Agricultural Innovation and Technology in Africa

Rwanda experience
Coffee, banana and dairy commodity chains

Draft Report

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Acronyms

ACDI/VOCA	International NGO
ADB	Africa Development Bank
AI	Artificial Insemination
BNR	Bank National du Rwanda
BRD	Rural Development Bank
CAPMER	Agency to support SME
COVEBAR	Compagnie de valorisation Industrielle de la Banane au Rwanda
CWS	Coffee washing station
EDPRS	Economic Development and Poverty Reduction Strategy
FAO	Food and Agriculture Organisation of UN
GOR	Government of Rwanda
HPI	Heifer Project International
ISAR	National Agricultural Research Institutes
INIBAP	International Network for Improvement of Banana and Plantain
IFAD	International For Agricultural Development
KIST	Kigali Institute of Science and technology
MCC	Milk Collection Centre
MINAGRI	Ministry of Agriculture and Animal Resources
MINICOM	Ministry of Commerce, Tourism, Industry, Trade and Cooperatives
MINECOFIN	Ministry of Finance and Economic Planning
MSU	Michigan State University
MTP	Medium Term Plan
NUR	National University of Rwanda
NSI	National Strategic Investments
PEARL	Project to Enhance Agriculture Research and Linkages
PSTA	Strategic Plan for the Transformation of Agriculture
PADEBL	Support through Diary Cattle Development Project
PDRCIU/UCRIDP	Umutara Community Resource infrastructure Development project
RARDA	Rwanda Animal Resource Devlopment Authority
RBS	Rwanda Bureau of Standards
RDI	Rwanda Development Investment
RIEPA	Rwanda Investment and Export Promotion Agency
RWASHOSCCO	Rwanda Small Holder Specialty Coffee Company
ROPARWA	Union of Cooperatives
SME	Small and Medium Entreprises
SUA	Sokoine University of Agriculture
TAMU	Texas A&M University
UBPR	: UNIONOF RWANDAN PEOPLES BANKS
UDAMACO	Umutara Dairy marketing Cooperative
UK	United Kingdom
UNDP	United Nations Development programme
UPU	Umutata Polytechnic University
USA	United State of America
USADF	United state Africa Development Foundation
WHO	World Health organization

1 Background: The agricultural sector within a policy context

Rwandan economy is essentially based on agriculture which contributes nearly 46 % of GDP and occupies 90% of active population. Facing economic *situation that suffered a lot* due to recent events of the 1994 genocide, a number of instruments has been introduced to exit out of underdevelopment and poverty as Vision 2020, EDPRS, National Strategy of Investment etc. – all those instruments put agriculture in the heart of national development policy. In fact, the Vision 2020 projects " transformation of agriculture into a sector of high add value and of high productivity" and EDPRS document include rural development and agriculture transformation as development gateway. Furthermore, National Strategy of Investment (NSI) mentions agriculture and rural development as engine of primary growth and lever to return the country to the process of sustainable development and to fight the poverty. The NSI underlines the valorization of agricultural activities through the measures of production increase and downstream actions to allow increase of the production value. This is can be achieved through proper use of agricultural innovations along value chain targeting highest productivity and income returns from available natural resources and human capital and enabling useful research funding.

Rwanda is the most densely populated country in Africa with population was 8.5 million people in 2004, on an area of 26,338 Km2 (including water surface). The agricultural production is realised from about 1.4 million households on average size of family farm of 0.76 ha. About 66 % of the total food production is for family consumption. The food that reaches markets (34 % of the total food production) feeds non-farmers- (estimated at about 11.4 %), but also farmers who do not produce enough and have to buy more from the market to satisfy their needs.

Rwanda development is guided by Vision 2020 in long term plan and Economic Development and Poverty Reduction Strategy (EDPRS, 2007) in medium term. Due to limited presence of minerals and other natural resources, and current low level of industrialization; the agriculture and animal husbandry will, in the period covered by Vision 2020 and EDPRS, be the main engine for accelerated economic growth and sustained development (PSTA). The Government of Rwanda perceives the agricultural sector as the major engine of growth, as indicated in the EDPRS, and that agriculture is the largest sectoral contributor to national income and food security, and must lead any effort to increase Rwanda's real growth rate.

Rwanda's adoption of an export-oriented growth strategy has implications for the agricultural sector which will seek to increase the unit value of agricultural exports by improving quality and by producing new exportable products. Under EDPRS the agricultural sector aims to promote commodity chains and support the development of agribusiness. The Government will assist the private sector by improving the investment climate, so that Rwandan exports are competitive in regional and world markets. This will require significant improvements in product quality, and more use of improved agricultural technologies and innovations.

In order to achieve its objectives, the agricultural sector must apply technology innovations to make it competitive in the liberalized global markets. Since both competitiveness and integration of Rwandan agricultural products into domestic and foreign markets is more and more determined by the capacity of producing countries to satisfy the requirements of consumers in terms of quality and reliability of the food produced or transformed. Therefore, the Rwandan agribusiness competitiveness in international markets must attain the standards of quality and reliability required internationally. There is increasing dependence on meeting rapidly evolving market standards. Considering the significant importance of the agricultural sector in Rwanda's economy, the sector is a prime candidate to benefit from agricultural technologies and innovations.

The experience from recent years, (2001 – 2007), the application of different innovations on coffee production and marketing of fully washed coffee (speciality coffee) has created awareness and interest on application of agricultural innovations among Rwandan community; coupled with need for increasing productivity and value addition on agricultural produce; making Rwandan community ready to try new ideas, approaches and innovation which will improve their productivity and competitiveness. The readiness and need for improvement make Rwandan community and a good case study for innovation system and policy support.

The Government of Rwanda is committed to establish a favourable business environment. The near absence of corruption is reflected in the traditional high marks which the country receives from the World Bank's corruption index. The Rwandan Investment Promotion Agency (RIEPA) facilitates investments and international transactions with a "one stop service" for private operators. For the last several years, Rwanda has been a safe and secure country. Crime rates are the lowest in the sub-region. Kigali is probably one of the safest capitals in the world.

Basing on the above information, the study on agribusiness innovation is imperative and will look on innovation and related policy support or impediment at all stages of commodity chain from production to marketing/selling including support services such as administration, transport, marketing, financial, input supply, buyers and sellers. The study will establish whether there are existing policies which support or impend or those which are missing in order to hasten uptake of innovations.

1.2 Agricultural commodities in national policy

Rwanda is a landlocked country with an area of 26.338 square kilometers. The economy is based on agriculture and majority of population live in rural and depend on agriculture for livelihood. Rwanda's demographic growth rate is estimated at 2.9% per year. According to the first estimates of the 2002 census, the Rwandese population comes to 8.162 715 inhabitants; it will go from 15 million in 2020 to 20 million in 2030. Rwanda is characterised by one of the highest population density in Africa, i.e. about 310 inhabitants per square kilometre. The whole area of cultivated lands is about 46% of the Country's area. The use of agricultural innovation is the only option for high productivity and income generation for the population.

1.2.1 Coffee commodity value chain

Bourbon Arabica coffee has been grown in Rwanda since the early 1920s. For long period coffee has been Rwanda's leading earner of foreign exchange but has recently been overtaken by tea production, reflecting the current depressed coffee market conditions and the civil strife of the early 1990s. In the late 1980s, Rwanda produced about 40,000 tons of semi-washed Arabica. In 2002, approximately 20,000 tons were produced and exported to high volume European importers. Rwanda being land locked country coffee is trucked out by container to the ports of Mombassa in Kenya and Dar Salaam in Tanzania and transferred to Europe or USA by cargo ships for expedition. Government controlled sector and export monopoly targeting "C" market. Almost 500,000 coffee producers , each one producing and processing it differently, all selling to one buyer (Rwandex), without any incentive for high quality. Poor price led to poorer quality.

Rwanda possesses ideal growing conditions for Bourbon Arabica production. Coffee is produced mainly in the three out of four provinces of the country, in the western part of the country along entire shore of Lake Kivu, eastern, central and southern provinces, at an altitudes ranging from 1350 to 1850 meters above sea level.

Rwanda's rich volcanic soils, rainfall distribution and moderate year long temperatures favour the slow maturation of the coffee bean, creating a distinctive taste in the cup. Rwandan coffee is produced using few chemical fertilizers and insecticides. Soil fertility is maintained using traditional mulching and manuring techniques. Coffee is harvested between the months of March and June. Coffee production is indeed a smallholder activity. Today some 430,000 households produce coffee, and the typical family farm has about 200 trees.

1.2.2 Livestock and Dairy commodity

The policy of the Ministry of Agriculture and Animal Resources is to increase animal production, modernize farming, reduce poverty, ensure food security and have surplus for the market. This will ultimately result in the increase of the standard of living of the population. The transformation of the animal resources industry can only be achieved if the constraints to animal production are reversed. To-date, the livestock sector contributes very little on GDP, about 8.8 % only

The major animals raised in Rwanda are cows (1 006 572) goats (1.263, 962), sheep (686,837), pigs (326,652), chicken (2,841,399) and rabbits (643,927). The three former provinces having the largest number of cattle are former Umutara, Gitarama and Kigali provinces. The former Umutara province in characterised by the extensive type of animal husbandry, whereas former Gitarama and Kigali are more or less oriented towards milk production, as intensive grazing.

Table 1. Livestock production and distribution in different former province of Rwanda

Province	Cattle	Goats	Sheep	Pigs	Chicken	Rabbits
Butare	64 281	117192	13373	34 667	216368	32448
Byumba	51 601	66 692	87193	8 525	766795	44242
Cyangugu	28 301	75 124	20127	17 041	142509	11596
Gikongoro	49 906	73 080	47528	32 904	45347	32904
Gisenyi	49 625	43 592	30786	9 328	242608	40667
Gitarama	176001	141837	31383	48 655	314418	227526
Kibungo	73 778	102872	4 520	12 045	175904	12952
Kibuye	52 766	73 050	46808	14 644	96384	152295
Kigali gari	102495	103505	33373	15 057	256564	36719
Ruhengeri	56 566	75 835	63224	20 570	94112	46514
Umutara	301252	89 033	2 242	1 265	168559	6064
TOTAL	**1 006 572**	**1 263 962**	**686 837**	**326 652**	**2 841 399**	**643 927**

Source: MINAGRI Directorate of Animal Resources Reports

More than 50% of the cattle population is concentrated in North-East of the Country. The former Umutara province ranks the first with 301 252 bovines followed by Gitarama and Kigali Ngari, which respectively total 176.001 and 102 495 heads.

Cattle population including improved dairy cattle is estimated at about 1006 572 heads of cattle. Out of that, 86% are local breeds, 13% crosses and 1% grade cattle (however, this data has to be taken with caution until a proper livestock census is carried out). The target is to have 38%, 54% and 8% of the cattle population being local breeds, crosses and pure breeds respectively.

The production systems are essentially of the traditional type, with very little improved techniques utilized. Intensive production is practiced for diary production, with genetic improvement activities, around Kigali City as well in the one of Gishwati.

Annual animal production is estimated at 97,981 litres of milk, 39,126 tons of meat, 2,432 tons of eggs, 7,612 tons of fish and 1,499 tons of hides and skins. This does not satisfy the needs and requirements of the population. Consumption in Rwanda is 12 litres of milk and 4.8 Kg of meat per person per year, while FAO recommends respectively 220 litres and 50 Kg per person per year.
The livestock product during the period 1999 to 2004 is presented in the table below. The amount is not sufficient, and it has to be supplemented with imports from outside.

Table 2. Livestock product (tons) during five years products (1999 – 2004)

Product	1 999	2 000	2 001	2 002	2 003	2 004
Milk	55 577	57 853	63 484	97 981	112 463	121, 417
Meat	22 807	25 608	35 748	39 126	43.589	48.681
Fish	6 433	6 996	7 308	7 612	8 144	8 126
Eggs	1 471	920	1 015	2 432	3 402	2,452
Honey	528	762	760	819	908	1 029
Hides					982	2158

Source: MINAGRI Directorate of Animal Resources Reports

Animal products show an increase over the years. The amounts of milk, meat, eggs and honey doubled over the 5 year period between 1999 and 2004. Fish increasd from 6,433 tons in 1999 to 8,126 in 2004. During this period, there was better organization among the staff and farmers were paying more attention to animal management. At the same time, farmers were acquiring loans to improve farming and purchase inputs. As a results, the quantity of animal products doubled between 2000 and 2004. The number of in-calf heifers that were imported in the country had an immediate impact on milk production.

Livestock sub-sector is supposed to cover 10% of animal protein needs of the population; that is 6 grams per person a day (according to FAO/WHO standards for Rwanda). However, this proportion has never been reached and the most significant progress was made in 1989 when the contribution of livestock was estimated at 4 grams per person a day.

Table 3. The quantities of milk products imported in Rwanda between 1990 and 2003.

YEAR	UHT MILK	POWDER MILK	MILK PRODUCTS	LIQUID MILK	TOTAL
1990		1150	10		1160
1991		2910	20		2930
1992		760	50		810
1993		2910	20		2930
1994		890	10		900
1995		2910	20		2930
1996		1360	60	800	2220
1997		2910	20		2930
1998		1600	8	19	1627
1999		2910	20		2930
2000		1200	18	62	1280
2001	703	651	20		1378
2002	1112	544	22		1678
2003	563	128	9		720

Source: BNR 2005

Basing on the data above the country has depended on imported milk and milk products for a long time. The amount of milk and milk products that were imported were mainly in excess of one thousand tons.The importation in some years was even close to 3000 tons. However, the amount of imported powdered milk fell by about 50% between 2000 and 2003. due increase in domestic milk

production as a result of the organization of farming and imported animals into the production chain.

In order to improve livestock sector, the Ministry of Agriculture and Animal Resource established Rwanda Animal Resources Development Authority (RARDA) to contribute towards the growth of animal production through the development of appropriate technologies, providing advisory, outreach and extension services to stakeholders in the animal resources sector including provinces, districts, NGOs, farmers and farmer's organizations, to allow them to modernise the sector in the framework provided by the national policy, EDPRS in medium term and the vision 2020 in long term.

RARDA decentralized its activities in line with the Government of Rwanda decentralisation policy of bringing services close to the population. According to this policy the Sector (Umurenge) is the focal unit for development. The services rendered target an improved delivery. The RARDA current strategic plan will focus on programmed vaccinations against major epidemics, establishment of stock routes, check points along highways and established quarantine posts at the borders of this country. The control will also involve carrying out regular epidemio-surveillance for the major diseases in the country. Working with decentralized local governments, strengthening capacity of the national and regional laboratories and educating farmers are keys components of the strategy. With the presence of veterinary staff at Umurenge level, the extension services to the population will be more effective.

Nevertheless, the following are the problems that still persist: (i) Weak animal feeding as far as quantity and quality are concerned to give profitable return to investment; (ii) Weak genetic performances of local cow races; (iii) Lack of a conservation system of (cooling system) which lead to the deterioration of animal products; (iv) Lack of an adequate extension system; (v) Lack of organization for animal products marketing system; (vi) Difficult access to agricultural loans; (vii) Academic research and whose results are not transferred to farmers, (viii) Prevalence of several epizootic and enzootic diseases of which some are transmissible to humans (brucellosis, tuberculosis, rabies, etc.)

According to vision 2020, the production of milk will have increased five-fold in volume and the value of animal by the year 2020. This could be achieved through promotion of dairy farming in rural areas and develop livestock and crop integration for economical use of limited natural resources available. Dairy farming is one of the most cost-effective methods of converting scarce land, crude and improved feed resources into high quality protein-rich food for human consumption . Since the smallholder farmers have labour and access to land, regardless of size, they are the most likely source of future increases in milk supplies in Rwanda if deliberate efforts are made to help them acquire one to two quality cattle managed under the zero grazing system. The impact of such a policy on the economy of the country could be enormous and has potential to revolutionarize agriculture in rural areas. What is needed is a concerted effort and imagination on the part of policy makers.

Whereas the crossbreds are more adapted to the local environment and the limited feed resources on smallholder farms, the purebreds from outside require intensive management which are difficult to achieve for many small farmers. However, the Government of Rwanda (GOR) through MINAGRI and her development partners, NGOs (Heifer project International-HPI and Send cow) and the private sector, are working hard to address dairy problems. The Government project, PADEBL, financed by African Development Bank loan (ADB) is currently directing efforts towards genetic improvement of the national herd through sound breeding practices, improved artificial insemination (AI) delivery systems and distribution of improved bulls to farmers and

farmer groups/associations, extension and farmer training and organized marketing systems for increased milk.

Other interventions include those geared towards the utilization of improved and locally available feed resources through better forage husbandry, utilization and conservation for dry season feeding. The latter aspects are mandated to ISAR. In addition to PADEBL, a new initiative of one cow per household (Girinka) targeting 600 000 families with sufficient land (0.7 ha) to produce both food and feed for cattle is assured.

The milk production in Rwanda is mainly produced by smallholders keeping traditional and crossbred cattle collectively about 99% of the total cattle in the country. The exotic breeds mainly Friesians, Jerseys and Browns Swiss are about 1%.

1.2.3 Banana commodiy value chain

Banana is one of the major commodities in agricultural sector used as both food and cash crop. The consumption of bananas in Rwanda is one of the highest in the Great Lakes region. Bananas are grown on 23% of arable land and contributes 60-80 % of household income in major banana growing zones (Mpyisi *et al.* 2000) . However, average yield is low (5.35 tons/ha/year) as bananas are cultivated in subsistence systems with low input and output. Considering the importance of the banana and it's potential for production and marketing, the Ministry of Agriculture and Animal Resources is committed in developing a programme on national level to improve production, marketing and diversified use.

Globally banana is the 4th most important crop in the world after wheat, rice and potatoes. It is the traditional food and cash crop in East and Central Africa highlands, Rwanda inclusive, where its production is largely for food security and unique in the world. Highland cultivars (Musa EA-AAA-both cooking and brewing) are endemic in the region and account 75% of production in Africa and 20% in the World (FAO stat.). Rwanda produces about 2 mill. Mt per year and it is the 6th in Africa and 11th in the world in production; however, it is the 2nd in consumption in the world with about 144 kg/pers/yr after Uganda with 223 kg/pers./yr. The fruit is available fresh through out the year, thus an important and reliable food security crop and good source of household income INIBAP..).

In Rwanda, banana is a traditional crop grown for about four centuries (Kagame, 1971). It is mainly produced in Eastern and Western provinces, however it is a priority crop only in the Eastern province. Banana performs well under good management and availability of both manure and much are key factors for good banana management. In generally a well managed plantation may have longevity of 20 to 70 years and above , while under poor conditions, longevity is in a range of two to three years hardly five. The areas where banana management is good, like Rukira in Ngoma District and Kirehe District are becoming the major source of banana in the country. The poor management is mainly due to poor weeding, lack of pruning/desuckering, poor soil fertility management as very few farmers in many parts of the country apply manure (less than 20%), lack of mulching materials and poor spacing

The Rwandan community attach considerable value to the banana crop beyond economic gain. It is associated with many cultural ceremonies. Banana beer is offered at each ceremony and banana plants serve for decoration of wedding places. Cooking banana bunches are offered at births and as a sign of good relations. Bananas became a social symbol of Rwandan culture, an obligatory element of every ceremony and essential agricultural landscape. Grown around "urugo" (farm), banana is considered as a symbol of prosperity and well-being.

There are four different banana types grown in Rwanda; dessert (for ripe fruits and industrial brewing), cooking (eaten boiled), brewing (brewing) and plantain (cooked/roasted ripe fruits). Brewing bananas account for 60%, while cooking and dessert accounts for 30% and 10% respectively (Gaidashova et al., 2001). Plantain production in is very low and less than 1%. In terms of production, brewing bananas have been predominant for many years, accounting for about 67% for the period 1984-90. The expansion of beer banana has largely been market driven and in response to consequences of acute demographic pressure coupled with declining soil fertility and poverty. Rwanda is unique in the region in having more brewing banana cultivars than any other country in Africa. Banana crop has numerous uses, such food security, local banana beer, crafts, animal feed, soil conservation, social interaction and status etc. Cooking banana processing is very limited. Only chips are produced for few supermarkets in Kigali and they are not known in other places.

Banana has extensive marketing system, which is complex and poorly developed. It involves a large number of intermediaries and comprises many distinct marketing channels. Most activities occurring within the informal sector and there is no association formed around marketing of banana only. A recent development was the formation of a cooperative for marketing both potatoes and bananas in Kigali city. However, banana marketing is relatively better developed than others in the region, as banana bunches are sold by weight. The price is given per kilo, contrary to bunch price used in Uganda or Tanzania. Few farmers organizations do exist on banana alone like kamara cooperative in Kirehe etc, as a result the commodity remains the subject of personal than community interest. This is due to perennial nature of the banana crop and longer time of investment return, poor capacity to invest and poor access to market information. The transport charges in the rural areas between farms and assembly points are higher than inter-urban transport charges with better marketing infrastructure.

Figure 4. Banana production in Rwanda during 30 years period (1970-2003)

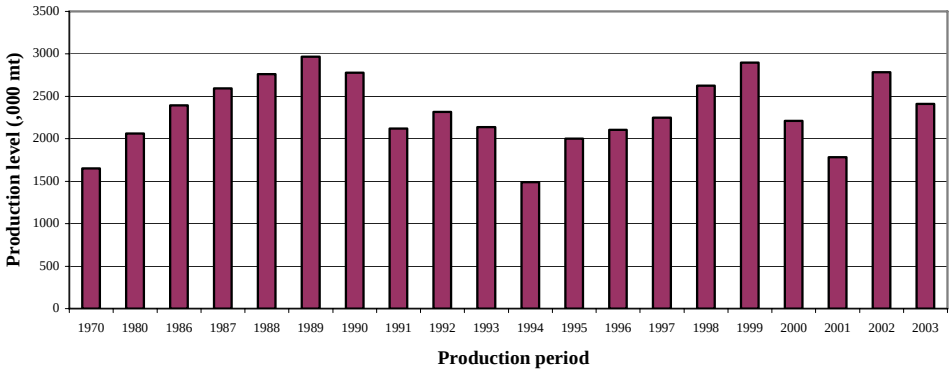
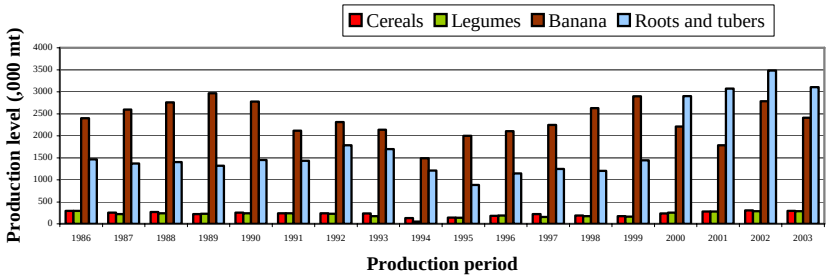


Figure 5. Crop production during the 18 years period 1986-2003



1.2. Objective of the study

The overall objective is *to assess the extent to which the prevailing national portfolio of public policies either enhances or impedes the possibilities for growth-stimulating innovation in Africa's agricultural sector as comparative assessment of six African nations including Rwanda.*

1.3 Study Methodology

1.3.1 Commodity Value Chains

Basing on the decision from Nairobi workshop, we agreed that the following commodity chains study in Rwanda will focus on the following three crops. Coffee, dairy and banana

1.3.2 Study sites

The study was carried out in all four Provinces (Eastern, Western, Soutern and Northern province) of Rwanda and Kigali city where the three commodity chains are operated.

1.3.2.1 Banana commodity chain

- *Kigali city: the districts of* Kicukiro and Gasabo,
- *East Province* Districts Kirehe (banana production, processing, transport,
- *South Province:* Huye District (banana craft making, marketing/selling)
- *North Province:* Rulindo District (banana processing, selling/marketing)

1.3.2.2 coffee commodity chain

- *Kigali city:* Kicukiro District: (Coffee processing, marketing/buying, transporting, exporting)
- *West province*: Rusizi an Rubavu District (Coffee production, processing, transport, marketing/selling, exporting)
- *South Province* Huye and Nyamagabe Districts (Coffee production, processing, transport,

1.3.2.3 Dairy commodity chain

- *Kigali city:* Kicukiro District (processing, marketing/buying, transporting)
- *West province:* Nyabihu District (production, processing, transport, marketing/selling)

- *South Province:* Nyanza District (production, processing, transport, marketing/selling)
- *East Province:* Nyagatare District (production, processing, transport, marketing/selling)

1.3.3 Sample Size

The study was conducted using open ended interview questionnaire developed during Nairobi workshop (Dec.2007) and included producers, farmers cooperatives, support service providers, processors, transporters and traders, policy makers, buyers etc. Because of diversity of interviewees, each commodity chain covered at least 10 interviewees using fixed sample size. In total the sample for the whole study was 30 interviewees.

1.3.4 Duration of field work

The field work was conducted in one month period using two additional staff (Mr Alfred Bizoza and Augustin Rwakimanzi) from the Department of Agricultural Economics and agribusiness in the Faculty of Agriculture of the National University of Rwanda.

2.0. Agricultural Innovations within a value chain framework

2.1 Agricultural Innovations in the Coffee Value chain

2.1.1 Policy reform in coffee industry.

In 1998, in response to diminishing returns resulting from global oversupply, the Government of Rwanda (GOR) recognized that the viability of smallholder production depended on transforming the coffee industry into a producer of premium quality, fully washed Arabica. The GOR, with the full and enthusiastic support of Rwandan private sector operators, and major donors such as USAID, the European Union, the World Bank and the International Fund for Agricultural Development (IFAD), embraced a policy of total quality management and developed a detailed medium-term plan (MTP) to transform the industry. In general the new government targeted coffee as a priority sector, liberalized coffee sector, cooperatives were formed, emphasised quality, private sector was encouraged to build processing centers, and laboratories were built for quality control.

The MTP included the creation of private and cooperatively owned coffee washing stations; the replacement of older coffee trees; the improvement in production techniques and the facilitating access to finance and the promotion of Rwandan coffee washing stations construction, water supply and energy sources. The plan calls for the establishment of 100 washing stations, producing some 44,000 tons of fully washed coffee in 2010.

The sale of coffee has been completely liberalized since 1999 and exporters are free to transact business without export taxes or undue government involvement in product marketing. OCIR-CAFÉ (The Office of Rwandan Industrial Crops-Coffee) is the government agency responsible for Rwanda's coffee sector. Among its many attributes, it is charged with elaborating national coffee policy, establishing quality standards and classification systems, controlling coffee quality and issuing certificates of origin and quality. OCIR-CAFÉ is committed to assisting importers and roasters in establishing contacts with Rwandan exporters and facilitating eventual transactions.

2.1.2 Specialty coffee innovations

Since the year 2000, the partnership of different universities and research institutes through finance provided by USAID, introduced many coffee innovations of doing coffee business differently through focusing on quality, linking partner institutions and buyers directly with farmers. Rwandan coffee growers' associations gained access to new markets and introduced quality standards that are geared for sales to these markets. Coffee innovations introduced during the last seven years included mainly:

2.1.2.1 Quality enhancing technologies and innovation

Production level: The quality control starts at production level and include (i) production of quality cherries, (ii) field management, (iii) picking only ripened cherries, (iv) sorting good cherries at the farm, (v) timely transport to coffee washing station (CWS) for processing on the same day. These technologies and innovations enhanced are key for quality of specialty coffee.

Processing level: The post harvest handling and process at CWS include: (i) sorting and remove poor or damaged cherries, (ii) floating and grading before de-pulping, (iii) floatation and grading in water along the canal pulped cherries, (iv) fermentation and cleaning to remove mucilage, (v) duration of drying in the shade and in open sun, (vi) cup testing, recording and storage, (vii) lot arrangement and sampling.

Sorting and grading: Cherries are hand-sorted in the field prior to delivery to the washing station and are then graded by density before pulping either in a flotation tank or in a pre-grader so that heavy and light beans are processed separately.

Figure 9. (a) Grading by floatation

The beans are fermented over a 36-hour period in tanks to loosen the mucilage. Coffee is then washed in the washing canal and is again sorted by density, prior to entering the soak tank where it is submerged for 24 hours. Finally, the wet parchment is set out on drying tables and is further hand sorted to eliminate off-colour, insect-damaged and irregular beans. Beans are sun dried until reaching 10.5% moisture content, which generally takes between 10 and 14 days.

Cup testing at laboratory: Quality control is the key for quality produce. The samples are taken at each lot by area, date and cooperative. The samples are kept separately in the laboratory. This is a combination of different innovations including both technical and organization. All these technologies are done at cooperative level.

Figure 13: Quality control in cupping laboratory

2.1.2.2 Organizational and management:

The coffee farmers had been selling to middlemen for long period, who in turn sold to exporting agency (RWANDEX). Following the policy reform in 1998, the coffee farmers formed cooperatives. These cooperatives were still at embryonic stage when specialty coffee innovation were being promoted. This prompted to promote also strengthening cooperative organization and management in areas of (i) cooperative management and organization, (ii) cooperative financial management, (iii) cooperative business management, (iv) export marketing and (v) extension programs.

2.1.2.3 Promising early results (key for innovations uptake)

In 2002, the first cooperative produced 38 tons of premium-quality, fully-washed coffee which was purchased by specialty roasters in the USA and Great Britain. The coffee had a distinctive quality. Since then, the success of the cooperative has been widely covered in industry publications such as The Coffee & Tea Journal, as well as in more general interest media such as The Financial Times, The Washington Times and CNN's Inside Africa.

In the year 2003, nine washing stations produced approximately 300 tons of coffee. Samples from each washing station were analyzed and cupped by independent evaluators in the U.SA. and Europe at the outset of the 2003 season. The vast majority of samples were evaluated in the mid to high 80s, indicating substantial potential in the premium and specialty segments of the coffee market.

Return to innovation uptake: During the first significant years of fully washed production, cooperatives and privately-owned washing stations purchased cherries at between 50 and 60 Frw per kilo. This was more than twice the parchment equivalent price obtained by farmers through the sale of their semi-washed coffee to traditional exporters. In addition to greater revenues derived from coffee production, farmers who supply washing stations are rid of the time-consuming chore of manual pulping and drying and can use this time for productive on-farm and off-farm activities.

Rural financing and impact: The impact of this additional infusion of money into the rural areas is already perceptible. Micro credit banking services and small businesses are springing up near cooperatives and primary school enrolment has increased as heads of households are better able to meet school fees. These additional revenues are particularly important as many Rwandan coffee farmers have been widowed or orphaned during the genocide and the AIDS pandemic.

All of Rwanda's washing stations operate in an environmentally responsible manner. Water used for pulping is re-circulated and then evacuated to percolation pits so as not to contaminate local water sources. Pulp is composted and reapplied on coffee trees to add nitrogen and potassium to the soil.

2.1.2.4 Infrastructures supporting innovations uptake

In order to succeed in application of coffee innovation for quality improvement; the important infrastructures are essential and in most cases beyond the capacity of cooperative. Under speciality coffee, the first infrastructures were built as grant to the cooperatives, however, the following ones

were built using own fund either from their own income or loan from bank after having confidence in them. The essential infrastructures include: (a) First coffee washing stations, (b) first coffee dry processing and (c) first cupping laboratories. These three infrastructures make up a complete system which enable quality control up to packing and exporting. However, the PEARL project, which started specialty coffee activities, sought partnership with interested NGOs, public and private organizations, foundations and even private people to join efforts in this activity. The first ones that intervened in coffee sector are: OCIR Café, ACDI-VOCA of USA and NAEGELE private family foundation in USA.

2.1.2.5 Capacity building of farmers

Technological innovations: The uniqueness of specialty coffee innovations, is their rural based nature, and rural poor empowerment and strengthening. The capacity building on innovations for specialty coffee occurred at all stages of coffee commodity chain including: (i) coffee good agricultural practices such as best field practices, selective harvesting of ripe cherries, (ii) post harvest handling and processing techniques such as transport in short period after picking, various sorting methods (at farm, CWS, at drying and green coffee), grading (floatation before and after pulping), drying (in shade, on sun, covering, open, and their duration), storage (by lot and area and their identification), and (iii) cupping techniques (cupping laboratory equipments, cup testing, recording, lot sampling methods and record management).

Organization and Cooperative management: The coffee cooperatives in Rwanda were at embroynic stage. They were started after 1998 coffee trade liberalization; with majority of them starting in 1999. The PEARL project with objective of rural development supported cooperatives in building their human resource capacity in different areas of cooperative development through offering variety of trainings using resource people from different areas as indicated in table 1 below. The trainings covered a variety of topics including: (i) cooperative management (good governance and financial management,).

The experts used in capacity building for both technological innovations and cooperative management came from different parts of the coffee world. Some were from Rwanda but others came from NGOs, regional and international organizations, coffee buyers, Universities (NUR, MSU, and TAMU) and research institutes. The trainings offered to farmers in different areas of specialty coffee and cooperative management included study tours, conferences and trade shows in order to enhance partnership with international coffee organizations and open horizon of thinking broadly.

The capacity building is continuous activity and to-date, the experienced coffee technicians from Maraba are sent in newly-started coffee cooperatives at the beginning of each coffee season to train technicians in coffee harvesting and processing techniques as scaling out the specialty coffee innovations.

2.1.2.6 Market access and direct link with buyers

Direct linkage with buyers: One of impediment for uptake of new technology or innovation is due to limited information and access of complete package of market quality standards, benefit from adoption and promotion system. In the last decades much focus of agricultural technologies has been on productivity with less emphasis on market and quality standards and benefit or income from application of innovation. The scale out was faced with problems because it was not focusing on market quality standards, income and benefits to farmers. The first coffee buyers who

contributed in helping Rwandan specialty coffee sector getting its current reputation it has today were: (a) Community Coffee from Louisiana in USA and (b) Union Coffee Roasters from London in UK and who were the first and second respectively to buy Maraba specialty coffee and promote it.

Access to new source of innovation: The experience from specialty coffee at Maraba, was that high income is a reward of high quality; which is in turn a result from right expert with both technical and market quality standards; coupled with willingness and commitment to work with rural poor to achieve the goal "high quality". At the start of the specialty coffee business at Maraba, the PEARL project hired "an experienced Specialty Coffee market expert, Sam Olivieri" who helped Maraba make a high quality specialty coffee and linked with first buyer, the Community Coffee Company. The Maraba coffee samples were sent to community coffee company, tasted and appreciated for their high quality. This prompted Community Coffee to send Carl Leonard to visit the Maraba cooperative.

2.1.2.7 Supportive Government policies

The government political will and support for coffee quality improvement was key factor in the success story. The innovation up take should meet community needs and income, political will and markets quality standards and buyers interests. The warmly welcome offered to the first specialty coffee buyer, and meeting with His Excellency Paul Kagame, the President of the Republic of Rwanda at Maraba was an indication of political willingness and support. The Government of Rwanda (GOR) of focusing on quality and competitiveness was the basis of success. However, political will without meeting buyers demands and additional interests does not improve innovation uptake.

2.1.2.8 Impact of innovations on coffee industry.

Buyers interest and partnership: The Rwandan specialty coffee started to gain reputation in US and UK and the good news spread out very quickly. This led many roasters and coffee importers to become interested in the Rwandan specialty coffee and came over to visit coffee plantations and cooperatives. At the beginning PEARL project covered some of their travel and living expenses for the marketing purposes but later buyers paid their own money to come and visit coffee cooperatives and make business contracts with them. There are seven retail roasters, 16 wholesale roasters in USA, Canada and UK, and four green coffee importers in both USA and UK. Some of these companies are now buying specialty coffee directly or indirectly from farmers' cooperatives.

The partnership and linkage with specialty coffee buyers ensured reliability of market and enhanced innovations adoption. The outcome from investment in innovation and quality gave immediate results which cultivated more interests among different cooperatives and members. Moreover, some of specialty coffee innovation were already in Rwanda since 1956, however, they were not promoted and even considered as quality enhancing because they were not linked with market and did not bring more income to the community. During forty five years only two large washing station for production and a small one for research purpose at National Research Institute (ISAR); as compared to more than 100 CWS in six years. The PEARL project promoted some of what was existing in Rwanda and brought or developed new technologies to address problems realised during operation.

In the process to promote Rwandan specialty coffee globally, SPREAD organized Golden cup competition in 2007. This year 2008, it organizing cup of excellence in Rwanda, and it is for the

first time in Africa. These are the latest innovations in Rwandan specialty coffee promotion. The innovations did not stop at quality control only, but also in popularizing and promotion on global scale. The market has expanded to Japan and China. The current need is more innovation on how increase production while maintain quality

2.1.2.9 Scale out of innovation and impact

After the introduction of Maraba cooperative in specialty coffee in 2002, it expanded to 11 cooperatives in 2006 producing and exporting specialty coffee to more than 10 coffee companies in USA and Europe. The gross income from the specialty coffee business by these cooperatives increased from 41.736.541 Frw in 2002 (for one cooperative at Maraba) to 343.372.150 Frw in 2005 for nine cooperatives only. These cooperatives had about 12.000 members and were in direct partnership with coffee buyers (importers, coffee retail and wholesale roasting companies) in USA and UK, which was new in coffee industry in Rwanda. The number of containers so far exported by all these 9 cooperatives from 2002 to 2005 is around 24; a container carries about 18 metric tons of green coffee, making a total of 432 metric tons from zero in 2001.

Table 1. Scaling out innovations on speciality coffee to different cooperatives and capacity building during four years period (2002 – 2006)

Year	Technological and organization Innovations promoted	Number of persons trained	Cooperatives represented	Resource people
2002	Accounting, management, production and Finance	8	Maraba Karaba	GTZ
2004	Cupping	13	11 coffee cooperatives	Cuppers from the Coffee Quality Institute and UCR
2005	Cupping	35	Representatives from Rwanda, Burundi, Uganda, and Kenya	PEARL and EAFCA
2005	Production: good agricultural practices on coffee	100 extension agents from 9 coffee coops	9 coffee cooperatives	PEARL
2006	Cooperative good governance, management	46 leaders, CWS managers, accountants	9 coffee cooperatives	PEARL

PEARL: Project to Enhance Agricultural Research and Linkages
EAFCA: East Africa Coffee Association

2.1.2.10 Sustainable organization of specialty coffee marketing

In order to sustain these innovations and maintain the link with buyers, nine cooperative united together and formed a commercial society (RWASHOSSCO) to market their specialty coffee under supported of Africa Development Foundation (ADF) funding. To-date RWASHOSSCO deals with buyers on behalf of member cooperatives, each linked with a particular buyer at a time to avoid competition between members.

. In general, the key factors to successful application of specialty coffee innovation include:

(i) **Partnership and linkages:** The success of innovations applied on specialty coffee can be attributed to a combination of efforts from many partners ranging from (a) Universities (National Iniversity of Rwanda (NUR), Michigan State University (MSU) and Texas A&M (TAMU)), (b) District authority, (c) National Agricultural Research institution (ISAR), (d) NGO's (ACDI/VOCA), (e) Donors (USAID), (f) buyers (Community coffee of USA, Union roasters ect), (g) cooperative members commitment and (h) Government of Rwanda agencies (OCIR-café). The existence of partnership between the former Maraba District authorities and NUR pulled all partners together to focus the donor funded project on coffee. The willingness and flexibility of donors to allow expenditure on quality enhancing activities even if it was not well sought and planned in advance.

(ii) **Infrastructures support and availability: c**onstruction of necessary infrastructures needed to get a high quality speciality coffee,

(iii) **Building Technical Capacity of farmers:** capacity building of grass root community through training of farmers in processing techniques for speciality coffee and other technological innovations.

(iv) **Strengthening Organizational and management capacity:** cooperative management development, coupled with willingness and dedication of cooperative members to work very hard and reach goal of producing high quality specialty coffee, competitive on international coffee market before knowing even price.

(v) **Market access and partnership with buyers: L**inkage of the cooperative with the international specialty coffee market was an important innovation in the country, and first time in the country.

(vi) S**upportive Government policies and Local authorities.** Maraba District was the third poorest District in the country. Coffee trees were the only agricultural item well distributed in the district in the community which when well improved will ultimately improve household income and reduce poverty. Therefore convergence of interests from different partners was the key factor of success of speciality coffee among cooperative members and Rwanda in general. The Government policy of focusing on quality coffee since 1998, the local authority willingness to partner with different organizations contributed to easy take off and promotion.

2.2 Dairy commodity chain innovations

Similar to specialty coffee, dairy commodity value chain has got good policy support and guidance to enable the country meet the protein required and cut down powder milk importation. However, the livestock keepers are encouraged to adopt the intensive system and zero grazing using improved breed of livestock. Similar to innovations in coffee, the dairy technologies also bring good returns in a short period. However, dairy lack foreign exchange because it is sold in local market, but it saves foreign exchange. Therefore, the external innovation from buyers is not significant, although direct contact with foreign organizations like Lando lake of USA or Vetagri of Canada can be a good source of new technologies.

2.2.1 Livestock production:

Dairy production system and organization has been mainly traditional with little application of innovations. Nevertheless, the national agricultural policy calls for livestock intensification and diversification. The intensification aims at increasing productivity of livestock products through the increased use of inputs and livestock techniques. The specific objectives of livestock productions include**:** (i) to create favourable conditions for the increase of animal productions (milk, meat, etc) through the genetic improvement; (ii) organise the marketing system for animal productions; (iii) contribute to the increase of the farmers income; (iv) contribute to the environment protection through the preservation and the protection of soils; (v) contribute to the improvement of nutrition for rural populations. Therefore, the innovation in dairy value chain include: (a) genetic improvement, (b) processing, (c) animal feed and (d) farmers organization.

2.2.1.1 Genetic improvement innovations

The genetic improvement is a key for increasing livestock productivity. Since research in livestock is still at embryonic stage, the country is currently carrying three approaches in improving genetic resources: (i) direct importation of improved breeds as indicated in the introduction; (ii) artificial insemination of local breeds at community level; and (iii) crossbreeding research at National Research Institute (ISAR). Crossbreeding research activities being carried out at ISAR targets to produce crossbreeds animals suited to smallholder farming conditions under which the majority of the farmers in Rwanda operate and derive their livelihoods. The appropriate dairy innovations may also be tested along the breeds being promoted.

Heifer in trust scheme: Currently there are two international NGOs (Heifer Project International-HPI; and send cow) having partnership with GOR to promote livestock innovations. HPI is introducing new breeds and their management at community level using heifer trust scheme. Similar Send cow also is using heifer trust scheme, but it integrates with agriculture and train farmers in both livestock and crop technologies. Under heifer trust a farmer meeting minimum conditions receives an in-calf, and he/she will in turn give in-calf to the next farmer and so on.

The future of dairy industry in Rwanda is through small dairy-farming. The smallholder dairy-farming may be based on the Heifer in trust scheme (HPI-model) for improving the rural poor economy and the general well being of the people in the rural areas. There are minimum conditions that a farmer should meet before getting a cow which include: (i) 0.5 ha of forage, (ii) a shed and (iii) has to attend training on cattle management including nutrition and feeding. Follow up services include an on-going training program and farm visits.

Feeding under the schemme: All cows under HPI support are zero grazed. Supplementing cows with concentrates feeds is recommended. and some able farmers may afford, there is a problems with the availability of quality concentrate feeds in the country and those available are expensive while milk price is low. Farmers are encouraged to plant legumes and are given seeds obtained from national research institute (ISAR). With the introduction of legumes (*Desmodium intortum* and *Mucuna deeringiana)* it is hoped that milk yields will be increased.

Farmers organization under heifer in trust scheme: The HPI organizes farmers into their own organizations to tackle a number of developmental issues such as milk marketing etc. Such an organizations provide an ideal entry point for the innovations on dairy-farming as special group of common interest.

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Livestock crop integration innovation: The Send cow is promoting livestock and crop integration approach. The NGO has signed agreement with GOR/MINAGRI as executing agent of Girinka project and other MINAGRI which gives cows to poor farmers who meet the requirement to keep a cow. The approach includes a kitchen garden where to grow vegetables around the house.

Milk goat promotion technology to vulnerable households: The Send cow is promoting also milk goats and crop integration especially to HIV/AID patient to meet their nutritional need. The patients CD4 has improved over time. This is a significant innovation worth scaling out to many areas.

. 2.2.1.2 Feeding systems of dairy cows

Intensive livestock farming and feeding: In the eastern province, where there is largest number of livestock in the country, majority of cattle get their entire dry mater intake mainly from annual

pastures in individual farms; and a small number get from planted forage and very few on concentrate feeds. The Government has instituted a policy of parcelling land and distributing it to livestock keepers for eventual development into modern livestock farms. The main objective of this policy is to encourage farmers to keep improved breeds of cattle which give high return.

The government partnership and effort in supporting dairy industry innovations is seen from two major development projects (PADEBL and . Namely PADEBL, which is concerned with all issues of dairy and Umutara Community Resource and Infrastructure Development Project (PDRCIU/UCRIDP). Both projects have feed and feeding activities funded and planned activities include seed multiplication, capacity building through training of staff and farmers, equipment and transport facilities and post harvest handling.

GOR/MINAGRI through PADEBL project is a developing a strategy for milk production with the milk marketing interventions as a model for suitable for the country which can help farmers to get higher income from well managed dairy cow and reduce overstocking problems especially in eastern province. The development of sustainable milk and cattle marketing systems may assist farmers to adopt improved livestock management and other related technology innovations.

. 2.2.1.2 Improved pasture technologies

In order to increase milk production, the cooperative under support of MINAGRI/PADBEL is promoting the development of improved pastures which includes legumes varieties, and farmers are taught on silage and hay making for feed conservation and utilisation during dry season.

2.2.2 Dairy Milk marketing system

There are two systems of milk marketing in Rwanda. The first is by raw milk through intermediaries, the second is through processed channel. The former is cheaper and affordable by majority due to low purchasing power. While second is expensive and available only in supermarkets in Kigali city. Also the price of processed milk is double the price of raw milk. Moreover, the use of raw milk or processed using indigenous technology is a part of community.

2.2.2.1 Private Milk processing and marketing

During field study and interview, we visited three major milk processing plants in Rwanda, (i) Inyange Dairy Industry, (ii) Rubilizi Dairy Industry and (iii) Nyabisindu Dairy industry (Subsidiary of Horizon) . The first two (Inyange and Rubilizi) are located in Kigali city, while Nyabisindu is located in Southern province. Nyabisindu is the oldest of them as it started during colonial time around 1930's; The Rubilizi started in 1952 as dairy farm, however, milk processing started in 1986. The Inyange dairy industry is the youngest which started in 1999. All three milk processing industries are privately owned, and apart from Nyabisindu which gets milk directly from own dairy, four equipped milk collection centres and individual small scale farmers delivering direct to the processing plant. The other two (Inyange and Rubilizi) depend on supply from individual small scale farmers and they compete with raw milk market sellers.

Private milk processing constraints: The major constraints the Rubilizi and Inyange dairy industries is lack of sufficient milk and seasonality of supply because they depend in private farms and have competition with raw milk market suppliers leading to under capacity production. They

obtain large supply during rain season which can not stored for long period and low supply during dry season. This led to Inyange to diversify the product and introduce the mineral water and juice processing in 2001 to sustain investment and staff. The Rubilizi dairy tried to diversify by producing juice however, competition with Inyange was high and they stop the idea. Later in 2007, they started to produce skimmed milk for referal hospital (King Faysal hospital).

2.2.2.2 Farmer organization in milk marketing and processing

In addition to milk processing industries, we visited dairy cooperative, UDAMACO (Umutara Dairy Marketing Cooperative), a Union of 23 primary cooperatives with 4125 members . It operates in eight Districts of Eastern province. The UDAMACO is responsible to link the producers in rural area with the market in Kigali city, thus increase income from milk sales through quality control, confidence building among clients of their milk and removal of middlemen who were not reliable to the clients and producers. Currently it is supplying raw milk to Inyange and Rubilizi dairy industries and selling remaining to the community at their selling points in Kigali.

UDAMACO is operating in an area with largest population of livestock in the country among the community which love cattle and willing to take maximum care of their heard of cattle. The Government of Rwanda is also willing to support them in increasing their productivity and income to meet national protein requirement.

2.2.2.2.1 Milk hygiene and handling:

Milk collection centre (MCC). The cooperative has ten milk collection centres, of which seven were constructed under support from Government project, MINAGRI/PADEBL dairy project while other three were constructed under support from UNDP. Currently they producing 43000 lts/day, while in 2003, they were producing only 21000 lts/day. The cooperative has applied a series of innovations both in management, marketing, financing and production.

The cooperative promoted the milk collection centres with coolers where the milk is received and kept before transport to Kigali city (about 150 km) away. In order to get income for administration at province and district level, the cooperative charges fee per litre of milk supplied to the milk collection centre. The 80% of the fee is left to the grass root cooperative as its income for administration and self development; and 20% is sent to UDAMACO of which 10% is used for administration and 10% is kept for emergency use in disease control. Every milk collection centre is owned by grass root cooperative and it can expand it according to their incomes. Every MCC is equiped with coolers, milk testing equipments to test the quality before buying.

2.2.2.2.2 Milk transportation

In addition, the milk is transported in steel milk cans which allow easy cleaning and ensure quality milk delivery; contrary to use of plastic containers, which are easy to clean (jerry cans). However, there is no trade policy guiding the marketing of milk in the country. The milk marketing only follows standards established by Rwanda Bureau of standard (RBS), of which the chairman of UDAMACO is a member of the committee establishing these standards. RBS is also at enfant stage trying to set these standards in

2.2.2.2.3 Milk processing under farmers organization

he Government through PDRCIU/UCRIDP project has invested in building milk processing plant with a capacity of processing 33000 litres per day. It is also expected to include UHT production unit the ensure that the milk processed has extended shelf life. Because of the importance of the plant interested private investor to get shares. They include Rwanda Development Bank (BRD) and Rwanda Development Investment group (RDI). The Government investment through PDRCIU/UCRIDP equivalent to 60% was granted to UDAMACO, BRD and RDI is 20% each. The plant operates independently with a manager and a Board of Directors of of 9 members representatives from UDAMACO (3), BRD, RDI (1), PDRCIU/UCRIDP (1), District (1) and others (2). The plant will produce four products: (a) pasteurized milk with 7 days of shelf life, (b) skimmed milk (50%), (c) ghee and (d) UHT.

2.2.2.2.4 Cheese making technology

There are different cooperatives adopting cheese technology in places where road transport and delivery to consumer is not possible. The technology is widely used in Gishwati area where access to market is difficult. Similarly, two primary cooperatives under UDAMACO are making cheese when they get power problem and store milk may get bad. However, Rwandan community are not used to cheese, therefore cheese promotion is needed.

2.2.2.2.5 Scaling out improved breeds adoption among :

In addition, the cooperative is supporting the farmers to acquire loan from the banks to purchase improved with large milk production. The Rwanda Development Bank (BRD) and Cooperative Banks (UBPR: Union des Bank Populaire du Rwanda) have given the cooperative a loan to purchase improved breeds for their members. BRD has approved 50 mill. FRW to purchase 453 improved cows, while UBPR has given 10 mill.FRW to a primary cooperative to purchase 20 cows. With assured market and income, farmers are willing to invest in productivity raising innovations and are charging a culture of having confidence in number of heads to the amount of income from the head of cattle. This is a good development idea and will ultimately reduce poverty in rural area; since increase return to investment in cattle management and resources used.

2.2.3 Partnership and collaboration:

UDAMACO has established collaboration with 13 different partners at national and international level. The international partners include: (a) Lando Lakes of USA, (b) VetAgri of Canada, (c) USADF and (d) HPI; while national being PDRCIU/UCRIDP (Community development project), PADEBL, ROPARWA (Union of cooperative), KIST (Training Institute), Banks (BRD and UBPR), CAPMER (GOR agency for SME support), RBS, UPU (Umutara Polytechnic University) and Livestock world (input supplier). The collaboration with Lando Lake of USA which has 100 years of experience in dairy industry is expected to help improving quality along milk commodity chain, process, hygiene, cheese making, marketing etc. While VetAgri of Canada will support them with establishing central veterinary drugs and supply 3000 aluminium milk cans. The cooperative had 196 milk cans bought from Livestock world which is also one of their collaborators.

During our field study, we visited an input supplier, the livestock world with expertise in milk chain and who can supply equipments for milk hygiene (eg mastitis testing cups etc). The have introduced small milking machines, mineral supplements, dummy udder for training, cattle handling equipments, produced training manual. and they are collaborating with many organizations in the

region. UDAMACO collaboration with livestock world is important because they are capable to provide private extension service to the primary cooperative whenever need arises.

2.2.4 HIV/AID Patient support

The international NGO, Sendcow -Rwanda is a partner with MINAGRI agencies such as RARDA and RADA and projects such as PAPSTA and PADEBL for livestock placement, management, breeding, monitoring, capacity building of farmers, further distribution, farmer organization into associations and use of manure for organic production. However, HIV/AID patient can not manage dairy cow management.

Send cow-Rwanda has introduced dairy goats to HIV positive family to get milk and improve their nutrition status while taking ARV drugs. The dairy goats have helped them and their CD4 has increased. This is an important innovation because goat milk is rarely accepted in Rwandan community. Dairy goats may be an important source of milk for families with smaller land size, not qualified to get a cow from GOR Girinka programme. However, a lot of promotion needs to be done to milk from goat acceptable in a wider community.

2.2.5 Proposal additional policies

There are some policies for improving dairy chain are missing like, while they are key to the success of dairy industry in Rwanda. These include the livestock breeding policy, intensive livestock system (zero grazing) policy, private extension policy, milk marketing policy, and livestock trading policy and milk marketing policy.

Livestock breeding policy: A good livestock breeding programme takes very long period and should be based on a good but flexible livestock breeding policy to guide the researcher institutes. Currently Rwanda has no national breeding policy. The policy will guide in appropriate technology based on affordability to the farmers. and consider the environment under which they operate. It may be either artificial insemination (AI), natural service using bulls or on embryo transfer technology. Long term Careful planning is needed dairy industry in order to get desirable breeds of cattle which can be easily feed and realize desired and profit from such big investment

Intensive livestock management (eg zero grazing) policy: While the livestock is facing open grazing area, the national policy is to keep livestock under zero grazing system. However, there is no guiding policy on how they should be kept as dairy or beef and service provision whether private or public. The private extension may be better option, but it also need policy guide.

Milk and livestock marketing policy: the policy should set guidance and standards to follow and capacity needed. To-date, it is done in traditional system, where quality is not an issue and innovation uptake is minimal. The main impendement of innovation uptake is the lack of standards and their re-enforcement.

Private extension policy: The extension and veterinary services are poor in all livestock areas. This is mainly contributed by both low skill of extension staff and small number according to the livestock. Since livestock is not like crops, the private extension service can be promoted and privately paid by farmers. Livestock keeping is investment and can meet the cost of service offered.

2.3 Agricultural innovation in the banana value chain

2.3.1 Banana production technologies and innovations

2.3.1.1. Technologies and innovation for export Apple bananas

Apple banana is thought to be very popular with "ethnic customers" within the European market. Moreover, the Rwandan apple banana is said to be of very good taste. Thereore apple banana has potential for export crop because of its quality, small sized fingers, good taste, aroma and sweetness. During the field study under this survey, we visited *Floris fruits export company*. Similar to specialty coffee, the company do not have banana estate, it organize small holder farmers and buy bananas from them.

The company has developed a series of innovations on export apple bananas together with buyers or clients from outside the country similar to what happened in the specialty coffee innovations. In addition, the company has already processed and paid for organic certification of whole former Kibungo province. This mechanism of getting innovations through buyers or partners is one of the recognized system of taping from global knowledge. The company has already acquired and applied the export banana technologies which are not created from national research institutes. The export bananas apply a series of innovations to from production, protection, recording, harvesting, packaging and shipping.

2.3.1.2. Production technologies and organization

Farm management: The farmers are responsible for care and management of their own fields (manure application, mulching, desuckering, deleafing etc); however, the company staffs follow up banana field management and ensure that the fields are kept according to organic farming requirement.

Flowering monitoring and cover with polythene sheets: The company staff monitor flowering of bananas plants and protect them using polythene bags.

Bunch age identification: The banana bunches are marked using different colour for each month as they flower. The monthly marking innovations assist in planning and estimation of expected harvest and quantity of bunches. Since banana is not like cereal crops, flowering is distributed in different months and without marking is not possible to estimate the number of bunches.

Flower bud removal: The flower bud is removed from the bunch at 8-14 days after flowering to ensure uniform finger maturation. The field staffs give report every Friday.

Record keeping and validity: Field staffs keep record of banana bunches flowered and covered, and every farmer keeps his/her own book for record and payment also. The field staff are paid according to the number of bunches covered, harvested, washed, and packed in boxes. The record of field staffs are compared with farmers records before payment.

Harvesting: The bananas for export are harvested in evening of the day before the flight and kept overnight to cool. In the following morning of exporting day, the banana hands are cut from the bunches, washed in clean water, packed in boxes and transported to airport to keep in cold room.

Packing: Packing into boxes is done on the same day of export to ensure that they do not stay more than 48 hours before reaching destination in Europe.

Quality control: Banana grown for export are handled carefully to ensure high fruit quality and excellent fruit appearance. They are covered with plastic bags immediately after flowering (within 2 weeks), harvested carefully and de-handed in paper boxes before being transported from farm.

What is important to note is that the company got banana technology from their client in Europe who even visits their farmers to confirm on origin. This is a different model, which is a Private-Private-Farmers –Partnership (PPFP). The research system in Rwanda and probably in Region has not yet developed trade oriented export banana technologies. The focus on fruits quality is limited to export bananas only.

Impediment of innovation uptake: Lack of quality standards for local markets and failure to pay for quality service. Both cooking, brewing and dessert bananas grown for local market are not handled in the same way to protect fruit quality and they reach consumers being damaged with black sports on fruit skin, because consumers selection criteria for dessert banana on local market are different from those of export market and the major issue is ripening stage. However, in areas, where bananas are grown for export, the quality of bananas for local market have benefited from quality education targeting export market.

Export banana farmers organization: It has organized farmers into associations and work as a group, and employed its own field staff to assist farmers and follow up from production up to harvesting. The company organizes regular meeting with farmers growing export banana, and they make contract and agree on price. During the time of interview, the price was 1000 Frw per bunch. This is good price because the apple bananas are sold at about 500 Frw.

1.3.1.2 New varieties introduction.

The banana production is predominately brewing with about 60% of varieties. The Ministry of Agriculture and Animal Resources is promoting five new varieties. The new varieties are accompanied with improved technologies of bananas.

2.3.2. Processing of banana products

2.3.2.1 Processing of banana beers

Brewing bananas: Beer banana commands a largest rural and urban market across the country. Generally, brewing bananas are processed into mainly banana beer by small or medium enterprises and on farm for rural community beer markets. The local banana beer in rural areas and township control large market. There is only one industry making banana beer, namely COVEBAR (Compagnie de valorisation Industrielle de la Banane au Rwanda) and few small entreprise making and packing banana beer into bottles.

Banana beer technologies and innovation: During the study we visited three banana beer making companies. These include (i) COVEBAR (which process Tarama and Mbanza), (ii) Urwibutso Entreprises (which process and pack Akarusho), and (iii) Cooperative Tuzamurane (which packs banana beer called Ibanga). The COVEBAR is the largest and use 20 tons of banana per week.

The COVEBAR company use apple banana because of high sugar content (24%) which does not require any additional sugar. The company produces two types of products: banana beer with brand name of Tarama which has 14 % alcohol, and Mbanza spirit with 40% alcohol. Contrary to

COVEBAR, the other two companies use the variety Kayinja. Both COVEBAR and Urwibutso entreprises use machines for processing and packing of beer, while cooperative Tuzamurane use manual processing.

The adoption of banana beer making innovations is market driven. The market of banana beer in in Kigali city is very large and supply is still low. All the value addition technologies are market driven, and they raise income and extend shelf life of the product.

Technology development and partnership with Research institutions: In addition to beer and spirit making, COVEBAR is engaged in developing technology for banana juice extraction and packing without sedimentation. This research is done in collaboration with National Research Institute (ISAR) post harvest unit, and Kigali Institute of Science and Technology (KIST) food technology department and Sokoine University of Agriculture (SUA). The team testing different methods of making a clear banana juice which can be packed and sold to the community. Banana is the only fruit available continuously through out the year, like wise the juice from banana may be available through out the year.

2.3.2.2 Crafts making technologies and innovations

There is a wide range of craft products made from banana bark by rural women in various craft shops around the country mainly in Kigali city and Butare town. The cooperative COBABU (Cooperative des Producteurs Artisans de Butare) with more 550 members (with 70% being women) has developed more thirty different crafts from banana fibers which are sold in their shop. Their model is unique, not like other cooperatives. The members make crafts and bring to the shop for selling. When the product is sold, he/she pays 22% to the functioning of cooperative and keeps 78% for himself/herself. The price of a craft is determined by the amount labour spent on it.

Similar to Floris company, this cooperative received original training from GTZ and thereafter their own innovations and inventions. Sometimes they get resource people from outside, however, it is expensive for them to pay. They collaborate with an Italian company which sells colours to them and sometimes gives training. There is little assistance they get in Rwanda. Todate, they have more 100 type of crafts from their innovation, and out of them, about 30 are from banana fibers.

The local market for these products is still small and offers low value. This is mainly attributed to the low purchasing power of the local market. The export market for these products is of a much higher value though at the moment it is still small. There is poor access to foreign markets and yet these much higher prices. Local associations rely on very limited range of marketing agents who just give them orders. Transport costs inhibit sales on foreign markets. Sellers rely on air transport which is expensive. This is mainly due to the small volume of trade currently going on. With a bigger market, producers could get more value through economies of scale.

There are varieties of post harvest technologies available in different parts of banana growing areas, such as papers, jam, crisps, etc; however, very little work has been done in the region.

3.0 . Policy perceptions by agribusiness, sectoral policies, and the drivers of innovation

Rwandan economy is essentially based on agriculture which contributes nearly 46 % of GDP and occupies 90% of active population. Government of Rwanda has put in place a number of instruments to exit out of underdevelopment and poverty. These include Vision 2020, EDPRS, Investment Promotion Policy, National Industrial Sector promotion Policy, National agricultural

policy etc together with institutional frame to support putting agriculture in the heart of national development. The Vision 2020 and EDPRS puts emphasis into transformation of agriculture into a sector of high add value and of high productivity. Furthermore, National Strategy of Investment (NSI) mentions agriculture and rural development as engine of primary growth and lever to return the country to the process of sustainable development and poverty reduction.

The agribusiness in Rwanda is new and still at infants stage. The GOR has put in place institutional framework to make it grow into sustainable institutes which can move national economy. This includes the formation of RIEPA (Rwanda Investment and Export promotion), CAPMER (Centre d' Appui au peti et Moyen Entreprise au Rwanda. ie (centre for SME/centre for small and medium entreprises), PPMER ect to develop business and agribusiness through support to exhibition, training, study tours, business plan development etc. In addition the Government since 1998, developped policy to orient farmers into operating their activities through cooperatives as a way to help them join effort and become competitive. Therefore both cooperatives and private individuals operating in agribusiness are at the national of national policy.

Different actors of agribusiness interviewed had in one way or another benefited from the service provided and they were aware of key policies related to them. They indicated that the policies are supportive to their activities. They sited study tours and participation in exhibitions as one of the tool which help them to understand how others are doing. For example, the transformation of dairy industry in Eastern province through changing from local to improved breeds was energized by a study to Kenya for 120 farmers in the former Umutara province. The tax exemption for those exporting and on equipments imported for use in agribusiness. The GOR has policy of giving power to private sector and cooperatives through by including them into the Governing Bodies of different institutions. This policy enables them to know important policies related to them which is communicated through their networks. They are involved in development of standards related to their agribusiness such as bureau of standards. In addition, they are taught the international standards (eg ISO) related to their business. The current agribusiness operators are probably benefiting from the enfant stage, and communication system put in place.

The drivers of innovation in all three commodities value chain studied were government support and income from the use of innovation. The interest to get higher price for better quality; and need to reduce loss and get higher income were the drivers for using innovation. This is clearly demonstrated in coffee value chain where the production of specialty coffee through use coffee washing stations to get higher quality and get higher income transformed the coffee industry in Rwanda. In addition the Government policy support and willingness to continue giving support and liberalization of agribusiness gave important drive on innovation use. Whereas the first coffee washing station (CWS of Nkora) was constructed since 1954 and started operation in 1956, however, the failure to give price of coffee according to quality did not change coffee business in Rwanda till 2002. Therefore, GOR policy to focus on quality became the driving force behind the success of specialty coffee coupled with better price and income the producers are getting.

The need to get higher income has been a major driving force behind use of innovations at individual, institution and national level. For example the number of cattle in Umutara area is not counted as important as the amount of money received from sales of milk. Similarly, the private operators who are paying for construction of coffee washing stations are driven by assured market and expected income from it. Likewise the GOR interest is to raise national revenue from the coffee industry. Therefore the driver of agricultural innovation is the expected return from investment in innovation application, and the policy support for the use of innovation.

4.0 . Coordinating linkages through the value chain and organizational innovations

The importance and use of agricultural innovation are key elements in agricultural development and sustainable economic growth in Africa, and Rwanda in particular. Currently Rwanda is focusing on application of agricultural innovation in increasing productivity in all sectors as the only option available to increase productivity and competitiveness. In this study, the use of innovation was demonstrated in all three commodities studied namely, coffee, banana and dairy value chains. However, it was much more clearly demonstrated in coffee where it brought immediate impact within a short period and revolutionize coffee industry in the country

The agricultural innovations applied in producing specialty coffee of high quality involved a series of steps which required coordination and linkages. It involved quality control system starting from field selection; harvesting, processing, packaging, transportation till shipping is completed. The processing steps at the Coffee Washing Station (CWS) played critical role in determining the quality of green coffee. These activities involved different actors at different levels who needed to be linked and coordinated. This required commitment and determination for success. Knowing innovation is one thing and successfully application of innovation is another thing.

The coordination and linkage of all process along value chain for specialty coffee production was facilitated by responsibility of PEARL project, a USAID funded project. There was a series of innovations including, organizational, technical etc. All ideas were new and outcome was not known; however, there was determination and willingness to succeed. The effort applied by the Director of PEARL project and his team is the basis for successful use of specialty coffee innovation in Rwanda. Therefore, the determination to use innovation in addressing a known problem is the drive behind the coordination and linkage along the value chain. The coordination and linkage, do not stops in application of established knowledge, but it also establishes scientific gaps and link up with actors who can participate in seeking solution. The coordination and linkage focus in achieving the intended goal. It involves key actors including farmers themselves. Empowering farmers or key actors through training, organization etc to take lead in quality control was key factor in application of innovation for their own benefit.

5.0 Public-private sector interactions

The application of agricultural innovation under Rwanda context is for public and private interest. Agriculture is backbone of Rwanda economy as result the GOR is support private investors, both national and international. Whereas, the private sector is still at enfant stage, the interaction of public with the private investing in agriculture is very high. The Government has establish two institutions to support business development. The first one is RIEPA (Rwanda Investment Export Promotion) with objective to create economic environment for business by export and investment promotion. It is called one stop centre, because it facilitates paper processes needed to start business; and thereafter it coordinates business activities and promotes export. It involves different activities to support growth of business, takes firms to study tours to explore export markets, organize contacts with foreign importers, finance feasibility studies, organize workshop, meetings and training. Finally, they conduct regular visits to business area. .

The second institute is CAPMER (Centre d' Appui au Petit et Moyen Entreprise au Rwanda/ Centre for support of small and Midium entreprise in Rwanda : SME). The centre assists in business plan development free of charge and advice to start SME. The public takes these initiatives to support the private sector which is still at enfant stage, because these activities are important, but dot not bring immediate return or profit. During interview, most people we met indicated that they have

good working relationship with these two institutins. When asked about about policies, they also sited on how they get assisted these them as good policy.

In addition, GOR has put in place a system whereby most of Government projects have two sub components for agribusiness development. They should have grant for agribusiness and soft loan passed and approved through the bank. To enable access to the soft loan in the bank, GOR has put in place guarantee fund in the central Bank (BNR) to support guarantee requirement by banks which are operating the soft loan. Therefore, the contact between public and private is very high in Rwanda, because of current state of private sector in the country.

In all three commodity value chains under study, the private –public interaction is evident. The agribusiness in coffee chain is supported by public in many areas. The public interest is very high because of the importance of the crop in the national economy. Similarly, the dairy chain value is supported by GOR, in particular, the construction of milk processing is currently funded jointly with GOR project (PDRCIU/UCRIDP) with two private investors. The GOR contribution will be transferred to the cooperative. Likewise in banana value chain, the GOR is developing banana program, and target to support farmers in planting about 20000 ha of apple bananas, to prepare for sufficient raw materials needed by the processing plant for spirit in eastern province. Due to recent history of Tutsi genocide and war, the country lost a large of number of people including private sector operators. The GOR is now investing this sector which is expected to be an engine for national economy and sustainable development.

6.0 Conclusions: drivers and constraints on agricultural innovations

6.1 Drivers of agricultural innovation

Rwandan economy is based predominantly on agriculture and the Government perceives the agricultural sector as the major engine of growth: In the absence of minerals and other natural resources, the landlocked ness, the current low level of industrialisation, and the low purchasing power of the population largely explain why agriculture and livestock will remain in the period covered by Vision 2020 and the EDPRS the main engine for accelerated economic growth and sustained development.. Therefore, the Government gives the first priority to “rural development, and especially the transformation and modernisation of the agricultural sector. It has put in place supportive policies and institutions as drivers of agribusiness, in particular the investments in none profitable sub sector to benefit agribusiness actor, for example, the dairy development project is construction milk collection centres for primary cooperative, improve breeds, capacity building of the farmers, provide inputs needed either as grants such as feed seed, or soft loan etc. This is in addition of investing in milk processing plant as market for milk in the area.

Supportive policy and political will: There are two major drivers under this study of three value chain commodity, coffee, banana and dairy in Rwanda. These include the supportive policy and assured market and related income. The supportive policy as driver can be observed in all three commodities. The basic technology of coffee washing station and specialty coffee was not totally new in the country, it was known since 1950’s. However, in the absence of supportive policy, it did not help marketing and promotion of Rwanda coffee, till when policy and strategy indicated that coffee quality is the national interest and focus. In this context, the impact of policy in agricultural innovation is demonstrated in the number of coffee washing stations constructed in last six years. The construction of the first station at Nkora was completed in 1956, and from this time till 2001, only one more was constructed at Masaka near Kigali city, plus a small one for research purpose at ISAR-Rubona research station in Butare. Therefore for 45 years, only two working coffee washing

station were constructed and used. During this period, the specialty coffee market was there, what was missing was supportive policy and political will.

However, since 2002, when the Maraba coffee washing station was started by PEARL project, and its early results, there is now more 110 washing stations and they are increasing, and Rwanda specialty coffee is globally known and liked. Therefore the supportive policy was a key driver for the current specialty coffee success in Rwanda. This is also demonstrated by political will, as shown by HE Paul Kagame, President of Republic of Rwanda visit to Maraba coffee washing station in Butare and meeting with coffee buyers.

Market and income: The second driver is the assured market, income and price of output from agricultural innovation. What farmers are interested in is the income they get from the product of innovation. The income from specialty coffee is driving the construction of coffee washing station in all coffee producing areas. Similarly the income from milk is driving the need to keep the improved breed cattle. The cooperative UDAMACO is getting bank loan to buy cows. One woman who was selling brewing banana in rural market as bunches was asked as to why brewing bananas was more than cooking ones, and she answered with confidence that her market of brewing banana is assured, because if the bunches are not bought, she will not get loss, because the whole community is her customers, she will take the bunches at home and make banana beer and get income, contrary to cooking bananas which do not have alternative use for bring same income. This is assured market of banana beer which is encouraging different private sector actors to invest in processing for value addition, quality improvement and extending shelf life. A group of farmers once expressed their views on used high yield improved seed and technology like “show us market of produce and we will finish all your seed”. This out cry for market is key in agricultural innovation application.

Level of investment: In addition the above two drivers of innovation, the level investment required for the application of innovation determine the success. Some innovation may be more costly and many actors may fail to apply it.

6.1 Constraints on agricultural innovation

Basing on the result of interviewees for the three commodity value chains studied, the main constraint reported was the lack of sufficient fund for application of innovation. The other constraints are high charge rate for electricity and water which may limit any testing using these items, high air flight charges, and lack of skilled qualified staffs.

Documents contacted

MINECOFIN (2004): Vision 2020, Ministry of Finance and Economic Planning, Kigali, 2004.

MINECOFIN (2007): Economic Development and Poverty Reduction Strategy

MINAGRI (2004): National Agricultural Policy

MINAGRI (2006): CAADP implementation in Rwanda. Par I : Review and Stock taking Report on ongoing Development efforts in Rwanda and alignment with CAADP Targets and Principles.

MINAGRI (2004) : Strategic plan for Agricultural Transformation in Rwanda.

MINAGRI (2004): Rwanda Animal Resource Development Authority Business plan

MINICOM : National Policy on Promotion of cooperatives

MINICOM (2006): Trade Policy and Strategies

MINICOM (2006): Investment Promotion Policy

Law no 26/2005: Investment and Export Promotion and Facilitation

Watkins, A. and Verma, A. (2008): Building Science and Technology, and Innovation Capacity in Rwanda.

World Bank (2008): World Development Report; Agriculture for Development

Annexes

Annex 1: List of people contacted and interviewed for all three commodities (banana, coffee and dairy)

Institution	Activities	Contact person	Address
Floris co.	Banana fruit export	Donatile NIBAGWIRE	
RIEPA	Investment & Export promotion	Martin Gasasira	P.o.Box 6239 Kigali-Rwanda Tel. 51025; o8490834 www.rwandainvest.com
RIEPA	Director of investor mobilization	Rosemary MBABAZI	P.o.Box 6239 Kigali-Rwanda Tel. 51025; 08484497 www.rwandainvest.com
PSF	Director of Institutional Relations and Policy Advocacy Department	John Bosco Kayangoga	P.o.Box 319, Kigali, Rwanda Tel. 583541; 08763163 www.rpsf.org.rw
PSF	Entrepreneurship development manager	Antoine Rutayisire Manzi	P.o.Box 319, Kigali, Rwanda Tel. 583541; 08301410 www.rpsf.org.rw
ABADAHEMUKA COOP	Cooking bananas trade	Jacqueline Uwanyirakuru	ABADAHEMUKA COOP Nyarugenge, Kigali 08559763
TUZAMURANE Cooperative	Banana Wine Producer	Christine Murebwayire	TUZAMURANE Cooperative District of Gasabo, Kigali 08536121
INYANGE DAIRY INDUSTRY	Production Manager	Cyrille Sinayobye	INYANGE DAIRY INDUSTRY Kicukiro, Kigali
RUBILIZI DAIRY INDUSTRY	Production Manager	Robert Ruzindana	RUBILIZI DAIRY INDUSTRY, Kicukiro, Kigali
MINAGRI Extension office	PASNVA, Deputy Coordinator	Joost BAKKEREN	MINAGRI, Kacyiru, Kigali Tel 08300057
SPREAD	DEPUTY DIRECTOR	J.Claude Kayisinga	Deputy Director, SPREAD. NUR. Tel. 250-08303665
Rwanda Dairy Farmers' Coop	President of COOP	Emile Mutunzi	
MINICOM	Department Trade	Director ,	

	Promotion	Francine UMURUNGI	
Livestock Wolrd	Livestock input supplier and consultants	Mr Innocent Rutamu	Kigali, Rwanda, Tel. 250-08301699
Horizon Limited Holding	Nyabisindu dairy processing	Lef. Can. David Rwiyamilira	Kigali, Rwanda, tel. 250-08300183
Urwibutso Entreprises	Food processing	Alex	Kigali, Rwanda, Tel. 250-08305111
MINAGRI	Minister of State for Agriculture, MINIGRI	Dr A. A. Karibata	Kigali, Rwanda, TeL. 250-08302180
Ets Nkubiri	Coffee farmer and trader	Mr A. Nkubiri	Kigali, Rwanda, Tel. 250-08300760
UDAMACO	Milk marketing and processing	Mr Katabarwa	Nyagatare, Eastern Province, Tel; 250-08777609
MATWOKI	Milk marketing and cheese processing, primary cooperative of UDAMACO	Mr Mushaija Charles	Matimba centre, Tel. C/O 250-08510855
Ubahuzamugambi ba kawa, Maraba	Coffee cooperative	Mr Rurangwa Juvenal, president of cooperative	Maraba cooperative
COVIBAR	Banana beer processing	Mr Antoine Director of Finance	Kigali. Tel.
COOPAC	Coffee cooperative	Mr Emmanuel	Gisenyi, Tel. 250-08353543
OCIR-café	Coffee authority	Mr Maniragaba E.	Kigali, Tel. 250-08303724
SPREAD	Coffee cooperative and private support	Dr Tim Shiling	Butare, Tel. 250-08303610
PDCRE	Cash crop project	Mr Mutebwa, A.	Kigali, tel. 250-08300010
MINAGRI	Director of Planning	Mr Ernest	Kigali, tel. 250-08300765
COCAGI	Coffee cooperatives	Mr Theobald, Executive committee	Rusizi, Western province, tel.
Munyura Company, private owned	Coffee production and processing	Mr Kajyaho Boniface	Rusizi, Western province
RWASHOSCCO	Coffee marketing for cooperative members	Mr Gatali Gilbert, Director.	Butare, Huye, tel.
Banana farmer	Banana production	Mr Ngabonziza	Kirehe, tel. 250-08844319
COOPABU	Craft makers cooperative	Executive secretary	Butare, Huye District, Southern Province

Annexes 2: **Coffee buyers up to 2006**

Seven retail roasters in USA and UK: (a) Groundwork Coffee in L.A., CA, (b) Stumptown Roasters in Portland, OR, (c) Counterculture Coffee in Durham, NC , (d) Ancora coffee in Madison, WI, (e) Thousand Hills Coffee in Boston, MA, (f) Starbucks Coffee in Seattle, WA, (g) Mamamouth Coffee in London, UK

16 wholesale Roasters in USA, Canada and UK. (i) Community Coffee in New Orleans, LA, (ii) Intelligentsia Coffee in Chicago, IL , (iii) Deidrich Coffee in San Fransico, CA, (iv) Thanksgiving Coffee in Fort Bragg, CA, (v) Allegro Coffee in Denver, CA, (vi) Howell Select Coffees in Boston, MA, (vii) Bullrun Roasters in Minneapolis, MN, (viii) Green Mountain Coffee Roasters in Burlington, VT, (ix) Mr. Espresso in Berkeley, CA, (x) Kavanaugh Coffee in Berkeley, CA, (xi) Duncan's Coffee Roasters in Houston, TX, (xii) Paramount Coffee Roasters in Ann Arbor, MI , (xiii) Peet's Coffee, Berkley, California, (xiv) Starbucks Coffee in Seattle, WA, (xv) Coffee Pacifica in Vancouver, Canada, (xvi) Union Coffee Roasters in London, UK.

Four Green Coffee Importers in USA and UK: (a) InterAmerican Coffee Company in California, (b) Volcafe Specialty Coffee Company in California, (c) Sustainable Harvest Specialty Coffee Importers in Oregon, (d) Mercanta Specialty Coffee Hunters Inc. in London