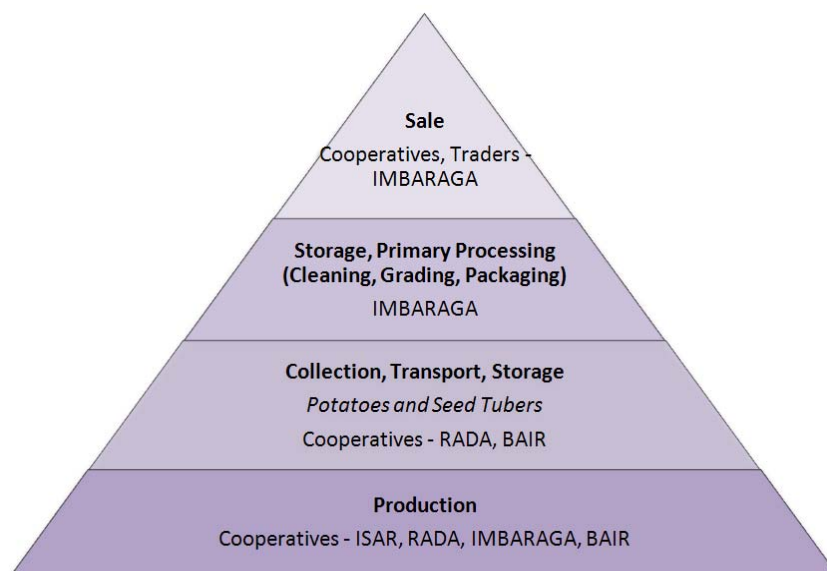
Opportunities

- Renovation of the Gatsibo processing facilities in conjunction with the Cassava Initiative Platform would enable production of high quality flour in district
- Possible products from dried cassava:
 - **Ethanol:** Cassava chips are an alternative source of raw material for producing liquor as well as medical and industrial alcohol.
 - **Livestock feed:** Cassava roots can be processed into chips and pellets which can be used in compounding animal feed for cattle, sheep, goats, pigs, poultry, and farmed fish. The cassava leaves are also a good source of feed for livestock if from “non-bitter” (low cyanide) varieties.
 - **Food:** Cassava is used widely in Africa, including Rwanda (ubugali in Rwanda, gari in Nigeria and other West African countries, fufu in Ghana). It is also eaten raw or roasted as a snack. Cassava flour is widely used in a number of bakery products. Modified cassava starch or starch derivatives have been applied for thickening, binding, texturing and stabilizing a range of food products such as canned foods, frozen foods, salad dressings, sauces, and infant foods.
 - **Confectionery:** Modified cassava starch or starch derivatives are used in confectionery for different purposes such as thickening and glazing. Cassava starches are widely used in sweets such as jellies and gums.
 - **Monosodium glutamate:** Cassava starch is a common source for making monosodium glutamate in Asia. It is used to enhance flavor in food, e.g., Ajinomoto.
 - **Sweeteners:** Glucose and fructose made from cassava starch are used as substitutes for sucrose in jams and canned fruits. Cassava-based sweeteners are preferred in beverage formulations for their improved processing characteristics and product enhancing properties.
 - **Pharmacy products:** Native and modified cassava starches are used as binders, fillers, and disintegrating agents for tablet production.

Threats

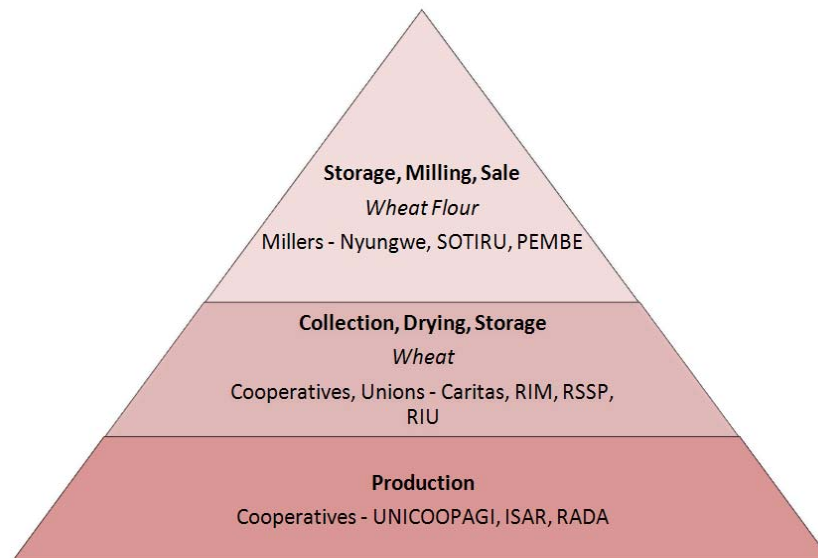
- Outbreak of Brown Streak Virus (exists already in neighboring DRC and Uganda) for which no varieties with proven resistance have yet been developed

Figure 7: Irish Potato Value Chain



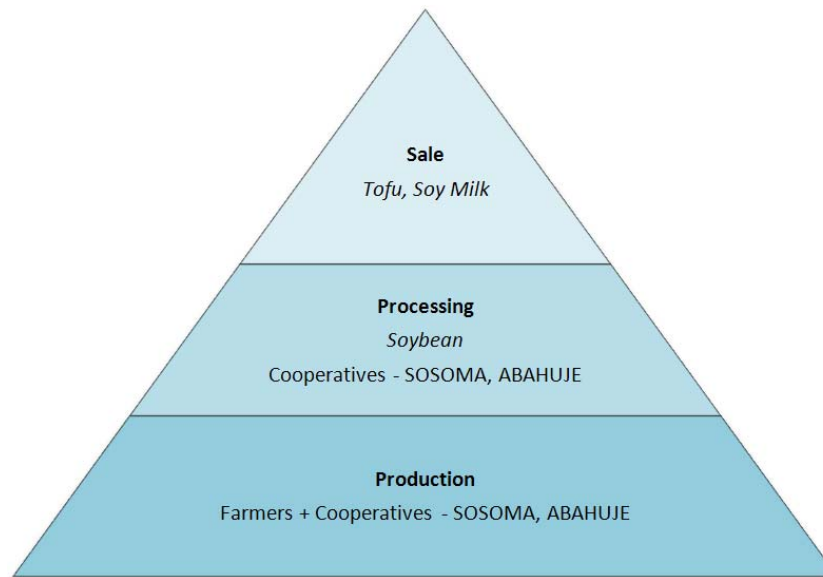
<p>Strengths</p> <ul style="list-style-type: none"> • Large production volumes of Irish potato • Favorable climate, soils and long tradition of cultivation give Rwanda a competitive advantage in trade of this crop • Potato production cooperatives are strong, well organized and well supported 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Existing production, harvest and post-harvest handling practices result in high post-harvest losses • Potato bulkiness and perishability is high relative to grains and legumes, adding to greater transport and storage costs • Need for two week in-field suberization period post vine cutting, plus high value, renders crop susceptible to theft
<p>Opportunities</p> <ul style="list-style-type: none"> • Significant reduction in post-harvest losses could be achieved through provision and adoption of improved production, harvest and post-harvest handling techniques • Improvement of existing post-harvest storage facilities as well as establishment of new, improved ones could reduce post-harvest losses • Improved marketing infrastructure (e.g. Kigali Fresh Produce Market) could reduce post-harvest losses at market level • Value addition through washing and selling tubers in improved packaging to high-end markets such as supermarkets and hotels 	<p>Threats</p> <ul style="list-style-type: none"> • Disease pressure is increasing due to failure to respect an adequate rotation period (one crop every two years), failure to follow other good IPM practices • SOPYRWA (pyrethrum processing) factory in Ruhengeri could resume operations on a large scale and reduce Irish potato production in northern Rwanda by offering greater profits for pyrethrum production

Figure 8: Wheat Value Chain



<p>Strengths</p> <ul style="list-style-type: none"> • Demand in Rwanda far exceeds supply • Some cooperatives are well organized and have storage facilities • Milling facilities exist in country 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Very low volumes of Rwandan wheat production • Inability to dry down to required moisture level (14%) in most production locations; machine dried wheat considered to be of lower quality by millers • Quality further compromised by high content of impurities incurred during threshing, winnowing and drying • Price offered by two of the major millers lower than what is paid on the market • Most cooperatives lack adequate drying and storage facilities • Threshing and winnowing mostly manual
<p>Opportunities</p> <ul style="list-style-type: none"> • Training of wheat producers in integrated pest management of wheat rust could reduce losses • Appropriate technology threshers and winnowers could improve quality • Other uses of wheat, such as porridge, could be promoted to mitigate problem of high moisture level rendering Rwandan wheat unsuitable for flour 	<p>Threats</p> <ul style="list-style-type: none"> • Imported wheat of better quality and available in quantities required by flour mills • Poor relationships between producers and millers discourages wheat production • Strong assistance to cooperatives provided by ACIDI/VOCA has ended – production likely to suffer as a result of drop in technical and financial assistance for cooperatives

Figure 9: Soybean Value Chain



<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Large demand for cooking oil in Rwanda • GoR program of “one cow per family” will see increased need for livestock feed 	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> • Lack of <i>Rhizobium</i> which is needed at sowing to ensure nitrogen fixation since production unit at ISAR-Rubona ceased operations; difficulty of production and dissemination serves as obstacle to any other organization or entrepreneur undertaking this activity, unless a large commercial demand were to develop • Small-scale farmers have limited experience producing crop on commercial scale – will need substantial training
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> • Large demand will be created if Kayonza factory is established and proves to be a viable venture 	<p><u>Threats</u></p> <ul style="list-style-type: none"> • Intensification of production increases risk of outbreak of devastating levels of soybean rust disease

VII. NEXT STEPS

Through its Inception Assessment, the PHHS team has identified a number of promising opportunities for the project to implement in the upcoming two years.

Next Steps:

- Share results of Inception Assessment with key partners and stakeholders
- Continue partnerships with regional entities, including MLI and COMPETE, to identify grants to finance targeted opportunities
- Continue to identify key opportunities to improve post-harvest handling
- Solidify partnerships with financial intermediaries to harness private sector investment
- Engage with partners to leverage shared resources for post-harvest handling training and capacity-building
- Identify lead firms and processors who will provide incentives for farmers to improve their post-harvest handling practices

VIII. ANNEXES

- A. Value Chain Assessment**
- B. Finance and Investment**
- C. Revised Performance Monitoring Plan**
- D. List of Interviews and Stakeholders Met**
- E. Inventory of Existing Storage Facilities**
- F. Questionnaires**
- G. References Cited**

Annex A – Value Chain Assessment

Through a survey of the major production zones of staple crops in Rwanda, the PHHS project assessed current practices in each of the seven targeted value chains – rice, maize, beans, cassava, Irish potatoes, wheat and soybeans. For each value chain, the PHHS team surveyed a) market trends, b) cultivation practices, c) collection and trade practices, d) processing and storage capacity, e) price formation, f) market, technology and investment opportunities, g) post-harvest losses and h) targeted partners.

1. Rice

A. Introduction and Overview of Market Trends

Rwanda's climatic conditions provide an ideal environment for rice production. There is abundant rainfall during the rainy seasons leading to rivers with additional supply water and a warm, dry season which facilitates harvesting and drying rice. Annual rice production is currently around 65,000 MT, but this does not meet the market demand, and more than 30% of rice consumed in Rwanda is imported from Asia and Tanzania. The rice value chain is perhaps the best organized amongst all staple crop value chains in Rwanda, being vertically integrated from the lowest level - swamplands cultivated by rice cooperatives, known as "COPRORIZ" - up to the national level -FUCORIRWA, the national umbrella organization for rice producers. FUCORIRWA is comprised of six rice unions which in turn contain a



Bugarama rice paddies

total of 52 rice cooperatives (COPRORIZ) and other rice producing groups. In total, there are around 62,000 rice producers under the FUCORIRWA umbrella.

B. Cultivation

According to the GoR's plan for the swamplands of Rwanda (2003), there are 66,904 ha of swampland that are suitable for rice production in the country. At present, 14,911 ha are cultivated each year, of which only 9,708 ha are used for rice production during both rainy seasons. The remaining 5,204 ha are used during one season due to lack of sufficient water or risk of flooding.

Average yields of rice are between 5 – 7 MT/ha, although it is possible to achieve 8 MT/ha by adopting improved production practices. In addition, research on rice production in Rwanda has intensified over the past few years. Major constraints to rice production in Rwanda are improved water management to reduce risk of flooding or drought, and lack of availability of well trained technicians. Additionally, rice is a crop that requires intensive utilization of labor, and labor costs are high (700 RWF/day); this is an impediment to suitable harvesting and post-harvest handling, as the operations must be carried out rapidly and producers do not have adequate funds to hire external labor.

C. Collection and Trade

The rice harvest occurs twice per year, in January-February (Season A) and June-July (Season B). Rice cooperatives are responsible for collecting and transporting the paddy rice to the rice milling factories, a process significantly hindered by the poorly maintained rural roads.

With respect to trade opportunities, it is worth noting that at least four zones of rice production in Rwanda – Nyagatare, Gisagara, Bugesera and Bugarama – are located in areas bordering neighboring countries including Uganda, Burundi and the DRC, which could catalyze cross border trade. At present, this would not work in Rwandan producers’ favor due to insufficient milling facilities in-country, which could result in the export of paddy and re-import of white rice. Several projects are under study, for example in Nyagatare, or in the process of being implemented, for example in Bugarama, in order to strengthen local rice milling capacity. This enhances the likelihood of boosting Rwanda’s production and possible regional exports of white rice.



COPRORI cooperative drying rice

D. Processing and Storage

Each rice swampland has drying areas, generally concrete slabs, and some primary storage facilities ranging from hangar type shelters to closed buildings. However, both the drying and storage facilities are severely inadequate and in need of renovation. As a result, rice delivered to the mills is generally poor quality with a high moisture content and a high percentage of impurities. No rice cooperative uses mechanical equipment for post-harvest handling. A few trials were conducted with machinery in Rwamagana at Union Twibumbe and Gikonko (UCORIBU) in collaboration with RADA, but these were inconclusive and the machines were taken back after adoption rates were found to be low.

Before privatization, all the major rice milling factories belonged to the Government of Rwanda and were utilized in a collaborative manner with development partners: Chinese Cooperation (Bugarama, Rwamagana, Kabuye), Canadian assistance (CODERVAM) and French assistance (Gikonko). Around 2005-2007, all factories were privatized, with four out of five acquired by the multinational Australian company ICM.. Some other investors, however, are becoming interested in setting up rice milling factories, for example SOPAV in Bugarama. The small, privately-owned rice mills that were widely used in the past were banned by GoR authorities in the course of restructuring the rice value chain.

The current rice milling facilities in Rwanda and their milling capacities are as follows:

Table 7: Major Actors in the Rice Value Chain in Rwanda

Facility	Milling Capacity
ICM-Rwamagana	2-3 MT paddy/hour
ICM Kabuye	0.5 MT paddy/hour
ICM Gikonko	2-3 MT paddy/hour
ICM Bugarama	2-3 MT paddy/hour
CODERVAM-Nyagatare	0.8 MT paddy/hour

No comprehensive list of rice storage facilities could be established, as they range from very small and rudimentary units to relatively larger storages associated with the rice mills; a number of cooperatives have received support from RSSP for rice (combined with maize) storage facilities, but specific volumes allocated to rice are unknown.

E. Price Formation

The rice unions and rice mills in each region hold negotiating meetings every season to determine the selling price for paddy rice. In situations where the unions have established a clear and collaborative relationship with the milling factory, this procedure is more easily carried out, and the negotiations are much more amiable than in locations where the rice cooperatives conduct the negotiations in a dispersed manner. For the 2010 Season A harvest, the price of paddy delivered to factories varied between 240 RWF/kg for short grain rice and 260 RWF/kg for long grain rice. Transporting rice from the site of collection and primary storage to the factories costs an average of 20 RWF/kg – this is paid to the union or cooperative, which in turn decreases the price paid to producers to between 220-240 RWF/kg paddy, according to the variety produced. For certain cooperatives located at great distances from factories, the transport cost can be very high and weigh heavily upon the producers, as the factory purchasing price remains the same.

F. Markets, Investments, Technologies and Potential Trading Opportunities

Despite Rwanda's impressive rice production, access to finance for investments in the rice sector is very limited. The large investments needed such as improving swamplands and renovating mills remain inaccessible due to lack of guarantees, as the swamplands are still the property of the Government of Rwanda. The specific investments needed are:

- With only five milling factories possessing a total capacity of only 10 MT paddy/hour, the need for increased milling capacity is significant, especially for the zones of Nyagatare and Bugarama. Plans are underway to establish a new factory in Bugarama with a capacity of 2 MT paddy/hour, and operations are expected to begin in the third quarter of 2010.
- Post-harvest equipment (for harvesting, threshing, or winnowing) is very scarce in Rwanda, and with the expansion of rice production and increasing yields, it is becoming evident that human labor alone will not be capable of handling all the work, and/or will produce a paddy of inferior quality.
- The drying and storage infrastructures at the cooperative level are similarly insufficient in terms of quantity and quality, yet means of accessing credit to address these constraints are not available to cooperatives.

Some development initiatives in different areas are being undertaken to facilitate access to credit for various actors in Rwanda's rice value chain:

- The District of Gisagara has promised UCORIBU, a rice union working in conjunction with ICM Ginkonko rice mill, to cede the management of the swamplands to the cooperatives, which will provide them an ability to access credit from banks
- The World Bank's RSSP Program continues to serve as a source of finance for large projects, however the administrative process required to tap into this source takes time
- Microfinance Institutions such as CAF Isonga and RIM have become interested in the rice value chain and are implementing innovative activities (the "warrantage" system, finance for producers for production activities, finance for cooperatives to purchase paddy at harvest, etc.)

G. Post-Harvest Loss Summary

Similar to what was encountered in the maize value chain study, no reliable figures could be found on post-harvest losses of rice in Rwanda. Measuring such losses is complicated by the different types of losses, as previously discussed. Discussions with different actors in the rice value chain did reveal the most important causes of rice post-harvest losses, which are:

- Insufficient and inappropriate drying and storage facilities at the field level lead to quality, especially percentage moisture, but also impurities and insect infestation losses; at times significant quantity losses can arise from unprotected rice grains germinating when exposed to high levels of rainfall. Field level drying and storage facilities range from a) non-existent, necessitating transport of paddy to distant locations for drying, b) old and in need of renovation, or c) new but inadequate surface area/volume for quantities of paddy harvested.
- Manual threshing and winnowing results in quantitative as well as qualitative losses.
- Most milling facilities are old, resulting in a reduction in the quality of milled rice as well as quantitative losses during the milling process. Conversion of paddy to white rice ranges from as low as 68% at Bugarama to 75% at other facilities.
- Old mills cannot handle volumes of paddy delivered in a timely manner; consequently, there are likely to be losses in paddy stored for a long time prior to milling.
- Long distances between production and milling sites reduce the price paid to producers due to high transport costs.



ICM Rwamagana - rice delivered above required moisture content

H. Targeted Rice Value Chain and Post-Harvest Partners

The most likely partners to be targeted by PHHS with respect to the rice value chain are:

Rice producers	FUCORIRWA, UCORIBU, UCORIVAM (union of rice producers affiliated with CODERVAM-Nyagatare)
Processors	ICM, SOPAV (if initiative succeeds in Bugarama)
Support organizations	Centre IWACU, CAF Isonga, Rabobank/Bank Populaire
Regional partners	MLI, COMPETE

2. Maize

A. Introduction and Overview of Market Trends

Maize, as a dried grain, is not a common traditional crop in Rwanda, having been grown in the past more for consumption of fresh maize cobs, and the stalks fed to livestock. As a crop with the “C4” system of photosynthesis, maize grows better under higher temperature regimes than are found in parts of Rwanda’s (high altitude zones). Following the “Plan Stratégique pour la Transformation de l’Agriculture II” (PSTA II), and the launch of the Ministry of Agriculture and Livestock’s Crop Intensification Program

(CIP), maize production in Rwanda was strongly promoted and supported, and yields as well as volumes of maize produced in country have sharply risen over recent years. Despite this boost in production, supplies of maize from Rwandan producers are insufficient and do not meet quality standards required by the major buyers, as moisture content and impurities are both too high. As a result, much of the maize purchased and processed in Rwanda is imported from neighboring countries, where the grain is lower in price, and reportedly of better quality in terms of moisture content.

B. Cultivation

Much of Rwanda's maize production is concentrated in valley areas, many of which have been recently drained for crop production purposes. However, some maize is also grown on hillsides, usually with poorer results. The best production areas in terms of climate are found in eastern Rwanda, where temperatures are higher and there is a longer dry season for drying the thick grain. Production in valley areas is greater during Rainy Season A, due to the risk of flooding in Rainy Season B, whereas hillside production predominates in the heavier Rainy Season B. Some valley areas with adequate moisture are used for maize production in the long dry season, Season C. Rainy season A falls from mid to late September to mid to late December, with maize harvest taking place in February-March; rainy season B falls from late February-early March to early June, with harvest taking place during Season C which is late June to early September.

As mentioned above, maize is not adapted to production at high elevations in Rwanda, where it is reported to require 6 to 8 months from sowing to the harvest of dry grain, as opposed to 4 months in warmer regions; it is also difficult to dry the grain down to required levels in high altitude sites. The long growing cycle and difficulties with drying at high elevations often result in farmers in these zones opting to harvest the fresh maize for sale, although the GoR has passed regulations forbidding the harvest and sale of fresh maize.

The Rwandan Agricultural Development Agency (RADA) has provided strong support to and promotion of maize production, supplying hybrid seed imported from southern Africa and to some extent Kenya at a subsidized price of 600 RWF/kg, as opposed to the real cost of 1320 RWF/kg. The sustainability of this practice, however, remains open to question.

RADA and other MINAGRI institutions have promoted land consolidation and monocropped maize production; some producers still continue to intercrop maize with legumes, which is a sound practice from both a risk reduction and agronomic perspective, as legumes fix nitrogen, of which maize is a heavy consumer. More intercropping of maize with legumes would reduce cash flow problems, as beans mature in three months, as well as producers' reliance on the higher priced beans found in the market.

C. Collection and Trade

At present, there are different modalities of maize collection; some maize producing cooperatives have no viable storage facilities, are located far from main roads and have to pay high prices for transporters to take their product to markets.⁵ Other cooperatives, including COAMV in Burera, COIMU in Nyabihu have storage facilities where the grain can be further dried post-delivery, as well as stored at the facilities.

⁵ This is notably the case for maize cooperatives in Akanyaru River Valley, as well as some in Nyagatare District.

One maize processor located in northern Rwanda, the Maïserie de Mukamira, has proposed the establishment of collection centers in areas of high production, but considers their support to be restricted to the development of social organization, and is unwilling to invest in the construction of drying and storage facilities. In the Nyagatare District, the NGO Research Into Use (RIU) has constructed some collective drying facilities, and the district maize platform NYAMIG has identified some transit storage facilities at the sector level (14 sectors in the district in total).



Bugarama maize collection

These will not be sufficient, however, as the 2010 Season A harvest for the district is expected to be 60,000 T; moreover, the UNDP-funded drying and storage facility in Ryabega, close to Nyagatare city, upon which many producers were counting for the 2010 A maize harvest, has not been completed and made operational.

No company has yet become specialized in maize transport; traders either have their own trucks or use general goods transporters from within the region – Rwanda, Uganda and Tanzania. As mentioned above, much of the maize consumed in Rwanda is imported from neighboring countries including Uganda and Tanzania. Rwandan maize processors complain that local supplies are insufficient and poor quality, and selling fresh maize cobs further decreases local supplies.

D. Processing and Storage

During the course of the Inception Assessment, the PHHS team met with the major and medium-scale buyers and processors of maize, and gathered data on their processing and storage capacity (see Table I below).

The largest of all is Minimex, a company with one facility near Kigali which has a processing capacity of 144 MT maize/day and a storage capacity of 5000 MT. The company has a second facility near Rwamagana to the east, comprised of a dryer and primary silo with a capacity for 2000 MT of grain; the facility, which is not yet operational, will have a storage capacity of 20,000 MT when completed.

Minimex attempted to procure maize on contract from Rwandan cooperatives, but abandoned the initiative when producers failed to deliver maize at harvest. The company, which is processing mainly imported maize, is establishing its own commercial maize farm in southern Rwanda. A second important buyer of maize in Rwanda, the World Food Program's Purchase for Progress (WFP P4P) is only beginning to source maize from Rwanda cooperatives with the 2010 A harvest; they have some storage facilities of approximately 3.5 MT each in Nyagatare, Bugesera and Kirehe Districts.



Akanyaru maize cooperative with poor storage facility

POST-HARVEST HANDLING AND STORAGE PROJECT
Inception Assessment

Table 8: Major Actors in the Maize Value Chain in Rwanda

Actor	Facilities	Processing Capacity	Storage Capacity
Minimex – Kigali		144 MT maize/day	5000 MT
Minimex – Rwamagana	Dryer and primary silo. <i>Not yet operational</i>	2000 MT grain	20,000 MT (in progress)
WFP P4P – Byagatare, Bugerese, Kirehe	Storage	NA	3.5 MT each
Murenzi Supply Company – Kigali	Storage	NA	6000 MT
ENAS Nkubili – Kigali	Hangars; access to the ex-RWANDEX (former coffee) drying facilities; pilot project for construction and utilization of 5 MT silos at village level to facilitate his procurement of grain (rather than having traders buy up all product from farmers at harvest)	NA	2000 MT
Mwizerwa Ignace (grain trader) – Kigali	combination hangars and cocoons	NA	1950 MT
Mwizerwa Ignace (grain trader) – Nyagatare	combination hangars and cocoons	NA	1500 MT
SOSOMA Industries – Kigali	maize flour, sorghum/soya/maize combined food for children) capacity of 1300 MT/Year	700 MT maize/year	350 MT (grain); 200 MT (flour)
Maïserie de Mukamira – Northwestern Rwanda	<i>Operating at only a fraction of capacity</i>	12 MT maize grain/day	3000 MT
COAMV, Burera District – Northern Rwanda	Storage and drying facilities (insufficient); maize milling facilities; also provide members with maize shellers (both manual and electric)	15 MT grain/day	500 MT
Akanyaru River Valley cooperatives	<i>No appropriate storage facilities (members store much in their own homes, resulting in reduced volumes for the coops to sell), artisanal drying of cobs on racks in open air, manual shelling and further drying on tarpaulins, very weak “central” storage facilities made of wooden frame loosely covered with sheeting, unprotected dirt floor</i>	8500 MT maize/yr	None
Nyagatare Rwanda Development Organization/Rwanda Development Investment company project	Storage and milling capacity	15 MT/day	1000 MT grain (in bags on pallets, concrete floor)
UNDP – Ryabega (close to Nyagatare town)	Drying and storage facilities – <i>not yet completed</i> . Electric-powered dryer with capacity of 12 MT/grain per hour	NA	platforms for and acquisition of 50 cocoons of 60 MT grain each
MINAGRI – Kigali and TBD	Plan to renovate five of the former strategic reserve facilities with total capacity of 10,000 MT for storage of 7,000 MT maize (and 3,000 MT beans) by end of March 2010 (to be	NA	50,000 MT (in progress)

	managed by the GoR); They eventually plan to build two new silos of 25,000 MT capacity each (one in Kigali, the other site TBD) to replace old strategic storage facilities (latter will be ceded to cooperatives/private sector for management)		
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There are additional storage facilities, both those of the former Strategic Grain Storage initiative and several cooperatives which have received assistance from the World Bank Rural Sector Support Project (RSSP) for construction of maize and rice storage facilities.

E. Price formation

Some umbrella organizations and NGOs supporting rural development – BAIR in western Rwanda, Centre IWACU country-wide, and RDO in selected districts – have provided training to cooperatives to enable them to calculate their production costs and expected profit margins. However, these practices were reportedly not adopted. Some cooperatives, notably those in the Akanyaru River Valley, set the price at which they will purchase maize from members without first conducting a market analysis, leaving themselves in the difficult position of having purchased at a price considerably above market rates. No other price formation exists in the maize value chain.

F. Markets, Investments, Technologies and Potential Trading Partners

The Rwandan market for maize can be classified into four different types:

1. The World Food Program and other international organizations, that purchase large quantities, in general via a contract with grain traders
2. The industrial scale processing factories (Minimex, Maïserie de Mukamira, COAMV, RDO Nyagatare) and semi-industrial to artisanal. Several small milling facilities exist in Kigali and other cities in Rwanda.
3. RADA and other institutions that support the agriculture sector are involved in the multiplication and distribution of seeds, which are purchased from farmers specialized in multiplication and sold to cooperatives/farmers at a subsidized price. MINAGRI will be purchasing substantial quantities of maize for their strategic storage facilities, beginning with the 2010 Season A harvest, via traders as well as producers.
4. The direct consumers of maize, either in the form of the grain, or flour (prisons, schools, military camps). These entities generally announce “calls for offer” on a quarterly or annual basis, to which the traders reply. Maize can be sourced from Rwanda or within the region, without distinction.

From the perspective of physical points of sale, the major outlets are:

- The large grain market at Nyabugogo in Kigali City where traders from large to small-scale conduct their commerce
- The depots of the large buyers including ENAS and Murenzi Supply Company.
- The regional depots within Rwanda belonging to cooperatives or support-organizations in the zones of large production. These include COAMV, RDI, COAMANYA and others. These depots serve as intermediary storage facilities between cooperatives and the market including traders or the WFP, as well as strategic storage facilities, especially for seeds
- Collection centers or primary storage facilities. While the collection centers are underdeveloped, they are in high demand by all actors in the value chain who were met during the study including Maïserie de Mukamira and cooperatives in the Akanyaru River Valley. These

centers would make it possible to ensure improved post-harvest handling including drying, sorting, and grading prior to sale.

Apart from a few initiatives such as COAMV's manual shellers, no specific post-harvest technology is employed in the maize value chain, with almost all first-level post-harvest activities conducted by hand. This not only slows the pace of operations, but negatively impacts the quality and quantity of maize put onto the market place. RADA and other support institutions such as the agricultural training college, ISAE Rubulizi, Kigali Institute of Science and Technology or KIST, are undertaking initiatives to design and produce appropriate-technology post-harvest equipment. PHHS staff also learned that some international companies including Balton CP, and BrazAfrica beginning to show interest in providing post-harvest infrastructure for Rwanda's maize value chain.

G. Post-Harvest Loss Summary

Despite considerable efforts, no reliable data could be found on post-harvest losses of maize in Rwanda. Moreover, the complexity of how this parameter is defined makes it extremely difficult – even if data were available – to attach any figure to post-harvest grain losses. To begin with, there are different types of losses:

- (1) **Loss in value** arising from inadequate and inappropriate drying facilities such as cobs/grain dried in open air and subject to wetting when it rains due to lack of shelter; cool temperatures in high altitude zones make it impossible to bring moisture level down to 13% without facilitated drying. Also losses arise from contamination of maize with soil, insects and other impurities during drying, especially when grain is simply spread on tarpaulins on the bare ground, or old, dirty concrete slabs.
- (2) **Quantitative losses** due to insect damage. Storage facilities are not insect proof; there is inappropriate/poor use of pesticides; and opening of cocoons during storage period allows oxygen to rise to levels which insects can tolerate. There are also losses due to rots provoked by grain wetting during drying and storage and rodent damage due to unprotected storage.
- (3) **Quantitative “losses”** when (a) producers harvest and sell fresh maize which reduces supply available to buyers and processors, as well as quantity, cooperatives can bulk sell, reducing attractiveness of their offer; and (b) members of coops sell maize on side, rather than selling to coop or buyer (in case of contracts between buyers and farmers, e.g. Minimex);
- (4) **Quantitative losses** due to theft.

While actors in the maize value chain interviewed during the study had little foundation for their estimates, they seemed to agree that maize post-harvest losses in Rwanda vary from 20-30%, citing lack of drying facilities as the greatest cause of losses. Other areas where losses may be occurring, but which were not mentioned by any of the interviewees, are as follows: losses during transport, losses during shelling, losses during milling, and losses of maize flour due to insect infestation, rotting, and leakages in packaging.



Akanyaru maize cooperative with rudimentary drying and shelling facilities

H. Targeted Maize Value Chain and Post-Harvest Partners

The PHHS project is likely to be working with the following actors in the maize value chain in the second half of the first year of operations:

Buyers/Traders	WFP P4P, ENAS Nkubili, Maïserie de Mukamira
Support Organizations	NYAMIG (maize platform in Nyagatare District) which is affiliated with RDO/RDI in conjunction with DUTERIMBERE IMF, BAIR (umbrella organization working with producers of maize, wheat and potatoes in north and western Rwanda), Centre IWACU, ROPARWA, Urugaga IMBARAGA and ISAE Rubilizi (for appropriate technology post-harvest equipment)
Rwanda maize cooperatives	Akanyaru River Valley cooperatives, NYAMIG and BAIR assisted cooperatives, COAMV (Burera), Kirehe cooperatives supplying WFP P4P
Regional partners	CATALIST, Market Linkages Initiative (MLI), COMPETE

3. Beans

A. Introduction and Overview of Market Trends

Beans, both bush and climbing, are the most important traded crop in rural areas of Rwanda, and third most important in urban areas in terms of value.⁶ Although bean production and consumption declined in 2004-2005, there have been significant increases in production and consumption in recent years. However, despite the importance of beans in Rwanda, their production and trade do not have any organized structure as compared to almost all other staple crop value chains in Rwanda.

More attention has been devoted to the bean value chain in recent years. The Rwandan Agricultural Research Institute (ISAR) in collaboration with the International Center for Tropical Agriculture (CIAT), developed 15 new varieties that are expected to have greater yields (3-4 MT/ha) and be resistant to legume diseases such as anthracnose, root rot. ISAR began formally distributing these new varieties to farmers on 15 January 2010. The joint CIAT-International Food Policy and Research Institute's (IFPRI) HarvestPlus program has also commenced work on the development and promotion of iron-rich beans.



Field of pole beans in Northern Rwanda

B. Cultivation

Beans are cultivated by approximately 95% of Rwandan farmers, and occupy about 30% of all cultivated land; bean production in Rwanda is conducted primarily by women.⁷ Beans are cropped twice per year, with an average annual production of approximately 238,000 MT.⁸ Production increased following a decline in 2004-2005, with the area under bean cultivation increasing to 360,000 ha in 2007. The most significant increase in production occurred in the eastern districts of Rwanda.⁹

⁶ Ferris et al., 2002

⁷ Ferris et al., 2002

⁸ Based on most recent available data (2000-2007).

⁹ FAOSTAT 2009, Rwanda Beans Profile

Bush bean yields range from 0.8 to 2 MT/ha, while climbing bean varieties have much higher yields of around 5 MT/ha. About 5-10% of harvested bean seed is saved for the next crop, with other seed needs met by purchasing from primary traders; there is no commercial bean seed production in Rwanda.¹⁰

As mentioned previously, HarvestPlus has initiated a research program on iron-rich beans in Rwanda. The first commercial production of these varieties is planned to take place during the 2011A rainy season. Research and production are organized in partnership with local NGO Urugaga IMBARAGA and partner cooperatives, the Ministry of Health, Rwanda's National Agricultural Research Institute (ISAR), and the National University of Rwanda's Faculty of Medicine, School of Public Health, and National Laboratory.¹¹ The HarvestPlus program hopes to organize farmers into bean producer cooperatives in three districts in northern and northwestern Rwanda.

C. Collection and Trade

In Rwanda, self-consumption of beans in rural areas accounts for 49% of total rural production. The Beans are traded by a large number of primary traders and a small number of wholesalers, such as the WFP P4P and Murenzi Supply Company. The primary traders purchase beans directly from farmers and keep a stock to be sold locally, including stock that will be resold as seeds for the next cropping season. Wholesalers are based in and around Kigali and receive their supplies from a network of traders. Typically, retailers will collect beans from the wholesalers, but they may also collect them directly from primary traders.

None of the bean value chain actors have a large degree of control over production, storage, transport and trade, and the level of vertical integration in the value chain is very low. The cost of marketing beans from rural areas to urban consumers is relatively high because of poor access to stores.¹² Bean production takes place on farms which are usually distant from markets, and rural roads are in poor condition. Within the rural communities distances are covered on foot or by bicycle.

In the past, there were significant imports of beans into Rwanda from the Democratic Republic of Congo (DRC), estimated at about 28% of total consumption.¹³

D. Processing and Storage

In Rwanda, beans rarely undergo any processing until reaching the final consumer. A bean plant was once established in Butare, but food safety procedures were not followed, resulting in several cases of food poisoning and eventually closure of the plant.

At present no large commercial or storage stocks exist, although WFP P4P and MINAGRI would like to establish

some facilities. Most beans are stored at household level in unprotected conditions, leaving them vulnerable to insects, temperature and humidity changes. Some of the larger



Abandoned and unused former strategic grain storage facility

¹⁰ H. Hendrickx, personal communication

¹¹ Source: <http://www.harvestplus.org/content/iron-beans-rwanda>

¹² Loveridge et al., 2007

¹³ CIAT 2002

traders, for example ENAS Nkubili and Murenzi Supply Company, have their own storage facilities, but these are not specialized for bean storage, and the product only remains at their premises for a very short time.

MINAGRI has plans to renovate five of the former strategic reserve facilities with a total capacity of 10,000 MT for storage of 3,000 MT beans and 7,000 MT maize by the end of March 2010. Beans will be purchased from the major traders, and the facilities are to be managed by GoR. They eventually plan to build two new silos of 25,000 MT capacity each. Plans are for one silo in Kigali, the other site to be determined. These new storage facilities will replace old strategic storage facilities, which they plan to cede to cooperatives or private sector entities for management.

E. Price Formation

According to the East African Grain Council’s Regional Agricultural Trade Network (RATIN), bean market prices in Kigali remained fairly stable at US\$200 to US\$250/ton between 2000 and 2004. Since then, prices have increased and varied between US\$358 and US\$617/per ton - equivalent to 200 to 347 RWF per kg - in 2009. The breakdown for locally produced unsorted beans traded in Kigali is as follows:¹⁴

Farm Gate Price	180 – 200 RWF
Primary Trader	200 – 220 RWF
Wholesale	220 – 250 RWF
Retail	270 – 300 RWF

F. Markets, Investments, Technologies and Potential Trading Opportunities

As mentioned above, beans are the most important traded crop in terms of value in rural areas, and the third most important crop in urban areas.¹⁵ The main market for beans is found in Nyabugogo, Kigali. Beans are rarely graded or selected, nor packaged or branded, although there is potential to increase selling price by grading according to appearance so as to sell “single variety” beans, as occurs in neighboring Kenya.

The largest buyers of beans in Rwanda include WFP P4P, MINAGRI, prisons, boarding schools and other school feeding programs.

In terms of post-harvest technologies which would reduce losses in the bean value chain, the most important is the need to insect proof and insulate seed storage facilities to maintain seed viability.



Current practice for drying beans in Rwanda

¹⁴ RATIN 2009 – www.ratin.net

¹⁵ Loveridge et al., 2007

G. Post-Harvest Loss Summary

As was the case for the other staple crop value chains, no reliable data could be found on the extent of bean post-harvest losses in Rwanda. Interviews and review of secondary data indicated that quantitative losses of beans in storage are caused mainly by weevil and other insect infestations. Another phenomenon known as “hard-shell-hard-to-cook,” which renders the beans unusable, is brought about by lack of control of relative humidity and temperatures in storage. Quantitative losses also occur due to damage during transport and loss of seed arising from the rudimentary threshing techniques. Qualitative losses include discoloration, physical damage during shelling, and aflatoxin build up.

H. Targeted Bean Value Chain and Post-Harvest Partners

The most likely partners to be targeted by the PHHS project with respect to the bean value chain are:

Producers	Cooperatives selling to the WFP P4P, producer organizations supported by the HarvestPlus iron-rich bean program and CATALYST cooperatives who produce beans as a rotation crop with maize
Buyers	WFP P4P, Murenzi Supply Company and perhaps MINAGRI
Support organizations	HarvestPlus, CATALYST, the Banque Populaire
Regional partners	MLI, COMPETE

4. Cassava

A. Introduction and Overview of Market Trends

Cassava production in Rwanda declined over the period of 2002 – 2005 due to the Cassava Mosaic Virus (CMV) epidemic. Introduction of CMV resistant varieties, which contain some cyanide, in 2006-2007 has reversed this decline, but has resulted in almost all of Rwanda’s consumption of cassava flour products. With the exception of the PEARL/SPREAD/ACDI-VOCA assisted cooperative COVEPAR, almost all cassava flour production is at the artisanal level and for local markets only. Some cassava may be exported to the DRC, where it is a popular staple food. Urban consumption was about 21 kg per capita in 2000/2001, while rural consumption is roughly estimated at 30 kg per person and per annum, but differs strongly according to ecology and farming system. In recent years, cassava has become a preferred food of urban middle and low-income citizens as it is inexpensive and easy to prepare.

B. Cultivation

The southern province including the Muhanga, Ruhango and Kamonyi Districts and the eastern province including Gatsibo and Kirehe are zones of high cassava production in Rwanda. Cassava production is best at mid to lower altitudes, and the crop is usually grown in rotation with a wide range of other staple crops, such as beans, maize, and sorghum. The production cycle lasts 12-15 months from planting of cuttings to harvesting. Cassava roots deteriorate rapidly once removed from the ground, and are left in the soil until needed for sale, consumption, or processing.

C. Collection and Trade

Cassava marketing chains in Rwanda are dominated by small-scale informal intermediaries, including: farmers, rural assemblers and traders, transporters, urban wholesalers and retail traders. Some

intermediaries combine different functions. Farmers sell their produce in the field, along the road, at the farm gate on a daily, weekly and biweekly basis. The transaction volume is small, and prices are negotiated at the time and place of sale on the basis of bargaining power between the buyer and seller.

Transport from the farm to market places is a major problem for this staple crop. A strong tradition of rural farmer groups, cooperatives and associations exists, who bulk their produce in rural areas and organize transport to urban markets in order to obtain a better price. There are at least four to five seasonal wholesale markets in each cassava growing province. In Kigali, wholesale trade is organized through a large number of informal wholesale markets. These wholesale markets specialize in all perishable items including banana, vegetables, fruits, and roots and tubers, including cassava). Most vendors are women or transporters, and their clients are retailers and urban consumers.

D. Processing and Storage

Over the past two years, cassava has become a high priority crop for the GoR; at least ten semi-industrial processing facilities were constructed across the country, with a concentration in Bugesera with some facilities in Southern Province Districts including Kamonyi, Muhanga, Ruhango, and Nyanza. A big industrial plant is being launched in Ruhango District. It will be managed by the Banque Rwandaise de Developpement (BRD) and later transferred to the private sector through the Build-Operate-Transfer (BOT) scheme. Other cassava processing facilities include:

- Abandoned CSC UGAMA processing facility in Gatsibo
This facility may become operational if (a) District cedes the facility to the Cassava Initiative Platform (CIP) and (b) CIP receives technical and financial assistance needed to renovate facilities and undertake processing
- PASAB (CARITAS/Catholic Church supported) facilities in Bugesera
- COVEPAR: cassava flour initiative targeting Africans living in France and other EU countries, and developed with strong assistance from the PEAR/SPREAD-projects and ACDI/VOCA, both using USAID financing.



Abandoned cassava processing facility in Gatsibo

E. Price Formation

The price of quality cassava flour ranges from 300 RWF/kg in local markets to 900 RWF/kg in Kigali supermarkets. Prices are calculated differently for traditionally-made flour and the modern, stabilized flour. Roughly, the pricing chain is as follows:

Cassava fresh roots	40-60 RWF/kg
Cassava chips	150-250 RWF/kg (depending on quality and type of processing)
Milling (as service)	10-20 RWF/kg
Flour	300-900 RWF/kg

F. Markets, Investments, Technologies and Potential Trading Partners

The major outlets for cassava are local markets for flour and potentially DRC markets. Numerous products, not yet manufactured in Rwanda, can be produced from cassava roots. These include livestock feed, for which demand is anticipated to grow due to the GoR's "One Cow per Family" program.

G. Post-Harvest Loss Summary

As with other staple crops, no reliable estimates of cassava post-harvest losses were found during the assessment study; both from interviews and secondary data, the types of losses which occur are:

- Qualitative and quantitative losses brought about by physiological deterioration of the root as soon as it is harvested
- Quantitative and qualitative losses in processing: lack of clean water for soaking peeled roots, lack of adequate drying facilities, both of which result in cassava “chips” which rot quickly if not processed
- Qualitative losses due artisanal flour production techniques which result in flour with inconsistent quality

H. Targeted Cassava Value Chain and Post-Harvest Partners

The most likely partners to be targeted by PHHS with respect to the cassava value chain are:

Umbrella organizations	INGABO and affiliated cassava cooperatives in the southern province, Cassava Initiative Platform and affiliated members
Research organizations	International Institute of Tropical Agriculture (IITA) in Uganda and Tanzania and the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)

5. Irish Potato

A. Introduction and Overview of Market Trends

Irish potato has a long history of cultivation and consumption in Rwanda, which dates back to the colonial era. Despite its small size, the country is in fact the largest producer of Irish potato in the East African Community. Most of Rwanda’s potato production occurs in the north and northwest regions, with the harvested tubers transported mainly to markets in Kigali, with some exports to Burundi and Tanzania. The average price for potatoes on local markets has increased steadily since 2002.

B. Cultivation

Irish potato is cultivated in all four provinces of Rwanda, as well as in Kigali city. Rainy Season A (September – February) yields a greater production of tubers than Rainy Season B (March – August); however, there are higher incidences of post-harvest rots in the Season A harvest. The zones of greatest production are the Northern and Western Provinces, which alone account for 90% of Irish potato production in Rwanda, particularly the former provinces of Gisenyi and Ruhengeri which yield approximately 64% of the national production. High yields are achieved in these regions due to the fertile volcanic soils and high altitude.



Chief of Party Anne Turner points out a *Pseudomonas* infected potato plant

Most potato producers grow one crop per year in rotation with maize, beans and peas, while the best practice is actually to grow one crop every two to three years to reduce disease pressure. Similarly, the

production of seed tubers is supposed to be separated from the production of tubers destined for consumption, mainly to avoid carryover of diseases from the field into seed tubers and therefore subsequent crops. However, this is not always carefully monitored and controlled.

Although seed tuber production should only come from cooperatives and producers certified by RADA, visits to fields of certified seed tuber producers revealed a significant lack of adequate disease control measures, with resulting high levels of disease-infected tubers, especially the bacterial disease *Pseudomonas*. Since most farmers do not follow a good potato “Integrated Pest Management” (IPM) production program, which emphasizes disease prevention, they instead apply large amounts of fungicides to control Late Blight and other fungal diseases.

Bacterial wilt, a disease not controlled by fungicides, was the most serious post-harvest disease problem observed, as no bacterial control agents are available or used in potato production in Rwanda. The failure of most farmers to follow IPM programs results in high levels of bacterial wilt infected tubers at harvest. These tubers (a) are prone to rot in storage, and (b) if planted, further disseminate the disease. Potato tubers need to be left in the ground for two weeks after vine cutting to ensure the skin matures, extending the storage life of tubers. Many producers who were interviewed complained that there is a serious problem of theft of tubers over this period, which discourages many from following this practice.

Rwanda’s potato producers are, for the most part, grouped into strong cooperatives, which are supported by both local and international NGOs including BAIR, CECMA/Imbaraga, and ACDI/VOCA.

C. Collection and Trade

Rwanda’s potato producing cooperatives have established collection centers in zones of high production. Some cooperatives, with support from their partners (BAIR, ACDI/VOCA, IMBARAGA), own storage infrastructure that is generally used for storage of seed potatoes. Collectors purchase potatoes from producers at the collection centers, which they sell to transporters and traders. Traders transport and sell the tubers in nearby markets, Kigali city and in neighboring countries including Burundi, Uganda and Tanzania. Some of the large cooperatives have formed organizations to avoid price speculation: for example, CECMA takes charge of transporting the tubers and marketing them in Kigali in order to have stronger bargaining power.

A local NGO, Urugaga IMBARAGA, which is very involved in the potato value chain, has started a project for grading and cleaning potatoes prior to selling them to large supermarkets in Kigali such as Nakumatt and Simba. Prices paid for cleaned, graded potatoes sold in bamboo baskets are over three times the regular market price for tubers.

Major consumers of Irish potatoes are households, hotels, restaurants, and educational institutions, who often purchase from traders or retailers.

D. Processing and Storage

The majority of potato storage facilities in Rwanda are utilized for seed tubers only. Tubers destined for consumption are not stored for any significant period of time, in part due to their high perishability. The seed tuber storage facilities identified during the inception assessment are almost exclusively in northern and northwestern Rwanda, and are in different



New seed potato storage facility

conditions ranging from well built, new facilities to older facilities in need of renovation. The best example is that of the COAMV seed potato storage facility in northern Rwanda, which is newly built, provides solid protection and is kept clean.

The only Irish potato “processing” in Rwanda is the IMBARAGA initiative which washes, grades and packs tubers in bamboo baskets, targeting the high end supermarkets for their sale. There is no production of frozen or dried potato products in Rwanda.

E. Price formation

As is the case with all perishable products, potato prices fluctuate significantly, changing from one season to another and even from one point of sale to another. Price variations arise as a result of changing volumes of production.

Potato production cooperatives and support organizations have started to train producers on how to calculate their profit margin and improve storage of tubers so as to stabilize prices by controlling supplies. However, available post-harvest infrastructure is insufficient, and the lack of application of standards on potatoes sold on the market place results in significant risk of post-harvest losses. Rather than risk these losses, producers seek to sell their potatoes as soon as possible after harvest, regardless of the price. The general price distribution is as follows: if the selling price is 100 RWF, the producer receives approximately 40 RWF, the remaining being split between the collector (20 RWF), the transporter (20 RWF) and the wholesaler (20 RWF). For potatoes which are washed, graded and sold in bamboo baskets, the selling price includes the services provided by the support organization (IMBARAGA) and the costs of the bamboo baskets. Potato producer organizations struggle to 1) reduce the number of steps in the distribution chain and 2) increase their share of the profits.

F. Markets, Investments, Technologies and Potential Trading Partners

The value of potato tubers sold on the market place could be significantly increased, and post-harvest losses reduced, with the simple application of more careful harvest and post-harvest handling techniques – ensuring the tubers are not damaged by harvesting tools, placing rather than throwing containers into trucks and storage facilities, and not leaving the tubers unprotected from the elements while waiting for collection. Improved transportation practices, such as the use of enhanced containers to reduce bruising, less overloading of trucks, and slower driving speeds, would also result in a more attractive, and therefore higher value, product arriving at the market. As mentioned above, more value can also be added by cleaning and grading tubers and placing them in improved packaging for sale to supermarkets, as in the IMBARAGA initiative.



Typical means of potato transport: overloaded sacks stacked on top of one another result in significant bruising to tubers, leading to post-harvest losses

G. Post-Harvest Loss Summary

No data was found on the extent of post-harvest losses of Irish potatoes destined for consumption. Some seed producing cooperatives did have estimations of losses of seed tubers in storage. These are believed to be significant, arising primarily from the storage of disease infected tubers rather than (a) reducing the incidence of disease by following a strict IPM program and (b) rigorously grading out all tubers with signs of disease or injury prior

to storage, as well as periodic inspection and removal of affected tubers during storage. Cleaning storage facilities with a simple disinfectant such as chlorine prior to each new storage cycle would also help to reduce losses. Based on interviews with cooperatives certified by RADA to produce seed tubers, there is an estimated 30% to 50% loss in stored tubers over a 3-4 month period.

Other potato post-harvest losses, none of which are quantified, were found to include the following:

- Premature tuber harvesting resulting in injury and moisture loss
- Damage to tubers during harvest including wounds and bruises. These not only render the product less attractive, but serve as entry points for pathogens
- Damage to tubers during packaging and transport
- Lack of protection of tubers during storage and marketing from high temperature and sunlight
- Unattractive packaging resulting in lower prices

H. Targeted Irish Potato Value Chain and Post-Harvest Partners

Potential partners in the potato value chain include, but are not limited to:

Cooperatives	Those assisted by the soon to end ACDI/VOCA program, supported by the umbrella organization BAIR, based in Gisenyi, supported by IMBARAGA and the Burera based cooperative COAMV
Support Organizations	BAIR, IMBARAGA, CECMA, DERN
Regional Partners	MLI, COMPETE, the International Potato Center (CIP)
The Kigali Fresh Produce Market Facility	If/when it becomes operational

6. Wheat

A. Introduction and Overview of Market Trends

Similar to the situation encountered with maize, wheat supplies from Rwandan producers are both insufficient and do not meet quality standards. Moisture is a serious problem given that all wheat is grown in high altitude zones, and the cool temperatures prevailing make it even more difficult to dry the grain down to required moisture levels of less than 14%. Wheat millers also complain that Rwandan wheat producers grow the “wrong” variety, and that the grain delivered to factories contains a high level of impurities. The director of PEMBE wheat factory in Byumba, one of the largest wheat processors in Rwanda, said that almost all of their wheat flour is produced from imported grain from Argentina, Russia, Brazil, and Australia. This is because local production was not only very small, but reached the factory at a very high moisture content of 17-18%, as opposed to 13-14% for imported wheat.

B. Cultivation

In Rwanda, wheat is almost exclusively produced in high altitude zones. The crop is produced in both rainy season A and B, but a greater percentage of production takes place in season B.

Although small, the wheat value chain has strong support from cooperatives and unions through the provision of inputs, agronomists/training and post-harvest assistance.

C. Collection and Trade

Some of Rwanda's wheat cooperatives provide trucks to collect their members' grain from the production sites to their storage facilities or processing factories (e.g. COPROVAB in Ruhengeri, KOAGIMITA near Gikongoro); some also have collection centers to facilitate this activity (e.g. COPROVAB, UNICOBLE near Gikongoro). Additionally, some of the wheat cooperatives/unions assist their members with marketing of their grain (COPROVAB, UNICOOPAGI, UNICOBLE). Because the prices offered by the wheat millers are often considered to be low compared to market prices, many producers end up selling their wheat on the markets. PEMBE, on the other hand, considers it to be a "waste of time" to work with Rwandan wheat producers, and relies almost entirely on wheat imports, as mentioned above.

D. Processing and Storage

The processing and storage facilities available to wheat cooperatives/unions are largely small and rudimentary. COPROVAB has a small, unsheltered concrete slab for drying wheat and a storage capacity of 100 MT grain. Two of the BAIR-assisted cooperatives have together a total of 70 MT storage facilities which are in poor condition and need renovating, and UNICOOPAGI has a small 50-60 MT wheat storage facility. Only KOAGIMITA, thanks to support from Caritas and the Irish NGO TROCAIRE, has adequate storage facilities comprised of two well constructed buildings with 100 MT capacity each, replete with pallets, a reception area and office.

With respect to wheat processors, the SOTIRU flour mill has basically ceased operations, and is in dialogue with foreign investors to seek support to improve their capacity. The Nyungwe Flour Mill is old, and in need of renovation; only the PEMBE flour mill has profitable operations in Rwanda at present, with a capacity of processing 200 MT of wheat per day, and with plans to increase to 400 MT per day in 2011.

E. Price Formation

With the exception of the Nyungwe flour mill, wheat prices are set by the processors. PEMBE will not accept grain with moisture content above 14%, for which it offers a price of 250 RWF/kg of grain, and before ceasing operations, SOTIRU offered a maximum price of 230 RWF/kg, compared to a market price of 250-300 RWF/kg. For purchase of wheat by the Nyungwe flour mill, a meeting is convened each season between the wheat producers, the processors and the District to negotiate the selling price.

F. Markets, Investments, Technologies and Potential Trading Opportunities

Rwanda's wheat value chain was found to offer the least amount of opportunity in new markets or investments.

G. Post-Harvest Loss Summary

A similar situation was encountered with respect to gathering information on post-harvest losses of wheat in Rwanda, namely that no reliable data exists. Causes of post-harvest losses, without any ranking, were cited to be the following:

- Quantitative losses during transport of stalks, threshing and winnowing
- Rotting caused by storage of moist grain (quantitative)

- Rotting in storage caused by (1) not roguing out rust infected plants in field and (2) not grading out rust infected grain from clean grain prior to storage, resulting in the disease spreading from infected to clean grain Qualitative loss due to impurities (stones, other foreign matter mixed with grain during threshing, winnowing and drying using rudimentary facilities)
- Losses during milling

H. Targeted Wheat Value Chain and Post-Harvest Partners

Potential partners in the wheat value chain include:

Wheat Cooperatives	COPROVAB, cooperatives assisted by BAIR, UNICOOPAGI, UNICOBLE and Caritas-assisted KOAGMITA
Support Organizations	BAIR, UNICOOPAGI, UNICOBLE, CARITAS/RIM, ROPARWA
ISAE	For development of appropriate technology equipment for wheat post-harvest handling
Regional Partners	MLI, COMPETE

7. Soybean

A. Introduction and Overview of Market Trends

Soybean production in Rwanda has never existed on a large scale, and has declined over recent years due to the fact that the Rwandan Agricultural Research Institute (ISAR) has ceased producing the inoculation material needed for nitrogen fixation by the soybean plant (the bacterium *Rhizobium*). At present, only small-scale production and processing of soybean takes place: maize-soy-sorghum blend (SOSOMA), tofu and soy milk (Cooperative ABAHUJE) and production for utilization at the household level in porridge, sauces and snacks.

B. Cultivation

Soybean production in Rwanda generally takes four months from sowing to harvest. The crop is cultivated during both Season A and Season B, in rotation with maize, rice, or other staple crops. Yields are around 500 kg/ha, although demonstration plots where all inputs and improved production practices are applied reported achieving 1800 kg/ha. Soybean is mainly produced by small-scale farmers, and production is not organized into cooperatives with the exception of those producing with DUHAMIC ADRI assistance for the SOSOMA factory, and three cooperatives producing for the ABAHUJE soy milk and tofu factory in Ruhango. As mentioned above, soybean production has been seriously reduced by the cessation of supplies of *Rhizobium*, the bacterium) which must be used to inoculate the seed prior to sowing in order for nitrogen fixation, and therefore good crop growth and productivity, to take place.

While it is a distant and uncertain initiative, plans are reportedly underway for a joint COMPETE/IFDC-CATALIST project to (1) organize a 700 ha soybean farm near Akagera, and (2) contract 7,000 small-scale farmers for soybean production, both towards the goal of supplying an oil and cake processing factory to be established in Kayonza

C. Collection and Trade

The very small volumes of soybeans currently produced result in negligible trade in Rwanda. The only significant commerce is between the ABAHUJE soy processing facility and three cooperatives which

process soybean with their (and IFDC) assistance, and the soybean producing cooperatives affiliated with SOSOMA Industries.

D. Processing and Storage

The company SOSOMA Industries, located in Kigali, processes a small amount of soybeans (300 MT/year) for blending with maize and sorghum to produce a nutritious porridge for children. The only other soy processing operation in Rwanda at present is the ABAHUJE soy milk and tofu factory in Ruhango, which processes 1.5 MT soybeans per year. The facility has got a storage capacity of 10 MT, and is anticipating “modern” equipment before the end of 2010 for production of both tofu and soybean oil, to be provided as a donation from the Association UMUBANO in conjunction with the Friends of the Rwandan Association of Belgian Residents.



Soybean plot adjacent to ABAHUJE soy processing facility

E. Price Formation

The selling price for soybeans in Rwanda varies from 150 RWF/kg for product destined for consumption, to 250 RWF/kg for selected soybean seed. Soybean flour sells for 450-700 RWF/kg, depending on its quality. Tofu, produced by ABAHUJE, sells for 800-1000 RWF/kg.

F. Markets, Investments, Technologies and Potential Trading Opportunities

The outlook for soybeans in Rwanda is fairly bleak at present, with the only potential opportunity being that of the aforementioned plan for a soybean oil and cake processing plant in Kayonza. According to most recent correspondence, this initiative is far from being implemented and in need of significant financial and technical support if it is to be realized.

G. Post-Harvest Loss Summary

Information on soybean post-harvest losses is minimal. The only cause of post-harvest losses cited was shattering of pods in the field, prior to harvest, with no estimation of the percentage lost due to this problem.

H. Targeted Soybean Value Chain and Post-Harvest Partners

If any work is undertaken on soybean under the PHHS project, it will most likely be in partnership with the combined operations of DUHAMIC/ADRI and SOSOMA Industries. Should the Kayonza processing facility come into being within the first year of the project, other partners would include the regional partners CATALYST, MLI and COMPETE together with the soybean producers supplying the factory.

Annex B – Financing and Investment

Overview

Rwanda has taken steps substantial strides in recent years to improve the country's investment landscape and attract private investment. The GoR has made private investment one of its top priorities, eliminating all policies that previously barred foreign investors from directly investing in sensitive market sectors and from owning an unlimited percentage of equity. Regulations have been implemented to simplify the processes of starting a business and registering property – the country is now ranked 11th globally in terms of ease of starting a business.¹⁶ Other attractive investment incentives include simple taxation, such as 100% write offs on Research and Development (R&D) costs, and legal protection of free repatriation of capital and profits.¹⁷

In 2008, Rwanda's Parliament passed legislation to create the Rwanda Development Board (RDB), a one stop shop for all investors and a key resource to improve the effectiveness of the Rwandan government with respect to potential business investors. The RDB merges eight government ministries that bear responsibility for registering and starting a business in the country; its board members include the ministries of finance, commerce, infrastructure and agriculture. It has global expertise and is modeled on other successfully recognized international best practices. For all its efforts, Rwanda has been voted the "world top business reformer" by the World Bank's 2010 Doing Business Report.

Recent macroeconomic data from the World Bank shows that the country's \$4.2 billion economy grew at a respectable rate of approximately 8.5% in 2008, from the previous year's 7.9%.¹⁸ Strong agriculture performances are helping elevate average real GDP growth rates, after a considerable slowdown of 5.6% over the period 2003-2007 that was preceded by a remarkable increase of 10.5% sustained during the first 7 years following the conflict. Data from the Rwandan Development Board, the government agency tasked with promoting Rwanda's business opportunity to the local and foreign direct investments, shows that Gross Domestic Product grew at a rate of 8%, placing it as the highest among the East African Countries members.

Rwanda's geographical location makes it a potentially strategic center for Eastern Africa regional commerce. It is surrounded by Uganda, Burundi, Tanzania and the Democratic Republic of Congo; all countries, along with Rwanda, are members of the East African Community (EAC), a large regional economic bloc that has a combined population and GDP of 125 million and \$60 billion respectively. As an EAC member, Rwanda shares a customs union with the other members, benefiting from duty free importation for all products produced within the EAC and, a common external tariff which translates to 0% on raw materials and capital equipment, 15% on intermediate goods and 25% on finished goods.¹⁹ Additionally, the prospect of an expected common market union, created in 2010, further enlarges Rwanda investment potential.

¹⁶ World Bank. *Doing Business 2010*.

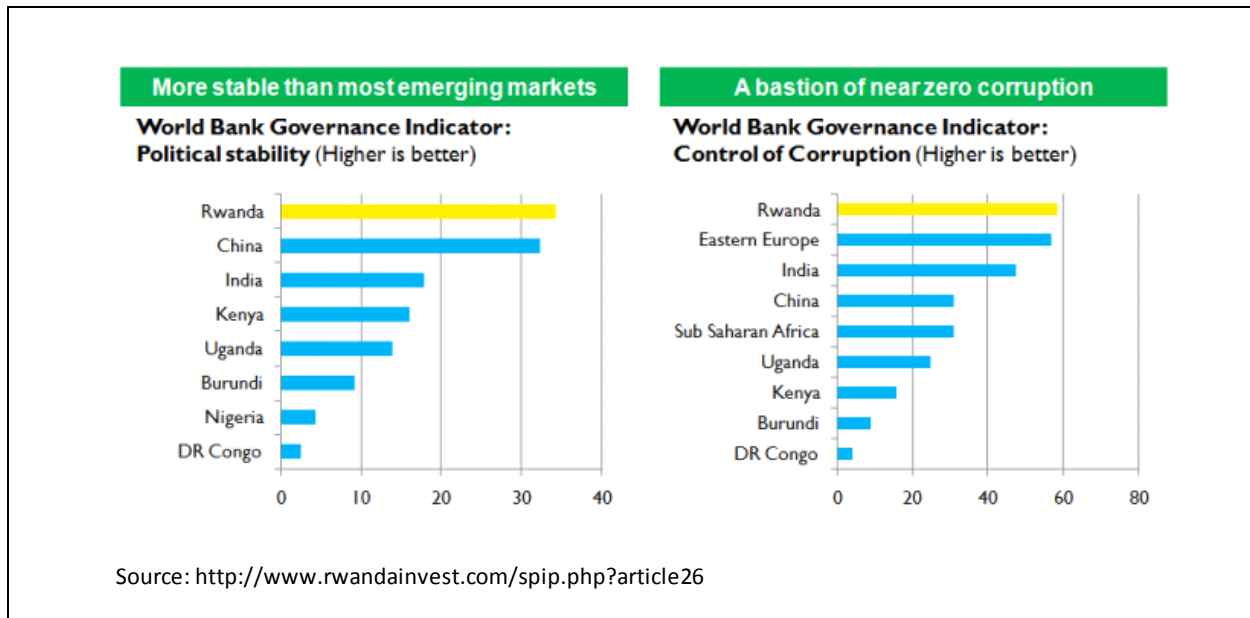
¹⁷ <http://www.rwandainvest.com/spip.php?article52>

¹⁸ <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/RWANDAEXTN/0,,menuPK:368714~pagePK:141132~piPK:141107~theSitePK:368651,00.html>

¹⁹ <http://www.rwandainvest.com/spip.php?article52>

The country has had a stable political and governance climate, with a low level of crime. The government, led by President Kagame has made fighting corruption its top priority.

Figure 10: Political Stability and Control of Corruption, Rwanda



Foreign Direct Investment (FDI) data compiled by the National Bank further reinforces the PHHS study's findings that Rwanda's agriculture sector in general, and activities related to post-harvest handling, storage and processing of staple crops in particular receive a relatively low share of investment finance. While figures show (

) a constant increase of foreign investment from 2005 to 2009, the agriculture sector has had limited benefits from this surge. Growth has only occurred twice, in 2007 with the acquisition of one of Rwanda's wheat flour mills by Pembe Flours Mills (a multinational wheat processing company) and few rice mills by foreign investors, including ICM, a leading Australian private agribusiness, representing only 4.86% of FDI that year; and, in 2008 with the 30% equity ownership of Rabobank in Banque Populaire du Rwanda²⁰, representing less than 10% of a total of \$103.35 million for the entire year.

²⁰ <http://www.highbeam.com/doc/1G1-180237240.html>

Table 9: Foreign Direct Investment in Rwanda, 2005 – 2009²¹

Period	2005	2006	2007	2008	2009
FDI (Million USD)	14.24	30.57	82.28	103.35	118.67
FDI in Agriculture Sector (Million USD)	2.3	1.5	4	10.1	0
FDI Growth Trend (Million USD)		16.33	51.71	21.07	15.32
Growth Trend of FDI in Agriculture Sector (Million USD)		-0.8	2.5	6.1	-10.1
FDI Growth Trend (%)		1.15	1.69	0.26	0.15
Growth Trend of FDI in Agriculture Sector (%)		-0.35	1.67	1.53	-1.00
Share of Agriculture in FDI (%)	0.16	0.05	0.05	0.10	0.00

The introduction of credit enhancements products (please refer to the Investment and Financing Potential section below), developed by the GoR, to boost Local Direct Investment (LDI) in the agriculture sector, has had mixed results, highly benefiting the export sector and limiting post-harvest financing in the local grain markets to the purchase of harvested commodities by middlemen contracted by the World Food Program and/or local processing mills.

Rwanda has the resources, as well as the public and private sector capabilities, to facilitate strong, sound investments in its agriculture sector. PHHS will work with all parties to develop investment practices and initiatives which benefit all players in the related agriculture and business sectors.

Summary of Interviews and Consultation of Secondary Data

Interviews conducted with the local financial community revealed that limited funds are allocated to support staple crop post-harvest activities. Few reputable private enterprises, contracting with the World Food Program and major processors, have access to financing for the purchase of commercially viable crops such as maize and rice.

The existing government initiated credit enhancement programs are mostly used to promote pre harvest activities and/or the post-harvest activities of the cash crop sector, of which coffee receives a substantial portion. Financing for infrastructure is made available for the construction of coffee washing stations, adding value for the country's coffee exports which generates more revenues in line with the government's Vision 2020 goals.

Commercial banks have also stressed the lack of existing bankable projects to review. The private sector lacks experienced entrepreneurs capable of clearly conveying manner information about their agriculture projects.

The level of guarantee required to finance a construction investment can be as much as 150% of the value, and the interest rate as much as 19%. These requirements are sometimes cumbersome for the private sector and out of reach for farming groups.

²¹ Source: National Bank of Rwanda, Department of Statistics

Microfinance institutions visited during the study showed an interest in post-harvest financing, but lack the necessary capital and adequate banking products to finance these activities. Additionally, staff trainings are needed to reinforce their capability to make sound decisions in regards viable projects to identify and fund.

Agriculture Financing and Investment Initiatives

I. Government Initiatives

Rwanda is fortunate in that several government-sponsored initiatives exist to facilitate access to finance for inputs and technical assistance to promote the development of the agricultural sector. While none are specifically dedicated to staple crop post-harvest activities, some do have sufficiently broad scopes to enable the provision of both finance and technical support to staple crop post-harvest operations.

A. Guarantee Funds managed by the National Bank of Rwanda (BNR)

As part of its economic policy development and poverty reduction strategy, the Government of Rwanda has developed different credit enhancement vehicles, such as guarantee funds and credit facilities that serve as financial instruments to stimulate investments in priority sectors, the agriculture sector included, to eradicate poverty among Rwandans. These facilities are managed by the BNR and used by interested local commercial banks and MFIs.

These enhancement vehicles are:

- The Rural Investment Facility, Phase 2 (RIF 2)
- The Agriculture Guarantee Facility (AGF)
- The Women's Guarantee Fund.

I. Rural Investment Facility, Phase 2 (RIF 2)

The Rural Investment Facility Phase 2 is designed to favor rural development projects. The facility is structured as a grant financed by IDA, the International Development Agency of the World Bank. It is a funding program that comprises 3 phases, each spreading over 5 years. The BNR is now administrating the second phase with \$10 million, covering up to 25% of any projects dedicated to the GoR's poverty reduction program.

Three main categories of investments are eligible for **RIF 2** funds:

- **Category I: Primary Agricultural Production.** Category I includes investments such as machinery, construction of agricultural buildings, land acquisition and improvements, storage facilities, transport facilities. Projects costs can be between RWF 1 – 50 million. Loans up to RWF 10 million receive a grant of 25% of the investment loan, while loans above 10 million receive a grant of 20% of the investment. Forty-five percent of RIF 2 is intended to be used in this category.
- **Category II: Processing of Agricultural products.** Category II includes processing equipment and construction of processing facilities. Project costs can be between RWF 2 – 150 million. Loans up to RWF 50 million receive a grant of 25% of the investment loan, while loans above this receive 20% of the investment. Thirty-five percent of RIF 2 is intended to be used in this category.

- **Category III: Agriculture Support Services.** Category III includes seed chain investments, extension services, and capacity building. Project costs can be between RWF 2 – 150 million. Loans will receive a grant worth 15% of the investment loan. A maximum of 20% of RIF 2 facility is intended to be used in this category

For the RIF 2 program, PHHS-related activities could possibly be financed under Category II. Please refer to the breakdown below for detailed information on the utilization of RIF 2 as of 27th January 2010.

RIF 2 Utilization by Category (through 27 January 2010) ²²		
	Amount (in RWF)	Percentage
Category I	266,716,738	4.703
Category II	5,250,000	0.093
Category III	0	0.00
Total Spent by 1/27/2010	271,966,738	4.8
Total Amount	5,671,120,160	

Given that 20% of RIF 2 is dedicated to the promotion of activities under Category II, the potential for further support of PHHS-related activities by this program remains high, since the utilization shows that only 0.093% of the current total amount have been already disbursed.

2. Agricultural Guarantee Facility (AGF)

The Agricultural Guarantee Facility (AGF) has been developed to increase the participation of commercial banks in financing the activities of the Rwandan agriculture sub-sectors. It has been created to reduce the banks' exposure to risk in agricultural loans and overcome the lack of insufficient guarantees for entrepreneurs wishing to launch viable projects which have the potential generating growth in the agricultural sector. AGF can cover up to 30% of short term loans and as much 50% of long term loans.

Its RWF 2.8 billion initial source of financing originates from a bilateral agreement between the GoR and, the Netherlands Cooperation, via the Netherlands Royal Embassy in Kigali, each contributing 38.45% and 61.55%, respectively. Recent data (see Table 10) show that thus far, 252 projects have been supported, for a total amount of RWF 8.09 billion, with 77% of the distributed funds awarded to export activities. Subsistence crops, apiculture, aviculture and energy make up 11% of funds awarded. During the inception assessment, the PHHS team was not able to obtain any data regarding the percentage of the fund allocated to staple crop activities in general, and post-harvest activities in particular. However, from the information obtained from commercial banks, it seems likely that at least some of the loans awarded under this fund were used to fund the purchase of commercially viable staple crops, such as maize and beans, in conjunction with the WFP P4P initiative.

²² Source: Rural Investment Facility Utilization as of 01/27/2010, Rhoda Rubaiza, MINAGRI

Table 10: Distribution of AGF Financed Projects by Sector

Sector	Amount in Rwf	In %
Coffee	3,771,057,720	47%
Tea	1,323,316,034	16%
Horticulture	1,187,257,016	15%
Cattle Breeding	699,742,660	9%
Macadamia	61,572,615	1%
Fertilisers	166,660,000	2%
Others*	877,551,490	11%
Total	8,087,157,535	100%

*Others: Subsistence crops, Apiculture, Aviculture, Energy

Source: BNR, Financial Market Department

The expectation for further investments for PHHS-related activities from this source of finance can be based on the fact that all agricultural activities are eligible for the AGF Program, including: production, processing, distribution, and all other activities allied to agriculture, including the purchase of inputs. Project proposals, however, must be financial viable/bankable, and the investor must be capable of paying back the loan facility.

3. Women’s Guarantee Fund

The Women’s Guarantee Fund has been created within the framework of the GoR’s poverty reduction strategy. It has been designed to be an investment vehicle dedicated to assist women access credit in a banking system that usually bars women because of lack of guarantees. Funds are derived from the GoR budget allocated to the Ministry of Gender and Family Promotion (MIGEPROF). The initial fund was estimated at RWF 255 million and covers all micro-projects undertaken by women, whether individually, by association or cooperatives. All loans awarded are up to RWF 5 million for individuals, and up to RWF 10 million for cooperatives and associations. The PHHS assessment was unable to obtain any detailed information regarding agricultural activities eligible for funding from the Women’s Guarantee Fund.

B. Other Government-Sponsored Initiatives

I. Rural Sector Support Project (RSSP)

The objective of Rwanda’s agricultural sector strategy is to enhance food security and increase rural household income by converting existing agriculture activities, highly dependent on subsistence farming, into viable and commercially driven activities. RSSP is a project financed by the World Bank and emanating from the **Ministry of Agriculture and Animal Resources (MINAGRI)** to ensure the achievement of these objectives. Its mission is to assist the Government of Rwanda achieve its strategic goal of revitalizing the rural economy and thereby reducing poverty, and reinforcing national stability. Its two key functions are the promotion of an input distribution system and the country wide improvement of the agricultural marketing system.

To promote input distribution systems, the RSSP approach is to:

- Provide technical and financial assistance to private traders in order to raise their capacity to import and distribute fertilisers and seeds to farmers;
- Promote the multiplication and distribution of improved seeds and livestock breeds by the private sector;
- Support the emergence of private sector based extension system to increase the adoption of new and modern innovations.

In line with the PHHS project activities, the RSSP approach to improve local agricultural marketing systems is to:

- Facilitate farmers' access to marketing services through technical assistance to farmers and local communities with respect to product conservation and marketing
- Encourage private sector investment in marketing services, and facilitate the flow of market information

2. Millennium Village Program in Rwanda²³

The Millennium Village Program is designed to expose ways to achieve the eight Millennium Development Goals in rural Africa within five to ten years “through community-led development. It has a pilot site in Rwanda that is located in Mayange, a sector of Burgesera District. The program has recently built a cassava plant production that employs 700 locals. This has been a result of the diversifying to new crops to combat drought incidents, common in the district. The project is also introducing the community to micro-credit, namely by raising awareness of the existence of micro-finance institutions and how they can be utilized to fund income generating activities, resulting in many farmers accessing micro-credit to purchase agricultural inputs.

Whether or not farmers will utilize micro-credit in the future to support staple crop post-harvest activities remains to be seen. The Millennium Village is funded by the Millennium Promise, a non-profit organization, the United Nations Development Fund and Columbia University's Earth Institute and relies on local government existing mechanisms, i.e. health workers and other civil servants specialized in rural administration, to implement its program. Annual funding for the program approaches \$300,000, including \$50,000 for overhead cost.

3. CAADP National Compacts

Signed on March 29 – 30 2007 in Kigali by the Rwandan Ministries of Agriculture and Finance, the Africa Union, COMESA and national development partner representatives, the **Comprehensive Africa Agricultural Development Program (CAADP)** was born as an African instrument that seeks to eliminate hunger and reduce poverty through a focus on agriculture. CAADP signatory countries have agreed to increase their public investments in agriculture, raising it to a minimum of 10% of their national budgets. The aim of this is to stimulate a minimum annual growth of 6% in agricultural productivity.

In the case of Rwanda, the focus of the CAADP process is to strengthen and add value to the Strategic Plan for Agricultural Transformation (PSTA) under the ongoing Economic Development and Poverty

²³<http://www.millenniumvillages.org/resources/index.htm#08>;
http://www.millenniumvillages.org/docs/news/press/AllAfricaCom_28August2009.pdf

Reduction Strategy (EDPRS). In Section 3.3 of its National Aid Policy, the Government of Rwanda (GoR) stresses the essential nature of strong strategic plans in all sectors and calls for the improvement of existing policies and strategic plans. The ultimate goal of the CAADP process in Rwanda is to answer that call for the agricultural sector by:

- i. helping define a coherent long term framework to guide the planning and implementation of current and future EDPS/PSSTA programs under the Vision 2020 agenda;
- ii. identifying two strategic options and sources of poverty reducing growth for the agricultural sector between now and 2020; and
- iii. developing existing and new strategy analysis and knowledge support systems to facilitate peer review, dialogue, and evidence based planning and implementation of agricultural sector policies and strategies. Furthermore it is intended that the national compact will provide a basis and inputs into the formulation of a supporting regional compact.

CAADP opportunities for PHHS-related activities

In the MINAGRI-sponsored stakeholders meeting on the CAADP Program held in Kigali on 7-8 December 2009, under **Program 3, Item “Government and Development Partners Planned expenditure”**, it was revealed that there are three sources of funds available for PHHS-related activities in Rwanda. These sub-programs funds are:

- US\$ 14,522,417 dedicated to the production and value addition for domestic staple products for the period 2009 – 2012,
- US\$ 26,653,638 dedicated to promote the Market - oriented rural infrastructure for the period 2009 – 2012,
- US\$ 14,522,417 dedicated to strengthening rural financial systems for the period 2009 – 2012.

Source: *Linkages between the CAADP and PSTA II study prepared by OTF Group July 2009*

In addition to the above CAADP-sponsored sources of funds, the initiative has identified seven private-sector investments expected to be realized in the context of Public Private Partnerships, where the GoR will take on some of investment risk and provide some of the infrastructure required for the initiatives, which are described in the table below.

Table 11: Expected Investments (US \$)²⁴

Activity	2009/10	2010/11	2011/12	Total Contribution to Funding Gap
Flower Park Development	5,000,000	5,000,000	5,000,000	14,000,000
Fresh Wholesale Food Market	12,000,000	10,000,000	10,000,000	32,000,000
PPP for Juice Concentrate Production	15,000,000	15,000,000	15,000,000	4,500,000
Mukamira Milk Processing Plant	15,000,000	15,000,000	15,000,000	4,500,000
Creation of Coffee Roasting and Packing Units	235,000	150,000	150,000	535,000
Tea packaging and Blending Plant	900,000	0	0	900,000
Warehouse Receipt Systems	100,000	100,000	100,000	300,000

²⁴ Source: Linkages between the CAADP and PSTA II study prepared by OTF Group July 2009

In large part as a result of the global financial crisis, however, the above private sector investments have not yet been secured. The Warehouse Receipt Systems initiative, as noted in the above table, only reflects a very small proportion of the targeted investments.

4. Rwanda Development Board

Among other activities, Rwanda Development Board (RDB) has the mandate to inform the private sector about opportunities in agro processing and encourage full integration of value chains. One of its achievements was the 60% equity acquisition by the international company, ICM of rice mills in the Rwanda. The RDB is actively pursuing a value addition strategy for the Rwanda agriculture sector, with the objective of developing agricultural-based industries that will transform agriculture products locally, raise export revenues and improve the country's deficit account balance. The RDB is seeking both foreign and local direct investment of at least \$250,000, especially in the heavy equipment sector where an aggressive push is being made to industrialize the country. The board actively promotes the tax incentives (0%) on imported equipments.

The RDB functions as a one stop station where the registration of a company: identification of land for sale, lease and purchase is possible; assistance to apply and pay for customs obligation is available; immigration work permits can processed; all services associated with establishing an investment in Rwanda are conducted.

The RDB also serves as an advisor, reviewing investors' business plans to ensure they are viable before providing fiscal and customs endorsements of same.

Additionally, the RDB helps businesses to establish and mobilize investor interest where opportunities exist. It is now promoting the horticulture sector and helping set up a fresh produce market, which could service the Irish potato value chain.

Finally, the RDB provides information on agricultural opportunities and promotes rural investment. It coordinates with the four provincial investment groups (Northern Provincial Investment Corporation, Southern Provincial Investment Corporation, Eastern Provincial Investment Corporation and Western Provincial Investment Corporation) established by the private sector to identify private investment opportunities in rural areas.

2. Private Sector Associations

A. Private Sector Chamber of Agriculture

The Chamber of Agriculture and Livestock is a professional organization created in June 2006 to represent the private members of the agro-pastoral industry in Rwanda. Its mission is to build an organizational framework for farmers and stockbreeders, reinforce their capacities of intervention and represent its members' interests with the governing authorities and within the private sector. For the agriculture sector, the focus is on reinforcing production and processing of agricultural products as well as marketing of the same. In particular, the Chamber wishes to tackle the issue of adding value to both exported and imported agricultural products, thus fulfilling a vision of promoting Rwandan agribusiness at the local, regional and international level.

With regards to post-harvest activities, the Chamber of Agriculture and Livestock focuses on:

- Developing the capacity building of cereal/staple crops farmers by establishing local training sessions and/or scheduling international agriculture exposition site visits, for example sponsoring attendance of Rwandans to agricultural expositions in China and India in 2009. The objectives of the sessions and site visits included dissemination post harvest management best practices.
- Promoting markets linkages in Rwanda by establishing contacts between cereals/staple crops producers and buyers across the country.
- Linking cereal producers with potential sources of funding. One example in this context is that the Chamber was successful in linking a local maize a producer, Mr. NKUBILI with MINAGRI, for assistance in the construction of his maize storage facilities in the Western Province.

B. USADF's Rwanda Program²⁵

USADF is an independent Federal agency established to support solutions that address African grassroots economic and social problems. In Rwanda, USADF shares the Government's commitment to private sector development, particularly in community based small enterprises and cooperatives. Its development assistance programs focus on capacity and infrastructures building. Through its Enterprise Development Investments (EDI) Program, USADF provides capacity building assistance, funding up to \$100,000 over a period of two years, to improve the financial, managerial, and technical capacity of the program beneficiaries. Limited additional funds, deriving from EDI can be allocated for fixed capital or working capital costs. Overall, EDI positions the grantee to effectively utilize future expansion funding through its Enterprise Expansion Investments (EEI), other public and private funding sources. USADF provides assistance for the acquisition of fixed assets among which, equipments, supplies and infrastructures through its Enterprise Expansion Investments (EEI). EEI provides funding for up to \$250,000 over five years for established enterprises and organizations with viable growth and expansion plans.

As of now the USADF has financially assisted the construction two community storage facilities for Irish potatoes (at a budgeted total amount of RWF 10.3 million) and provided milling equipment, improved drying facilities and two storage warehouses (at a value of RWF 5.5 million each) for a rice cooperative (Cooperative de Riz de Mirenge) in the Western Province.

3. Other Initiatives

A. The Market Linkages Initiative

The Market Linkages Initiative (MLI) is regional project funded by the Global Hunger and Food Security Initiatives designed to promote growth in staple crop value chains and food security by integrating low scale staple food producers into the commercial markets. The MLI project has a grants funding mechanism which can be used to improve storage facilities and services close to rural areas in targeted market areas, enabling these facilities to become collection and trading centers. The grant will also serve as a source of funding for capacity building of producers in storage conditioning to ensure quality and minimize storage losses. In Rwanda, the grant has set aside \$800 thousand for potential grants to be utilized for PHHS related activities, ranging from improving of post harvest equipment to upgrading the skills set of producers and private enterprises actively involved in post harvest activities.

B. The Competitiveness and Trade Expansion Program

²⁵ <http://usadf.gov/>

The Competitiveness and Trade Expansion Program, COMPETE, is a four year regional USAID funded project that, among other activities, is “working to reduce poverty” by improving small holders farmers access to commercial staple food markets. Through its Partnership Fund and a grant of \$24.6 million, COMPETE awards grants to cereal grower associations to help promote food crop security in the East Africa region by focusing on creating “village-based” post harvest infrastructure for farmers. The Partnership Fund emphasizes construction of storage and processing facilities, towards the ultimate goal of enhancing regional trade by improving post harvest conservation and quality standards. There is considerable scope for the PHHS project and COMPETE to collaborate, as is described in Sections 4.4 and 5 below.

C. The Rwanda Enterprise Investment Company

Similar to a private equity/venture capitalist, the Rwanda Enterprise Investment Company (REIC) fund was established to assist enterprises in Rwanda access capital. It is financed by a private and public consortium, made up of GoR (33.33%); BRD, Martha Group, Caisse Sociale, Housing Bank of Rwanda (all sharing 16.67%) and; private funds (50%). The fund mainly focuses in early stage companies providing seed financing and technical assistance when needed, in investment opportunities within the Rwandan border and, in growth sectors of the economy. It seeks to only work with entrepreneurs that have substantial experience in their industry. As of yet, REIC has not made any private sector agriculture investment because the country lacks of accurate production data to substantiate any investment in that sector. REIC has an initial capital of \$12 million, expects an internal rate of return on investment of 25% to 30% over a period of 4 to 5 years and, targets incorporated entities with annual revenues of \$50 thousands to \$500 thousands. It can structure a hybrid financing with an equity ownership of 30% and, is modeled to be a filling gap for the commercial banks, by lowering its collateral requirement.

D. “Warehouse Based” Financing Schemes

The implementation of a Warehouse Based Financing structure requires the availability of long term investment loan facilities. The banking sector is not effectively present in the area. However, some MFIs are willing to partner with other GoR initiatives to implement various programs in the country. It is in this capacity that The PHHS Project, in conjunction with the IFC, will explore the possibility of setting up a permanent training center which will help to assist either farmers, processors, banks, MFIs, etc. with technical, management and financial training on post harvest activities for a sustainable warehouse base financing program expansion in Rwanda agriculture Sector.

At present few warehouse base financing activities exist. The examples are:

➤ **CAF Isonga**

The Rwandan experience of CAF Isonga in the Southern Province is exceptional in its simplicity and innovative nature of its operations. The CAF Isonga model uses a tripartite approach to link farmers with warehouse and credit facilities. The micro-finance institution finances all farming activities, both pre and post harvest, (production, harvest, storage, distribution network). The model, although new, has demonstrated success in increasing farmer profitability.

➤ **RIM**

The Rwandan Catholic Church MFI RIM is participating in the Projet d’Appui a la Securite Alimentaire au Bugesera (PASAB). It is engaged in financing staple crop post harvest activities and intends to replicate

the experience across the country. RIM finances cooperatives by using groups as collateral. It disbursed RWF 7million in 2009 season A and RWF 5 million in 2007 season B.

RIM plans to contact IFC for the Program feasibility study.

➤ **AMIR**

AMIR is an association of MFIs in Rwanda. AMIR, BNR, MINAGRI and MINICOM in a meeting held at BNR in September 2009 agreed to initiate a common strategy for the implementation of the WRS Program in Rwanda.

AMIR has already identified 30 MFIs which can partner with cooperatives to execute the WRS Program. MINAGRI will build and renovate the existing warehouses and work with farmers' cooperatives to strengthen the agriculture activities and post-harvest handling issues, while MINICOM will work with cooperatives to address the marketing and commercialization of the harvest.

Because of its presence in the rural areas, AMIR will play an important role to implement warehouse based financing across the country. AMIR is working to consolidate the micro-banking sector in the country by developing innovative savings and microloan products such as, micro-leasing, micro-insurance.

Rice cooperatives are well organized and, have been targeted to pilot warehouse based financing programs. They serve as credit guarantors and, usually finance and store their members' harvest collection until, the price of rice stabilizes, upon when it is then sold and the loan reimbursed. In such scheme, the management of the warehouse based financing system is shared between the cooperative and the MFI.

➤ **COMICOKA**

COMICOKA is a young MFI engaged in maize and Irish potatoes agriculture activities in the Western Province. It has been selected to participate in the AMIR Microleasing Pilot Program. It is a participating institution in the RIF 2 Program. With some cooperatives, the COOPEC COMIKOCA is evaluating how to initiate a warehouse based financing program, since its members have already expressed the need for storage of their harvest.

Overall constraints facing MFIs can be summarized as follows:

- lack of capital to finance the warehouse buildings;
- lack of staff skills to identify bankable agricultural proposals; and
- lack of enough management skills in terms of warehouse based financing.

4. Partners

A. Introduction

In order to successfully achieve the PHHS project goals, including meeting the objective of mobilizing private sector resources to stimulate investment in the construction and management of post-harvest facilities, the PHHS team is likely to work with various partners.

To reduce the percentage of post harvest lost emanating from the lack of adequate post harvest handling farmers' groups or cooperatives will have to seek investment for the construction and/or rehabilitation of primary post harvest handling and storage facilities capable of drying, grading,) and storing their crops until suited buyers are identified and commodity prices recover. Microfinance institutions (MFI) working in the rural sector are best equipped to provide this financing.

To secure the amount of private sector funds which should be leveraged and increase the number of post harvest facilities constructed and purchased, PHHS will have to identify commercial institutions participating in the National Bank agriculture credit enhancement programs, and willing to commit their capital investment for post harvest infrastructure. The initial assessment found that nine commercial banks are participating in the RIF2 programs. Some commercial banks surveyed appeared enthusiastic about the prospect of collaborating with the PHHS project to identify suitable organizations willing to undertake such investments. However caution should be used as local banks are known to evaluate loan applications on the "case by case" basis.

The PHHS project will work with suitable entrepreneurs willing to renovate, expand and/or build commercially scaled post-harvest infrastructure facilities to reduce post harvest losses and increase the number and quality of these facilities in the country. The likely targets will be purchasers of substantial quantities of staple crops, already well known in the private sector and possessing existing selling contracts, such as the WFP P4P program, millers and other processors. The PHHS project will provide assistance in loan application processing, business plan writing and accessing cost sharing equipments financing, most likely with the MLI grants mechanism.

The PHHS project will also work with service providers capable of providing training in investment, sales and marketing. Furthermore both the service providers and the PHHS project will collect and publish information on post harvest management trainings' best practices.

B. Commercial Banks

La Banque Populaire du Rwanda is a local bank that is actively present in the rural sector. The bank is currently working with the RSSP program in the Akanyaru region and rice cooperatives supplying Gikonko Rice mill. The PHHS project could partner with this financial institution to develop business plans for the farming groups seeking post harvest financing.

Ecobank has also expressed interest in working in collaboration with the PHHS project to identify cooperatives or individual entrepreneurs seeking post harvest infrastructure financing.

Rwanda Development Bank (BRD) is a government owned financial institution specialized in promoting investment in the agriculture sector. The PHHS project will work with BRD to identify suitable entrepreneurs and/or cooperatives seeking to invest in post harvest infrastructure.

C. Services Provider

Center for Business Solution (CBS): PHHS will work with CBS to provide training in post harvest investment, sales and marketing to entrepreneurs and head of farmer organizations. The training will be complementary to the business plan writing assistance that the PHHS project will provide. PHHS will also use CBS database to access information on previous training participants who may be potential beneficiary of PHHS services.

D. Banking Sector Experience

Almost all commercial banks and the BRD under the supervision of the BNR have signed a partnership agreement to use the BNR Guarantee Funds in financing the agriculture sector. Despite this, the experience in banks shows that the level of funding the agriculture area remains minimum, compared to the total banks' loan portfolio.

Examples²⁶:

- The Access Bank Relationship Manager stated that with the assistance of the RIF 2 Program, the bank agriculture lending represent only between 5 to 10% of the total loan portfolio.
- COGEBANK also utilizes the BNR Agriculture Funds, but its agriculture loan portfolio of RWF 5 billion represents less than 10% of the total bank loan portfolio. As of now, the Bank has financed a warehouse receipts scheme for coffee export.
- ECOBANK is practically absent in financing the agriculture sector. According to the Head of Commercial Finance/SME, the Bank prior experience in the agriculture financing has been unsuccessful. As of now, with the BNR Programs, the bank has awarded only one loan facility to the SOPAV, a private agriculture input trader with \$200 thousands facility for the purchase of maize, under a contract with the World Food Program.

Conclusions and Recommendations

A. Conclusions

The PHHS inception assessment study found that Rwanda has limited credit enhancements targeting staple crop post harvest activities. Nine commercial banks are participating in the RIF2 programs²⁷ and, only two (representing, 16.3% of the total funds disbursed) have awarded loans under the program as of January 27th, 2010²⁸, for a total disbursement of RWF 271, 966,738. Seventy-four percent of total disbursement has been made by two MFI's, one of which is the COOPEC of COMICOKA, and thirty five percent% has been lent to staple crop pre harvest activities, further confirming PHHS findings. The disinterest of financial institutions to provide post harvest financing is further exhibited by the lack of staff expertise to identify viable projects and/or organized farmer organizations with substantial production capabilities. With the exception of BRD and Banque Populaire du Rwanda, few financial institutions have the dedicated resources for post-harvest activities related to staple crops.

MFIs are well positioned to have a significant input in the development of rural post harvest financing. However, their limited capital hinders any investment lending opportunities because of the long term period associated with the repayment. They are willing to finance most pre harvest activities, but refrain from providing post harvest financing at the farmers' level. During harvest, they prefer to receive reimbursement from their loans from farmers, and lend to the speculators and small local grains buyers working independently or contracting with major grain wholesalers. This is one of the causes of the abundance of staple crops available on the market after harvest. Farmers are pressured to repay their loans, and must sell their harvested product at any price to meet their obligations. Those MFIs which lack the knowledge and resources to finance profitable post harvest financing activities, i.e. "warrantage",

²⁶ Source: PHHS Team visit reports

²⁷ National Bank of Rwanda, Mme. Kagwesage Nz. Adelaide, Mgr, Special Funds & Line of Credit

²⁸ Rural Investment Facility Utilization as of 01/27,2010, Rhoda Rubaiza, MINAGRI

prefer to receive repayment of these loans and lend to the local merchants for shorter period of time, less than the six months required by the agriculture sector.

B. Recommendations

In addition to the technical assistance provided by the PHHS project, credit enhancement should be made available to “raise the appetite” of both commercial banks and MFIs to offer lending facilities for the financing of post harvest infrastructure. These enhancements should be solely developed for post-harvest infrastructure financing, and used to complement the existing government financing programs as an “enhancing tool”. The PHHS project foresees that the hybrid usage of these enhancements will not only increase construction investments but will also entice commercial banks to relax some of their guarantee requirements.

At the rural level, PHHS recommends developing long term credit enhancements for primary post harvest handling and storage constructions and for post harvest equipment purchase for the rural financial sector. A credit guarantee and/or facility housed at few MFI's, actively involved in providing access to credit and technical assistance to rural farmers groups and/or cooperatives should be emphasized.

The PHHS project was approached by a local commercial bank to explore the possibility of signing a memorandum of understanding to collaborate in identifying suitable loan applicants seeking post harvest financing. The project will attempt to replicate similar collaboration with other institutions.

ANNEX C – REVISED PERFORMANCE MONITORING PLAN (PMP)

Post-Harvest Infrastructure and Management

During the inception assessment exercise, it soon became apparent that the original targets set in the project PMP need to be revised downward. To begin with, the number of storage/processing facilities already in place in Rwanda is extremely low. Discussions with MINAGRI indicated that their estimations are that just over 80 staple crop storage facilities exist in Rwanda at present. The revised indicators presented in the Project Monitoring and Evaluation Plan below reflect the reduced numbers of post-harvest infrastructure facilities, and the lower numbers of farmers using these facilities, as well as volumes of products stored.

On the basis of the plans for training in improved post-harvest handling techniques and technologies, the PHHS project proposes to use a system whereby agronomists or other individuals working with farmers will be trained as “Master Trainers”; each shall in turn, with project assistance, provide training to individuals or “lead farmers”.

As indicated in the value chain assessment findings in the main report, the PHHS team found that reliable data on current post-harvest losses for staple crops in Rwanda simply does not exist. The MINAGRI Post-harvest Program uses a very rough estimation of “30% for all agricultural commodities”. PHHS believes losses may be higher from more perishable products such as the Irish potato. The figure of 30%, provided by MINAGRI, will be used as the baseline indicator.

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Indicator	Unit of Measure	Disaggregation	Data Quality	Data Collection Method	Collection Frequency	Reporting Frequency	Baseline (FY 2008)	Year 1 Target	Year 2 Target	Year 3 Target
New construction for post-harvest/ processing units commenced with PHHS assistance	storage units	commodity	High	Site visits	Monthly	Quarterly	n/a	115	225	275
No. of post-harvest storage/ processing centers for which site selection finalized	storage units	commodity	High	Site visits	Monthly	Quarterly	n/a	150	250	325
No. of storage/conditioning/processing centers constructed/ purchased with project assistance.	storage units	commodity	High	Site visits	Monthly	Quarterly	0	100	200	265
Amount of private sector funds leveraged to support post-harvest storage/ conditioning/ processing centers	dollars	commodity	Medium	Interviews with investors	Annually	Annually	n/a	\$50,000	\$150,000	\$200,000
% decrease in post-harvest food losses in project sites	percentage	commodity	Medium	Interviews with buyers/ farmers	Annually	Annually	30%*	5%	10%	15%
No. of farmers using storage/conditioning/processing centers with project assistance	farmers	gender	High	Site visits	Monthly	Quarterly	0	18,000 (###/###)	22,000 (###/###)	24,000 (###/###)
Quantity of selected commodities stored in improved storage facilities	metric tons (MT)	commodity	High	Site visits	Monthly	Quarterly	n/a	5,000	10,000	12,500
Number of rural households benefiting directly from PHHS assistance	# of households	gender	Medium	Interviews with farmers	Quarterly	Quarterly	n/a	18,000	22,000	24,000
Number of producer unions, trade + business associations, and community-based organizations receiving direct assistance	# of organizations/ associations	n/a	High	Active list of partners	Quarterly	Quarterly	n/a	50	50	50
Number of agriculture-related firms benefiting directly from PHHS assistance (access to invest + loan)	# of firms	n/a	High	Active list of partners	Quarterly	Quarterly	n/a	2	7	6
Number of individuals who have received short-term agricultural sector	# of people	gender	High	Training records	Monthly	Quarterly	n/a	11,000	20,000	10,000

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productivity training										
Number of farmers, processors, and others who have adopted new technologies or management practices	# of people	n/a	High	Site visits	Annually	Annually	n/a	11,000	22,000	11,000
Number of SMEs that successfully access bank loans or private equity	# of SMEs	n/a	Medium	Interviews with investors	Annually	Annually	n/a	1	3	5
Number of firms receiving assistance to invest in improved technologies	# of firms	n/a	High	Interviews with firms seeking financing for investment	Monthly	Quarterly	n/a	1	4	1

*Current percentage post-harvest losses as estimated by MINAGRI

ANNEX D – List of Interviews and Stakeholders Met

A. Buyers/Traders/Processors				
Organization	Contact	Title	Tel.	Email
World Food Program P4P	Emmanuela Mashaya	Coordinator	078 518 6324	emmanuela.mashaya@wfp.org
World Food Program P4P	Denis Mupenzi	Procurement	Tel. 0788 845 8200	denis.mupenzi@wfp.org
MURENZI SUPPLY	Donatien MURENZI	Directeur General	078 830 0759	murenzidon@yahoo.fr
	Ignace MWIZERWA	Commerçant	0788504875	
ENAS	Alfred NKUBILI	CEO	0788301967	
MINIMEX S.A.	Félicien MUTALIKANWA	CEO	0788300240	fmutilikanwa@yahoo.fr
SOSOMA INDUSTRIES S.A.	Thadée MUSABYIMANA	Directeur Général	0788304189	thaddemu@yahoo.fr
MAISERIE MUKAMIRA	Enode NDUWAYEZU	Managing Director	0788346225 or 0788604394	nduwenode@yahoo.fr or maizemanco@yahoo.fr
Rwanda Development Investment company (RDI) Nyagatare, Eastern Province	Obald Ndizihiwe	Extension Agent	0788282094	
NYAMIG (Nyagatare Maize Investment Group)	Eric Ntukabumwe	President du CA	078 835 5563	
NYAMIG (Nyagatare Maize Investment Group)	Shumbusho	Secrétaire du CA	0783072713	
Gatsibo Cassava Innovation Platform	Modeste Sebazungu	President	078 859 0412	
ICM Rwamagana Rice Mills	Theoneste Bikolimana	Technical and Operations Director	0788490008	bitheos10@yahoo.fr
KOAGIMITA, Stockage de blé a Mbuga, Nyamagabe	Vénantie Mukashyaka	Trésorière du CA et Gestionnaire des Stocks	0783333857	

B. Support and Umbrella Organizations				
Organization	Contact	Title	Tel.	Email
Ministry of Agriculture and	Ernest Ruzindaza	Permanent Secretary	0788 300765	ruzindaza@yahoo.fr

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Animal Resources (MINAGRI)				
MINAGRI	Gilbert Kayitare	Head, RADA Post-harvest Program	0788 594474	kagicade@yahoo.fr
MINAGRI	Alexandra Lowe	Consultant, Department of Planning	0783 852702	a.lowe.MINAGRI@gmail.com
MINAGRI	Rhoda Rubaiza	Consultant, Department of Planning	0783 342425	rubaiza@gmail.com
Rural Sector Support Program (RSSP)	J Jolly Dusabe	Director		jollydusabe@gmail.com
Institut des Sciences Agronomiques du Rwanda	Christine Mukantwali	Post-harvest Unit	0788 445328	mukantwalichristine@yahoo.fr
Institut des Sciences Agronomiques du Rwanda	Jean Ndirigne	Coordinator in Charge of Mid Altitude Research Center	0788 527320	ndrick@yahoo.fr
Rwanda Development Board	Rosemary MBABAZI	Director General Investment Promotion Unit	(250) 0788306391	rmbabazi@rwandainvest.com.rw
DUHAMIC ADRI	Innocent Benineza	Secrétaire Exécutif	0788305329	duhamic@rwanda.l.com
UGAMA CSC	Laurien Jyambere	Coordinateur	0788 840 4460	jyamberelaurien@hotmail.com
SYNDICAT INGABO P.O. BOX. 50 MUHANGA	Joseph Karangwa	Chargé de Programmes	250 55105421 ; 0788651849	ingabo@rwanda.l.com ; karangwajoseph@yahoo.fr
HARVEST PLUS	Harrie Hendrickx	Head of Product Delivery		h.hendrickx@cgiar.org
HARVEST PLUS	Jean d'Amour MANIRERE	Country Manager for Iron-Rich Bean	0788306916	j.manirere@cgiar.org
RWANDA DEVELOPMENT ORGANIZATION (RDO)	Augustin BAHORANA		Tel. 078 821 2604	
ROPARWA	TUMUKUNDE Aimée Marie Ange	Secrétaire Executive	Tel. 0252 589573; Cell 078 830 7930	roparwa@rwanda.l.com ; aimetum@yahoo.fr
CENTRE IWACU	MUPENZI Georges	Coordinateur	Tel. 55117086, GSM. 078 830 1546	ciwacu@rwanda.l.com , gmupenzi@yahoo.fr , Site Web : www.centreiwacu.org.rw

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DERN B.P. 45 Musanze	Celestin RUBURA	Coordinateur	Tel. 0252 546 238, 078 848 9435	dernord1981@yahoo.fr , ruburacelestin@yahoo.fr
BAIR	Ferdinand HAKIZIMANA	Agronome, Superviseur des travaux d'assistance technique aux coopératives	Tel.078 852 9180	hakifern@yahoo.fr
ISAE	Patrice HAKIZIMANA	Vice Recteur Affaires academiques et Recherche	0788300474	phakiza@yahoo.co.uk
FUCORIRWA	Aloys RUSANGANWA	Ingénieur Agronome, Coordinateur	078 877 8069	alvarus@yahoo.fr , Site Web : www.roparwa.org
UCORIVAM	Onesphore Habamenshi	President	078 377 2821	
UNION TWIBUMBE	JMV HABAMENSHI	President	0788438759	
UCORIBU	Thaddée Manirareba	Coordinateur	0788454526	manirareba44@yahoo.fr
UNICOOPAGI	Joseph Ndabamenye	Coordinateur	078 846 5660	jndabamenye@yahoo.fr
UNICOBLE	Daniel Nzamurambaho Tadju	President du C.A.	078874 2720	
UNICOBLE	Alfonse Habamungu	Coordinateur	078 844 4300	

C. Cooperatives			
Organization	Contact	Title	Tel.
COPROVAB	Denis NIRERE	Président du Conseil d'Administration	078 845 3850
COIMU	Esdras NTAGISANIMANA	Gérant	
COIMU	Jonas NZARAMBA	Président du CA	078 830 0764
IMPUZABAHINZI	Pascal BARIGORA	Vendeur et Gestionnaire des stocks	
COTEMU	Augustin NIYONSABA	Auditeur	078 883 3540
COTEMU	Theophile KWIRINGIRA	Agronome	078 841 1222
KOARU	Liberata BAPFAKURERA	Présidente	078 875 2053
COAMV	Thadee NIBISHAKA	President du CA	078 886 9830
UVA (Umutara Veterans Association)	Stanislas Mutabaruka	President	078 880 6585
COAMN	JMV Nshimyumuremyi	President	078 822 1874
COPRORIKA	Boniface Bimenyimana	Secrétaire du CA	0788289406
COTRAVAM	Felix Ndagijimana	Agronome/ Président du CA	078 326 6359
Cooperative ABAHUJE	Beatrice UWARUREMA	Présidente	0788755571

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Coopérative JYAMBERE MUHINZI GISAGARA (COJYAMUGI)	Onesphore Rudakubana	Président	078 526 0698
COPRORIZ NYIRAMAGENI	Jean Damascène Sindikubwabo	President	078 866 0954
COPAKI	Juvenal Mushinzimana	President du CA	0788452840
COPAPEF	Theophile Rubanzangabo	President du CA	0788639245

D. Financial Institutions and Partner Projects				
Organization	Contact	Title	Tel.	Email
Market Linkages initiative (MLI)	Anthony Moses A. Ngosi	Chief of Party		angosi@eamli.com
Market Linkages initiative (MLI)	Bizuwork Negussie	Grants Manager		bnegussie@eamli.com
Market Linkages initiative (MLI)	Sophie Walker	Commodity Marketing Manager		swalker@eamli.com
HARVEST PLUS	Harrie Hendrickx			
HARVEST PLUS	Jean d'Amour Manirere			
KARISIMBI BUSINESS PARTNERS	Dano Jukanovich	Co-founder	078 554 9062	dano@karisimbipartners.com
East African Grain Council	Harriet Nabirye	Uganda Country Manager		hnabirye@eagc.org
East African Grain Council	J. Kiraka	Market Information specialist		
Nyagatare District	Philippe Mutarambirwa	Coordinateur de developpement economique		
CHF International	Elly Kaganzi Mwesigwa	Team Leader Economic Development	0788 305642	ekaganzi@chfrwanda.org.rw
COMPETE	Steven Humphreys	Staple crops Specialist		shumphreys@competeafrica.org
COMPETE	Martin Wmaniala	Staple Foods Advisor		mwamaniale@competeafrica.org
COMPETE	Isaac Tallam	Private Sector Grain Trade Advisor		itallam@competeafrica.org
IFDC CATALIST	Bruce Smith	Chief of Party	0788 830 2832	bsmith@ifdc.org
IFC	Murekatete Rugege Karimba	Operations Analyst, IFC Rwanda CEDP Leasing Program	078 830 7201	mrugegekarimba@ifc.org
IFC	Etienne Ndatimana	Associate Operations Officer, Rwanda Entrepreneurship & SME Development Program (PEP Africa),	078 830 6686	ENdatimana@ifc.org

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IFC	Berry O. Odhiambo	Associate Operations Officer, Rwanda Entrepreneurship & SME Development Program (PEP Africa),	078 830 5106	bodhiambo@ifc.org
CBS/MAXINET	Daniel Pate			
CBS/MAXINET	Rebson Dzala Washe			
CBS/MAXINET	Patrick R. Kagabo			
US African Development Foundation	Taibu NAKUERIA	Country Representative	(250) 0788303933	tnakueira@usadf.gov
Association of Microfinance Institutions in Rwanda (AMIR)	Faustin ZIHIGA	Chairman	(250) 0788306518	fzihiga@amir.org.rw
AMIR	Claudine ZANINKA	Executive Secretary	(250) 0788303899	claudinembaraga@yahoo.fr
AMIR	Patricia UWIMBABAZI	Research and Product Development Specialist	(250) 0788356811	puwim@yahoo.fr
Vision Finance Company s.a	Patrick BIRASA	Credit, Operations and Marketing Director	(250) 0788304590	birasapatrick@gmail.com
Reseau Interdiocesain de Microfinance s.a (RIM)	Diane UWIMBABAZI	General Director	(250) 0788306384	udiane81@yahoo.fr
ZIGAMA CSS	Augustin KAYIGIRE	Credit Manager	(250) 0788303512	kayigire@zigamacss.com
Banque Rwandaise de Développement	Christine KARANGWAYIRE	Director of Investments	(250) 0788304376	c.karangwayire@brd.com.rw
Compagnie Generale de Banque	L. de Montfort MUJYAMBEREI	Head of Credit Risk Management	(250) 078303086	m_mujyambere@cogebank.com
Access Bank	Jean Luc CYUSA	Relationship Manager, Institutional Banking Group,	(250) 0788648349	cyusaj@accessrwada.com
Ecobank Rwanda s.a	Patrick BUKI KANUNI	Head of Commercial Finance/SME	(250) 0788308094	pbuki@ecobank.com
Banque Commerciale du Rwanda s.a	Renee KAYITAYIRE	Account Relationship Manager/Agriculture	(250) 0788304811	Kayitayire@bcr.co.rw
Banque Populaire du Rwanda s.a	Gerard MUTIMURA	Program Lending Manager	(250) 0788488184	Gerard.MUTIMURA@bpr.rw
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du Rwanda	KAGWESAGE	Lines of Credit Manager		
African Development Bank	Joseph NYIRIMANA	Agronomist	(250) 0788304270	j.nyirimana@afdb.org
Opportunity International	John Magnay	Agricultural Advisor - Africa	(256) 772771237	johnmagnayi@gmail.com
Rabobank	Hans Bogaard	Head Agribusiness	31(0)651503468	j.j.bogaard@rn.rabobank.nl
The World Bank	Valens Mwumvaneza		(250) 0788464196	vmwumvaneza@worldbank.org
CLECAM de WISIGARA	Ndaturangiwe Ildephonse	Directeur	(250) 0783480952	uclecam@yahoo.fr
UCEA	Sebazungo Alphonse	Directeur	(250) 0788762830	ucoopececa@yahoo.fr
REIC	Herbert Hatanga		(250) 0788306490	herbert@reic.co.rw
Sparkassenstiftung Fur Internationale Kooperation	Volker Walther		(250) 0788055740	

E. Others				
Organization	Contact	Title	Tel.	Email
Kivu Arabica Coffee Company KKC SARL	J. Bosco Seminega	Directeur Associe	(250) 0788304467	seminegajb@gmail.com
Balton CP	Kelving Odoobo	Agriculture Manager	(250) 0788307484	kelvin@balton.co.rw
Balton CP	Tunca Kocyigit	Commercial Manager	44(0)1923228999	tk@baltoncp.com
OTF Group	Eric Kacou	Managing Director	(250) 0788303063	

Annex E – Inventory of Existing Storage Facilities

List compiled by IFDC-CATALYST:

ENTREPOTS

Entrepôt et sa localisation	Capacité (T)	Propriétaire	Etat	Utilisation actuelle
Nyanza	3 000	Public	Moyennement en bon état	N'est pas utilisé
Nyamagabe	600	Public	En bon état	Est utilisé
Rusizi	600	Public	Un peu abimé	Non utilisé
Nyabihu	700	Public	Un peu abimé	Non utilisé
Musanze	3 000	Public	Beaucoup Abimé	Non utilisé
Ngoma	1 000	Public	En bon état	utilisé
Gicumbi	1 300	Public	En bon état	utilisé
Karongi	400	Public	En bon état	utilisé

2.2 STORAGES INFRASTRUCTURES INSTALLED BY RSSP

STORAGES INFRASTRUCTURES	Number	Province/	District	Status	Propriétaire
Rehabilitation of stores in Gaseke	9	West	Ngororero	Good	Coop. ADI
Maize store (COAMV)	1	North	Burera	Good	Coop. COAMV
Store in Budaha (Songa)	1	Westo	Ngororero	Good	Coop
Storage of Kinnyogo	1	East	Kirehe	Good	Coop
Silo of Muko	1	North	Gicumbi	Good	Coop
Store Bicumbi (rehabilitation)	2	East	Rwamagana	Good	Coop
Stores of KOPIUMU (INKINGI)	3	East	Rwamagana	Good	Coop
Stores of TWUZUZANYE (Kabuga)	3	MVK	Gasabo	Good	Coop
Store of CPRB Cooperative	4	West	Rusizi	Good	Coop
Storage of ABIYUNZE	1	South	Ruhango	Good	Coop

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Store Rutsiro	1	West	Rutsiro	Good	Coop
Storage for irish patato of COAMV	1	Northern	Musanze	Good	Coop
Storage for maize of COAMV	1	Northern prov	Musanze	Good	Coop
Irish patato store of COIMU 1	1	West	Nyabihu	Good	Coop
Storage of IABU 1	1	West	Rubavu	Good	Coop
Storage of IMPAKOMU 1	2	Sud	Ruhango	Good	Coop
Store of Mwulire (in Rwamagana)	1	Eas	Rwamagana	Good	Coop
Storage of IABINDI	1	South	Muhanga	Good	Coop
Storage of COCOF	1	South	Muhanga	Good	Coop
Store in Itabire	1	West	Karongi	Good	Coop
Storage of INGABO	1	South	Muhanga	Good	Coop
Storage of Abibumbiyehamwe	1	West	Ngororero	Good	Coop
Storage CEFAPEK	1	South	Kamonyi	Good	Coop
Storage of CODDT	1	South	Muhanga	Good	Coop
Storage CICODEB	1	South	Nyanza	Good	Coop
Silo de stockage pour CODEKA	1	East	Bugesera	Good	Coop
Storage of AVOPAC	1	MVK	Gasabo	Good	Coop
Store of Dukorerehamwe Cooperative (Bugarama), phase II	1	West	Rusizi	Good	Coop
Storage of IMPAKOMU 2	1	South	Ruhango	Good	Coop
Store in Muhazi (Murambi)	1	East	Rwamagana	Good	Coop
Storage IMPABARUTA	1	South	Kamonyi	Good	Coop
TOTAL	48			12 000 MT	

Each has 500 MT capacity

ANNEX F – Questionnaires

Buyer Questionnaire

- Do you own storage?
 - What location(s)?
 - What condition is it in?
 - What type (silos, cocoons, bagged)?
 - What is the capacity (MT) of the storage facility?
 - What commodity is stored?

- Are you planning to invest in new storage?
 - How much money can you invest now and in the future?

- Do you rent any storage facilities?
 - From whom?
 - What storage options exist in the sector/ district?

- Do you have losses in storage?
 - What percentage of your stock?
 - What is the cause (infestation, rot, other)?
 - How do you evaluate the losses?
 - Do you try to reduce losses?
 - If yes, what technology do you use?

- Do you have problems with transport and handling?
 - What percentage of your stock is lost during the transport and handling?
 - Who are the major transporters in/out of your market (transporter/businessman, cooperative, women/men)?

- Where are you purchasing stock from? From whom? At what volumes?
 - How do you finance the purchases?
 - Where do you sell the surplus?
 - How far is the market if sold on the open market?

- What quality, reliability, quantity issues do you face in dealing with your suppliers? /How do you determine quality? Do your buyers differentiate on quality?

- What are your projected raw material supply requirements over the next 3-5 years? How far out do you plan (by season? Month? Year?)

- What sort of contracting arrangements do you have with your suppliers (payment 2/10/n30? Installments? Cash? Barter?) ? Do you have contract fulfillment problems with your suppliers?

- Are you working with any other donor projects? Which ones?

- What types of financial products do you have access to and on what terms (commercial banks, microfinance, money lenders, personal assets)?
- Who are your 3 largest buyers (Names, location, relationship, frequency, organizations)?

Sector Umbrella Organizations Questionnaire

- Which value chains/crops?
- Which are the most advanced (market oriented) organizations/cooperatives in the sector?
- What are the types of support?
 - Funding?
 - Trainings?
 - Coaching?
 - Material benefits (constructions, inputs)

Banks/MFI Questionnaire

- Loans to agriculture sectors?
- Repayment problems? In which groups?
- Types of guarantees? Collaterals?
- Already financing PH activities? If no, why?
- If technical assistance availed by PHHS Project, would be interested in financing PH activities?
- What are the terms and conditions for their agriculture credits?

Producer Questionnaire

- Do you own storage?
 - What location(s)?
 - What condition is it in?
 - What type (silos, cocoons, bagged)?
- Are you planning to invest in new storage?
- Do you rent any storage facilities? From whom?
- Do you have losses in storage?
 - What percentage of your stock?
 - What is the cause (infestation, rot, other)?
- How much of your crop do you consume vs. sell as surplus?
- When do you sell your surpluses? Why do you sell at that time?
- Who buys your surpluses? At what price?
- What percentage of your crop is lost prior to sale? What is the cause of the losses (infestation, rot)?
- Are you working with any other donor projects? Which ones?

ANNEX G – References Cited

AllAfrica.com, 28 August 2009, Rwanda Millennium Village Brings Prosperity And Unity, http://www.millenniumvillages.org/docs/news/press/AllAfricaCom_28August2009.pdf

FAOSTAT (2009). Food and Agricultural Organization Statistical Database. <http://faostat.fao.org>

Ferris et al. (2002). Bean Sub-sector market survey Rwanda, ATDI-CIAT/ISAR/IITA Foodnet and PEARL Project.

Global Banking News (GBN), Rabobank acquires 35% stake in Banque Populaire du Rwanda, June 17, 2008, < <http://www.highbeam.com/doc/1GI-180237240.html>

Government of Rwanda, Rwanda Development Board, Business Environment, 2009

GTZ, Manuel sur la Manutention et la Conservation des Graines après récolte

HarvestPlus (December 2009). High Iron Beans in Rwanda, Version 1.4

Institut National De La Statistique Du Rwanda, Enquête Nationale Agricole (ENA2008), Novembre 2009

Kagwesage Nz. Adelaide Mgr, Special Funds & Line of Credit, C/O National Bank of Rwanda, Personal Interview , January 2010

Loveridge, Scott, Alastair Orr and Abdoul Murekezi (2007). Agriculture and Poverty Reduction in Rwanda: A comparative analysis of the EICV1, EICV2 and LRSS Surveys.

Millenium villages, Frequently Asked Questions, <http://www.millenniumvillages.org/resources/index.htm#08>

National Institute of Statistics of Rwanda (NISR), Statistical Yearbook 2009 Edition

National Bank of Rwanda, Department of Financial Markets, 2009

National Bank of Rwanda, Department of statistics, 2010

NGENDAHIMAN, Athanase, RUGAMBWA Théogène (October 2006). Projet d'Installation d'une Unité de Conditionnement, Conservation et Transformation de la Pomme de Terre en faveur de la CECMA, CAPMER

NKULIKIYINKA Théogène et al., (2006). PROJET DE REHABILITATION ET MODERNISATION DE L'UNITE DE TRANSFORMATION DU MANIOC DE L'UGAMA / CSC, Plan d'Affaires, CAPMER

OTF Group (July 2009). Linkages between the CAADP and PSTA II study.

POST-HARVEST HANDLING AND STORAGE PROJECT
Inception Assessment

Rural Sector Support Project, (2008), Action Plans for Agricultural, Intensification and Commodity Value Chain Development in RSSP2

Rubaiza, Rhoda ,C/O MINAGRI ,Personal Interview (March 2010) : Investment Facility Utilization as of January 27, 2010

Rwanda Development Board, Governance, October 2009

TERPEND Noëlle, KAYUMBA Joël et NTAGANDA, Emmanuel (Décembre 2007).
Diagnostic et Elaboration du Plan de Développement National de la Filière Blé, ROPARWA

United States African Development Foundation, <http://usadf.gov>

Wakala East Africa Consulting (October 2008). Feasibility study on the Establishment of a Pilot Processing Unit for Cassava in the Southern Province under the PPPMER II SMEs Promotion Project, PPPMER

Wakala East Africa Consulting (October 2008). Feasibility Study On The Establishment Of A Pilot Processing Unit For Maize In The Eastern Province Under The PPPMER II SMES Promotion Project, PPPMER

World Bank Group, “Country Brief”, World Bank, <http://go.worldbank.org/YP79K5BDT0>