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## **NATIONAL RICE DEVELOPMENT STRATEGY (PERIOD 2011-2018)**

**September 15, 2011**



## **EXECUTIVE SUMMARY**

Rice is one of the major staple crops in Rwanda. Coalition for African Rice Development (CARD), a consultative group of development partners and research institutions, has set out to double rice production in Sub Saharan Africa. Spearheaded by the Alliance for a Green Revolution in Africa (AGRA) and the Japan International Cooperation Agency (JICA), the CARD has taken the initiative of drawing National Rice Development Strategies (NRDS) for Rwanda.

In Rwanda, rice is cultivated mainly in the marshlands over an area of 6,838 Ha. The marshland ecosystem is similar to lowland rain fed ecosystems in Asia. With a 5.8 t/ Ha of on-farm productivity, rice yields in Rwanda exceed the average level of productivity of several other traditional rice growing countries. However, the local production in Rwanda lags behind the consumption needs of national market. Currently the domestic production is able to provide only 70.5% of the national annual requirement of 60,825 tons. The deficit is met through importation of milled rice from elsewhere.

The NRDS aims to achieve self-sufficiency in rice production by 2018, and to substantially raise the competitiveness of Rwanda rice in local and regional markets. It is envisaged that the approaches will raise the productivity level from 5.8 t/ Ha to 7.0 t/ Ha and expand the area under cultivation from 6,838 Ha to 28,500 by 2018. It is emphasized that an integrated approach on interventions in the key sub sectors along the rice value chain can provide the sustainability to the targeted increases in productivity and area under cultivation. The proposed strategies are aligned with the overarching national, regional and global perspectives on economic development and poverty reduction.

Seeds are currently multiplied and distributed mainly through formal public institutions. The available rice varieties have limited adaptability to marshlands, and need further improvement of such traits as early maturity, cold tolerance and resistance to pests and diseases. It is suggested that by improving the infrastructure and human capacity, improved varieties shall be made available to rice growers through farmers' participatory approaches and international research collaborations. The seed production system lacks quality assurance, timely delivery and adequate volumes. It is envisioned that encouraging private entrepreneurship in multiplication and distribution of basic and certified seeds will increase farmers' access to improved seeds.

Rice is cultivated by low-input and low-risk smallholder farmers. The high cost of fertilizers and lack of availability of fertilizers refrain farmers from using fertilizers. The soil fertility in marshlands is highly variable. However, farmers are currently advised to adopt standard fertilizer recommendations that are used in irrigated ecosystems. To improve the efficiency of fertilizer use and increase adoption, site-specific fertilizer recommendations and public private partnerships in procurement and distribution of appropriate fertilizers and manures are envisaged.

Rwanda has vast areas of marshlands with agro ecological features that are similar to already established marshlands where rice is intensively cultivated. NRDS aims to increase in area under rice cultivation by reclaiming new marshland areas that have the potential for rice production. In addition, rehabilitation of existing marshlands and irrigation structures therein shall expand the area under rice cultivation. Improving the knowledge on water use efficiency through training and by enabling efficient organization of irrigation water user associations in marshlands will increase land and crop productivity especially during the dry season.

In the absence of a strong extension network, rice growers in Rwanda mostly learn the production techniques from each other and through self trial and error. The strong presence of farmers' cooperatives enables farmers to collectively access the inputs such as seeds and natural resources. There is an urgent need to expand the capacity of extension system to enable efficient transfer of technologies on production, soil and water management, pest and disease management, harvesting, post harvest handling and storage of rice in marshlands. Public private partnerships in extension services can accelerate the dissemination of on-farm technologies to farmers. Such endeavors shall increase productivity levels in rice growing schemes.

Farm operations such as land preparation, crop management, harvesting and post harvest handling are done manually. The consistency and efficiency of farm operations can be improved through appropriate mechanization. Profitable mechanization options need to be identified for rice production in marshlands and disseminated. Furthermore, private entrepreneurship in provision of mechanization services and sourcing of machineries and implements need to be encouraged. Training of rural artisans, mechanics, technicians and engineers on the usage and maintenance of farm machineries will improve the adoption of mechanization in rice sector.

Rice produced in Rwanda is largely sold in unorganized rural markets, whereas the mainstream urban markets largely sell imported rice. This is mainly because the locally produced rice grains suffer higher breakages upon milling. Quality of rice can be improved through adequate supervision and/or regulation of milling operations. In addition, the quality shall be enhanced by introducing technologies and raising the awareness on handling of paddy grains at harvesting, drying, winnowing and storage phases by the producers.

After keeping some of the harvest for subsistence, farmers intend to sell the paddy grains. Those farmers who have obtained inputs from the cooperatives on loan sell their harvest to the cooperatives. However the time taken by the cooperatives to pay cash and the low prices often force farmers to sell the paddy grains to unorganized rural traders and/or millers. There is a strong need to improve transparency through trading regulations and by facilitating predetermined contracts with millers/traders. Providing market information on farm gate prices and establishing linkage between the markets of inputs and outputs will improve marketing of locally produced rice.

Most of the rice growers and other stakeholders along the rice value chain are constrained by the credit availability. Improved access to finance through diversified loan schemes and increased rural banking facilities and services that are targeted to farmers, cooperatives, agro-dealers, service providers and traders in marshlands will speed up the transfer of socio economic benefits from increased rice production.

Establishment of NRDS secretariat is proposed to help attain coherence amongst rice related projects and programs, and provide a forum for consultations on policies and implementation of projects by the various stakeholders along the rice value chain in Rwanda.



## The locations of rice schemes in Rwanda



## **ABBREVIATIONS & ACRONYMS**

AfDB	African Development Bank
AGF	Agriculture Guarantee Fund
AGRA	Alliance for Green Revolution in Africa
BTC	Belgian Technical Cooperation
CAADP	Comprehensive Africa Agricultural Development Program
CARD	Coalition for African Rice Development
CIP	Crop Intensification Program
DAP	Di Ammonium Phosphate
DFID	Department for International Development
EDPRS	Economic Development and Poverty Reduction Strategy
FUCORIRWA	Federation des Unions des Cooperatives Rizicoles au Rwanda
FAO	Food and Agriculture Organization
FBO	Faith-Based Organizations
IFDC	International Fertilizer Development Center
IPM/FFS	Integrated Pest Management/Farmer Field School
IRRI	International Rice Research Institute
IWUA	Irrigation Water Users Association
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
KWAMP	Kirehe Community-based Watershed Management Project
MDG	Millennium Development Goals
MINAGRI	Ministry of Agriculture and Animal Resources
MINEAC	Ministry of East African Community
MINICOM	Ministry of Commerce and Industries
MT	Metric Tons
NAP	National Agricultural Policy
NEPAD	New Partnership for African Development
NRDS	National Rice Development Strategy
PADAB	Bugesera Agricultural Development support project
PHHS	Post-Harvest Handling and Storage
PPP	Private Public Partnership
PSF	Private Sector Federation
PSTA	Strategic Plan for Agricultural Transformation in Rwanda
R&D	Research & Development
RAB	Rwanda Agricultural Board
RADA	Rwanda Agriculture Development Authority
RARDA	Rwanda Animal Resources Development Authority
RBS	Rwanda Bureau of Standards
RDB	Rwanda Development Board
RIF	Rural Intensification Facility
RSSP	Rural Sector Support Project
SIEM	Subsector Intervention Element Matrix
SP	Service Provider
SPS	Sanitary & Phytosanitary Standards
TF	Task Force
ToT	Training of Trainers
UNECA	United Nations Economic Program for Africa

UN-WFP  
USAID  
WARDA  
WB

United Nations World Food Program  
United States Agency for International Development  
West Africa Rice Development Authority (Africa Rice Center)  
World Bank

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## 1. Introduction

With an estimated population of 10,117,033 (NISR, 2010)<sup>1</sup>, Rwanda represents one of the most dense country in Sub Saharan Africa. The population is expected to rise further to 12.6 million by 2018<sup>2</sup>. Agriculture provides livelihood for 84% of the population and contributes 34% to the gross domestic production (GDP)<sup>3</sup>. The landscape of the country is characterized by its hilly terrain and topography where most of the lands are undulated. In a total surface area of 26,338 km<sup>2</sup>, 7.14% of the terrain is below 2% slope, 7.74% is between 2 - 6% slopes, 27.12% is between 6 - 13% slopes, 19.70% is between 13 - 25% slopes, 30.04% is between 25 - 55% slopes, and 8.27% is more than 55% slopes. Such geographic features force farmers to cultivate crops on steep terrains. Of the total arable land area of 13,850 km<sup>2</sup>, about 8,250 km<sup>2</sup> are currently being cultivated. Most of the uncultivated arable land is located on relatively steep terrains. Providing food security for a growing mass from a limited arable land resource poses constant challenges to the stakeholders.

Rice was introduced in Rwanda in 1960s by various missionaries from South Korea, Taiwan and PRC. Since then, rice has become one of the major food crops grown in Rwanda. Conforming to Rwandan geographic conditions, rice is grown mostly in inland valley swamps referred to as marshlands. It has emerged as the most suitable crop for the marshlands and inland valleys in recent years. Several reasons justify this recent shift in cultivation habit. Soil erosion in the hills and the associated slopes as a result of intensive cultivation of traditional crops such as banana, cassava, beans and potato has diminished the sustainability of farming in the uplands. Rice is the only crop that thrives well and produces better yields than any other traditional crop, especially during the rainy season. The recently introduced rice varieties can yield up to 7 MT/Ha. Thus rice provides a viable alternate for millions of resource-poor rural farm families in Rwanda.

Marshland ecosystems in Rwanda are comparable to the favorable lowland rain-fed ecosystems found elsewhere in Asia. The marshlands are situated at various altitudes ranging from 1,000 m to more than 1,700 m above mean sea level (MSL). High relative humidity, cool night temperatures (10 to 15°C), warm day temperatures (20 to 30°C), and frequent rains are the salient features of the marshlands. Rwanda has two rainy seasons from September to November and from March to April. Rice is cultivated in marshlands predominantly in these two seasons.

Although rice is not a traditional crop in Rwanda, characteristics of rice grains such as long shelf-life, ease of cooking and transportation, and less requirement of cooking fuel (compared to traditional food such as potato) has made rice in becoming a popular choice of food in schools, homes, restaurants, and public ceremonies in Rwanda. Rise in income levels, growing urban population, and changing lifestyles is further aggravating the demand for rice.

Having acknowledged the potential of rice production in marshlands and the trends in consumer demand, the Government of Rwanda declared rice as a priority crop in 2002. Government of Rwanda has since invested tremendous amount of resources through several high profile development projects for the rice sector in the country. As a result, the total domestic rice production has increased 32-fold in the last decade (Table 1), the highest amongst the East African

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<sup>1</sup> Statistical Year Book (2010) National Institute of Statistics of Rwanda

<sup>2</sup> Country Report – Rwanda (2005), Food and Agriculture Organization (FAO)

<sup>3</sup> National Agricultural Survey (2008), National Institute of Statistics of Rwanda

Community<sup>4</sup> (EAC). Such a significant increase in rice production was contributed by the several initiatives taken by MINAGRI in marshland reclamation and facilitation of inputs to farmers.

Decade	Rwanda	Burundi	Kenya	Uganda	Tanzania	EAC
1970s	1.85	4.44	24.56	12.4	184.05	227.3
1980s	4.64	15.41	30.19	17.29	329.54	397.07
1990s	6.53	29.75	31.58	54.47	446.29	568.62
2000s	213.03	199	475	1394	7646	9927.03

Despite the leap in production however, the consumer demand for rice has also been raising in Rwanda (Fig. 1). Currently the local markets respond to such increase in requirement through importation of milled rice grains from countries such as Tanzania, Uganda, Pakistan and Vietnam.

Fig.1. Changes in area under rice cultivation, local production, consumption and importation of rice in Rwanda

Rwanda, in accordance with its EAC membership, presently administers a tariff free rice imports from EAC countries and imposes a common external tariff for rice imported from outside EAC. The Rwanda rice is mainly sold through unorganized and price-sensitive rural markets. Rice markets in urban areas however largely sell imported rice. This is mainly due to lack of quality of the locally produced rice. In the last 5 years, the country imports an average of 26,736 t of milled rice from elsewhere which in turn puts strain on foreign exchange and trade balance of the country.

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<sup>4</sup> EAC Rice import tariffs and food security (2010) USDA Foreign Agricultural Service

In order to achieve the aspirations of economic development and poverty reduction, Rwanda's rice sector needs to attain self sufficiency in rice production and improve the quality and competitiveness of locally produced rice. This forms the underlying principle for the National Rice Development Strategies (NRDS) described in this document.

## 2. Methodology for developing NRDS

### 2.1. Establishment of NRDS Task Force

The Minister of Agriculture and Animal Resources (MINAGRI) appointed a Task Force (TF) that was given the responsibility of formulating NRDS in collaboration with the Coalition for African Rice Development (CARD) based in Nairobi, Kenya (Composition of TF presented in Appendix 1).

### 2.2. Review of available literature on rice development in Rwanda

The TF carried out an extensive review of the existing literature, including relevant policy (Vision 2020, EDPRS, NAP) and strategy (PSTA 2, Rice Policy, etc.) documents, and other MINAGRI and RAB reports on rice development in Rwanda. The key strategic and programmatic guidelines obtained from the above, together with documented experiences and lessons learnt, have been included in the NRDS.

### 2.3. Consultations with key stakeholders within the rice sector

All the major stakeholders within the rice value chain, including senior officials of the key ministries and public institutions (MINAGRI, MINICOM, MINEAC, RAB, RBS, PSF), rural development projects and programs (RSSP, PADAB, PAIRB, KWAMP, GAA, CIP, PHHS), International organizations (FAO, IFDC, UN-WFP), bilateral and Multilateral agencies (BTC, USAID, DFID, JICA), rice federation (FACURIRWA), unions, rice farmers' cooperatives, and individual farmers, rice millers/processors, rice traders/importers, input suppliers etc., were consulted and their experiences and recommendations incorporated in the final NRDS. On the basis of the review of the relevant documents, and analysis of the lessons learnt, the TF came up with an elaborate set of objectives and approaches to overcome the identified constraints and fulfill opportunities.

### 2.4. Collaboration with the Coalition of Africa Rice Development (CARD)

There has been active collaboration with the CARD secretariat, through frequent consultations with senior officials and consultants commissioned by CARD during the course of formulating the NRDS. During the second week of June, 2011, an intensive working week (WW1) involving all the TF members was organized. The TF together with the CARD Technical Coordinator (Kazuyuki FUJIWARA) and the consultant commissioned by CARD (Arumugam KATHIRESAN), carried out detailed analysis of the needs/constraints affecting the rice value chain using Subsector Intervention Element Matrix (SIEM), and elaborated the Needs Assessment Matrix as presented in Appendix 2.

## 3. Review of the National Rice Sector

### 3.1 Status of Rice in National Policies

In recent years, the Government's investment efforts have been geared towards the reclamation of vast areas of inland valley swamps (marshlands), construction of small dams in the valleys,

organization of farmers' co-operatives, privatization of rice mills, farm mechanization and improvement of the supply chain for inputs such as seeds, fertilizers, and pesticides.

The performance of the economy and the development of agricultural sector are closely linked. Therefore the strategic interventions and policies governing the rice sub-sector are designed to be consistent with national and regional framework strategies. The following government policies (see Appendix 8) have significant implications on the rice sub-sector:

1. Vision 2020
2. Government Program (2011-2017)
3. Economic Development and Poverty Reduction Strategies (EDPRS)
4. National Agricultural Policy (NAP)
5. Strategic Plan for the Transformation of Agriculture – Phase II (PSTA-II)
6. Rice Policy

These government policies among other things seek to transform agriculture into a productive, high value, market oriented sector, with forward linkages to other sectors, with major emphasis on industrial scale agro-processing, enhancing the rice value chain, promoting private sector involvement and agribusiness. This will be achieved through reclamation of marshlands and expansion of area under rice cultivation, development and promotion of improved rice technologies including post-harvest and processing, rice research, provision of subsidies to farmers' cooperatives to acquire seed, fertilizer and other inputs.

Within the regional and international context, the government policies are guided by the Millennium Development Goals (MDG). The Government is in cognizant of the fact that sustainable agricultural development, which is one of the major objectives of the MDG, can alleviate poverty and improve the quality of rural livelihood. At the level of New Partnership for Africa's Development (NEPAD), agriculture is stated as 'the engine' of inspired growth. NEPAD declares growth in production of food crops as one of its main priorities. It emphasizes three aspects: improving the livelihoods of people in rural areas; achieving food security; and increasing exports of agricultural products. NEPAD intends to bring in changes in strategy and policy reforms to promote modernization and diversification of agricultural production and exports.

National issues relating to agricultural revitalization and their implications on socioeconomic development, including household food security, quality improvement and competitiveness of the agricultural sector are adequately reflected in current national and regional policy guidelines.

### 3.2. Consumer preferences and demand projections

#### 3.2.1. Consumer preferences

Rice is replacing staples such as cassava, maize and plantain, especially in the urban areas. Consumer preference is generally based on physical and cooking characteristics. Consumers in mainstream markets generally prefer long and medium/slender type rice grain. Locally, two types of rice are in Rwanda – (i) short and bold (japonica type) and (ii) long and medium/slender types (*indica* type). Due to a strong preference for the latter, almost all imported rice into Rwanda is of the *indica* type.

### 3.2.2. Demand projections

In the National Rice Program (2005), the national demand of rice had been estimated based on the following assumptions:

- (1) Number of persons in households was estimated as six
- (2) Amount of rice consumption per household per day is 0.6 kg, and
- (3) Consuming rice 3 days per week

Consumption per capita in 2008 however has significantly increased, defying earlier assumptions. Based on current calculations, per capita consumption is increasing, and is expected to reach 15.6 kg per annum (Table 2).

Table 2: Projection of rice demand for Rwanda

Year	Population ('000) <sup>1</sup>	Consumption per capita (kg/year)	Predicted Consumption (Milled Rice, MT)
2008	9,908	6.2	60,825
2013	11,238	11.5	130,752
2018	12,568	15.6	204,110

### 3.3. Typology and number of rice farmers, processors and traders

#### 3.3.1. Number of Rice farmers

In 2009, people engaged in rice cultivation were 44,907. In Rwanda, rice farmers belong to a total of 60 cooperatives, distributed within 29 rice schemes country-wide {Western (2), Southern (12), Eastern (13), and Kigali City (2)}<sup>5</sup>. Each cooperative covers rice farmers in a watershed.

#### 3.3.2. Processors and Traders

The total milling machine capacity in Rwanda is 17,355 MT/year. The capacity of each milling machine varies from 0.2 to 3.6 MT/hour. In 2009, only 10,321 MT paddy rice was processed by modern mills, while others were either milled illegally in small-scale hullers or hand pounded. Most of the cooperatives do not have accurate figures of the production, it is estimated that over 50% of paddy production is not marketed through the cooperatives. It is either consumed at household level or sold directly to traders as paddy or milled rice.

Generally, farmers would supply paddy rice to their cooperatives, which in turn sell to unions. The union would then sell to the mills. In some cases the unions are also shareholders in the mill. In the absence of a union, the cooperative would sell directly to the mills. The mills would process and sell to intermediate traders, who buy bulk quantities of milled rice and sell it to retailers.

#### 3.3.4. Gender dimension of rice production, processing and trading

Women play a very significant role in agricultural production of Rwanda. Studies carried out in the region show that women in the age group of 15-60 years spend one-third of their time in agriculture, while men spend only 19% of their time in agriculture, 54% of their time in diverse leisure activities and on paid work, against 18% of women's time in this last category. Rice growers comprise

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<sup>5</sup> Rice Program, May, 2005, pg 4 – Distribution of the existing Rice Schemes & Productivity in 2004.



20,208 women (45%) and 24,699 men (55%). Women are not present in the processing and wholesale sub-sectors. They are predominantly represented in the retail sub-sector (60%).

#### 4. Analyses of Strengths, Weaknesses, Opportunities and Threats (SWOT Analyses) of Rwanda's rice sector

The rise in global prices on rice grain and the raising international standards of rice, Rwanda needs to base its strategies on its strengths and opportunities while overcoming the weaknesses and the global and regional threats over its rice sector (Fig. 2). This section examines the settings of rice sector and attempts to reveal the advantages and risks for the stakeholders.

##### 4.1. Strengths

The marshlands in Rwanda provide a suitable ecological niche for rice cultivation. The abundant natural water resources and the favorable subtropical climate allow rice production throughout the year. Despite of the low-risk and low-input nature of Rwandan farming, the current productivity level is at 5.8 t/ Ha. This is significantly higher than the average productivity levels obtained in the neighboring countries and that in some of the traditional rice growing countries in Asia. The high level of productivity is rendered mainly by the generally fertile soils, human labor supply and their efficiency, and the seasonal rainfall during the critical periods of crop growth such as tillering and panicle initiation stages. Although rice is not one of the traditional crops in Rwanda, the production of rice in Rwanda can easily be justified by the local market for rice. Trends in imports of rice (Fig. 1) clearly show that a strong consumer demand for rice exists in Rwanda.

The government of Rwanda has set the precedence for the rice sector by initiating large scale investments in reclamation and rehabilitation of marshlands. Through various schemes, the government has facilitated the inputs for rice production such as improved seeds, fertilizers, pesticides, tools and machineries. The farmers in all marshlands are organized into farmers' cooperatives. These cooperatives also have combined to form Union. Most of the inputs and other elements of value chain currently reach individual farmers through cooperatives. The farmers generally borrow the inputs from the cooperatives. At the end of the season, the cooperatives collect the grain equivalent of inputs from the farmers. Despite the absence of cash or mortgages in such transactions, most of the cooperatives are performing efficiently. In the recent years, the government has embarked on privatization of seed production, fertilizer distribution, and milling operations. The government envisages that after the initial wave of investments, the private sector will fully take over the operations of rice value chain. The government intends participation of private sector in all sub sectors and expects it to be driven by the spirits of competitiveness and entrepreneurship. The government has also recently drawn policies for the various issues along the rice value chain. These policies provide guidelines for the stakeholder on increasing production and improving competitiveness of Rwanda rice.

##### 4.2. Weaknesses

The fragmented nature and smaller size of plots in which rice is cultivated in the marshlands limit the scopes of raising the productivity. Although the marshlands provide an ecological system for the cultivation of rice, the diverse nature of micro environments of these marshlands in different altitudes provide a challenge in scaling up of new technologies and for blanket recommendations of agronomic production practices in Rwanda. For instance, the high post harvest losses (quantity and

quality) of harvested grains can severely limit the profitability and marketability of locally produced rice.

The human capacity constraints in research and development restrict the farmers from tapping the maximum potential of the marshlands. Lack of adequate infrastructure such as in storage of inputs and distribution network for inputs in marshlands limit the participation of private sector. Absence of committed public-private partnerships in facilitation of farm inputs also holds private investments and integration of quality elements in rice value chain.

Farm machineries and small tools shall increase the efficiency of field tasks and thereby reduce the time and cost required for the field operations in the marshlands. In the absence of creation of freeways for movement of machineries and tools, the current designs of marshlands allow limited adoption of farm mechanization. Furthermore the lack of technical skills in maneuvering and maintenance of machineries limit the adoption of technologies.

#### 4.3. Opportunities

Rwanda harbors vast areas of marshlands that could be reclaimed. For instance, Nyabarongo, a tributary of Nile, provides a total of 5,572.49 Ha of marshlands in 9 administrative districts of Rwanda. With a catchment area of over 2700 Km<sup>2</sup> receiving 1500 mm of annual rainfall, the Nyabarongo river shall support rice cultivation in its swamps. Given the organic nature of soils of Nyabarongo and the success of rice production in similar marshlands, it is tempting to suggest that Nyabarongo marshlands, when revamped, could become a major 'rice bowl' in Rwanda.

In some marshlands, rice is the only crop that thrives well especially in the rainy season. Despite the low investment/input nature of rice growing, the high productivity levels render rice production highly profitable. Given the strong demand for rice in local markets, the economic benefits of growing rice over other traditional crops in the marshlands are higher for the stakeholders. The integration of Rwanda into regional economic forums such as EAC further widens the scope of public and private investments in Rwanda's rice sector.

Marshlands such as in Bugarama where premium rice such as Basmati can be grown provide ecological niches. If appropriate aromatic varieties can be developed through research, Rwanda can reap benefits by tapping the special export markets such as Europe and North America. Since several international centers and research institutions/universities have long been conducting research and development in rice, several of the technologies that are required for Rwanda's rice production are readily available. Through collaborations with such international centers as IRRI, Africa Rice Center, Rwanda shall quickly identify off-shelf technologies that can appropriately address the needs of rice production, validate and transfer the technologies to farmers.

#### 4.4. Threats

The top soil in Rwanda's marshlands is highly heterogeneous. The continuous changes in soil profile resulting from the various degrees of soil erosion from the associated hills surrounding the marshlands poses a threat to viability of rice cultivation. Lack of recommendations and/or awareness on integrated soil fertility management practices and lack of usage of organic manure in marshlands threaten the production of rice.

The continued cultivation of rice in marshlands has also gradually been building the pressure from pests and diseases. The increased number of outbreaks of pests and diseases in marshlands, and the

inability of farmers to effectively prevent or combat the pests and diseases intimidate the sustainability of rice cultivation by small farmers. The looming consequences of climate change on the rice ecosystems through unpredictable rainfall pattern, temperature changes and human migration patterns further deepens the concerns on raising productivity in smallholder farms in marshlands.

The high population density and further increase in population constantly challenges the use of land and water for further sharing of these natural resources by agriculture purposes. On the other hand, the raising income levels and the rapidly increasing population also continuously increases the demand for rice in markets which tend to import rice from elsewhere and thereby adds strain to the foreign exchange and national economy. If the domestic rice sector does not find a stronghold, the increased imports of milled rice grains shall defeat the locally produced rice which already suffers from lack of competitiveness.

Owing to the recent initiatives on synchronization of farm activities in marshlands, labor constraints are felt by rice growers in some marshlands. The threat becomes acute during the peak phase of the rice seasons. Since farm mechanization in Rwanda is at an embryonic stage, the labor constraints threaten not the existing levels of productivity in marshlands, but also the profitability of rice cultivation in small farms. The profitability of smallholder rice farming is further threatened by raising fuel costs and the subsequent fluctuations in the cost of inputs such as fertilizers.

<p style="text-align: center;"><b><u>STRENGTHS</u></b></p> <p>Suitable Ecological Niches            High productivity (5.8 t/Ha)            Government’s commitment            Organization of farmers            Favorite Food Choice            Favorable policies            Rural and Family labor supply</p>	<p style="text-align: center;"><b><u>OPPORTUNITIES</u></b></p> <p>Vast areas of untouched marshlands            Special bowls for Premium rice            Profitability            Strong demand in local markets            Open regional markets            Off-shelf technologies            Regional and International Initiatives</p>
<p style="text-align: center;"><b><u>WEAKNESSES</u></b></p> <p>Inadequate integration of Value Chain            Inadequate research and extension            Low private sector participation            Low mechanization            Small farm size            High post-harvest losses            Standards of small mills            Access to credit and market</p>	<p style="text-align: center;"><b><u>THREATS</u></b></p> <p>Demographic pressure            Soil fertility management            Climate Change            Access to water            Pressure from pests and diseases            Competition from imported rice            Raising Fuel prices (input costs)            Seasonal labor constraints</p>

Fig.2. SWOT analyses illustrating the various current features of Rwanda’s rice sector.

## 5. Rice value chain Analyses

### 5.1. Seeds

Rice farmers in most parts of Rwanda find it difficult to access sufficient amounts of good quality rice seeds. In old marshlands where rice has been grown over the past few years, the quality of seeds limits the productivity. This is mainly due to the absence of an efficient public seed production and distribution network in the country. Furthermore, the characteristic features of already released rice varieties are not made available to the farmers and other stakeholders to verify the description of the varieties. Progressive farmers also feel that the varietal options need to be broadened through research and development. In new marshlands however, the quantity and the type (variety) of seeds cause greater concerns. Due to a rapid expansion of area under cultivation and the poor capacity of seed production and distribution system in the country, seeds of improved varieties could not be supplied to new marshlands. Farmers in such marshlands usually grow varieties of short- and bold type for which the marketability is low.

### 5.2. Pests and Diseases

The intensive mono-cropping of rice has gradually built up the pressure of pests and diseases to alarming levels in several marshlands. Lack of knowledge on appropriate control measures against pests and diseases amongst farmers is a major impediment in raising the productivity levels. The limited choices of rice cultivars and access to pesticides also affect the preparedness of farmers against the most common epidemics of blast and *Diopsis* in the marshlands. The pesticides used by farmers are not properly regulated leading to pollution of drinking water and raising health risks of farmers and farm families in marshlands.

### 5.3. Soil fertility management

Use of inorganic fertilizer is one of the major factors that catalyzed the rice green revolution in Asia. The low input intensive mono cropping pattern in the marshlands is constantly depleting the soil and water reserves. The lack of suitable fertilizer recommendations and the high fertilizer cost are the two major reasons for the poor nutrient management in rice fields. Farmers generally manage the crop residues such as straws by burning them instead of effectively recycling the nutrients stored in the residues through decomposition. Such practices further worsen the hidden nutrient imbalances in some of the marshlands. Erosion of top soil from the hills and the associated slopes into marshlands cause accumulation of silt. The lack of availability and the slow rate of decomposition of organic residues lead to low usage of organic manures in marshlands. Hence the texture and nutrient profile of the top soil in marshlands are constantly changing in marshlands. The soil fertility is highly variable amongst marshlands, and in some cases within a given marshland. Soil fertility thus remains a constant threat to sustainability of rice cultivation in marshlands.

### 5.4. Water management

Rice is widely grown as an irrigated crop in Rwanda. Water becomes scarce especially during the dry season in most of the marshlands where rice is grown. This scarcity is due to either (i) water availability and/or (ii) inequitable distribution of available water. In old marshlands the water availability is felt as a common problem. Due to poor maintenance, weeds and soils clog the irrigation canals. In new marshlands, the water equity, especially for rice fields in the tail ends of the water channels is perceived as a major concern by rice growers. Here the sequential cropping of rice and the general attitude of farmers towards rice as the water loving crop raises the demand for

water. In new marshlands, the water is available in enough quantities as the residual moisture and the water supply are fresh. However the equitable distribution of water is a major constraint here. Water equity is often the most fundamental cause of frictions amongst the rice farmers in marshlands.

#### 5.5. Extension services

In general, farmers in Rwanda learn rice cultivation from each other and from across other marshlands. The lack of human capacity has weakened the extension system in the country. The system is currently struggling to raise its technical capacity on effective and timely dissemination of improved soil, water and crop management practices that have been shown elsewhere to increase the productivity of rice production.

#### 5.6. Infrastructure

Rice cultivation is a resource-intensive enterprise. Synchronized planting of rice in a given marshland often requires planning of resources such as labor, threshing and drying yards, and storage. More importantly timely availability of these resources also inherently linked to the quality of rice produced in marshlands. Small holder farmers often find organizing these resources difficult and perceive it as a constraint in raising the productivity and profitability.

#### 5.7. Post-harvest Handling and processing equipment

The importance of post-harvest handling and processing is not recognized and/or is ignored by farmers and processors. As a result of poor quality assurance in locally produced rice, the commodity has a low market value in comparison to imported milled rice. There are no clear written regulations on milling operations. The mills are not routinely checked for the standards of operations and outputs. Small mills in marshlands generally produced Grade 3 rice. The government has recently banned such mills and has approved only those mills that can produce a minimum of Grade 2 rice. The by-products from milling (husk, bran and brewers' rice) are not efficiently utilized by the mills, both the private and co-operatives.

#### 5.8. Access to finance

Stakeholders in the country's rice sector follow the same credit system procedure as in other sectors under agriculture, through Micro-finances Institutions (MFIs) and Rwanda Popular Bank (BPR). The way to get the credit is that, farmers start by investing themselves first till when they can present a paddy field to the cooperative, prior to harvesting time and the cooperative can trust the farmers and request on their behalf the credit from any microfinance unit. In this case, the guarantee is made by the cooperative. Some of the weaknesses may be that, from this time onwards, the farmer has less power on the field, and once he/she can't pay back the credit the whole group, members of the cooperative are all affected.

#### 5.9. Coordination of rice development efforts

Currently, all rice development efforts are decentralized. There is a need to have a central coordination unit to avoid duplication of efforts and to maximize efficiency of utilization of resources. In this respect, human and institutional capacities need to be built.

## 6. Vision and scope of NRDS

### 6.1. Goals

It is envisaged that Rwanda will attain self-sufficiency in rice production before 2018, and will be well positioned to compete in local and regional market-places with significant improvements in quality and value. The medium-term goal is to double the area under rice cultivation by 2013, and increase output by three-fold. The long-term goal is to increase area under cultivation to 28,500 Ha under different ecosystems by 2018 (Table 3).

Table 3: Targets set under NRDS on area, yield, and production under different ecosystems

	Rain-fed lowland <sup>6</sup>			Irrigated			Total		
	Area (Ha)	Yield (t/Ha)	Production	Area <sup>7</sup> (Ha)	Yield (t/Ha)	Production <sup>8</sup>	Area (Ha)	Yield (t/Ha)	Production
2008	-	-	-	7,000	5.5	66,000	7,000	5.5	66,000
2010	-	-	-	6,838	5.8	70,680	6,838	5.8	70,680
2013	-	-	-	13,500	6.0	141,750	13,500	6.0	141,750
2018	2,500	2.0	5,000	26,000	7.0	364,000	28,500	-	369,000

### 6.2. Objectives

To attain the above described goals, the following objectives are set;

- i. Expand the area under rice cultivation by developing new marshlands and by diversifying the ecosystems under which rice is grown
- ii. Consolidate and efficiently use the land and water to improve productivity of existing rice cultivars in marshlands
- iii. Improve access and distribution of inputs such as seeds, fertilizers and pesticides to smallholder rice growers
- iv. Enhance the quality of the rice grain through improved management practices during harvesting, drying and storage of rice grains
- v. Introduce efficient and effective regulations on trade of rice at national level, and
- vi. Raise the standard of milling operations, thereby improving the quality and competitiveness of locally produced milled rice

These objectives will be realized by taking subsector wise approach through which the potential intervention elements for each subsector shall be identified after taking stock of the current actions. The identified actions will be taken based on the above described objectives. The overall approach however will revolve around the following four strategic axes.

<sup>6</sup> Currently rice development involves only lowland irrigated (marshlands), and efforts are underway for developing rain-fed low land rice during season B

<sup>7</sup> Land area is calculated based on the cultivation area in Season B which has much rainfall than season A

<sup>8</sup> Production is calculated based on output from two seasons (A & B).

Total area of 2008(A +B) = 12,000 (7,000 + 5,000), 2010 (A+B) = 6,838 + 5348, 2013 (A+B) = 23,625 (13,500 + 10,125), 2018 (A + B) = 54,500 (26,000 + 28,500)

Land area expansion is projected based on a 2,500 ha per annual increment of rice cultivation area. Total reclaimed area for irrigated paddy is between 2010 and 2018 will be 19,162 ha. Government plans to establish 100,000 ha of irrigated land between 2011 and 2017 in both hillside (60,000 ha) & marshland (40,000 ha). Half of newly reclaimed marshland is projected to use for rice cultivation while others are for vegetables of other crops



### 6.3. Strategic axes

i. Expand area under rice cultivation

The production area under irrigated rice in marshlands will be increased to 26,000 Ha and that under lowland rain fed rice will be increased to 2500 Ha by 2018

ii. Raise productivity in rice farms

The potential of rice production will be sustainably increased from the current level of 5.8 t/ Ha to 7.0 t/ Ha

iii. Improve quality of locally produced rice to become competitive in local and regional markets

By improving the quality of milling operations and standards of grading, the quality of rice produced in Rwanda will be improved. Through multipronged approaches, the post harvest losses will be reduced to <5%. Introduction of marketable varieties with consumer-preferred traits is also a key to improve quality. The marketability of rice produced in Rwanda will be improved to effectively compete with rice that is currently being imported in Rwanda. The production of premium rice such as Basmati will be improved through research and developmental efforts

iv. Capacity development for sustainable development of Rwandan rice sector

The human capacity constraints will be addressed across the value chain through additional recruitment, training and other skill development activities of all the stakeholders including farmers, agro-dealers, traders, millers, service providers, extension agents, and researchers in the rice sector

## 7. Sub Sector Strategies

### 7.1. Seeds

#### 7.1.1. On-track actions

The seed system in Rwanda is governed by national seed legislation. The legislation advocates that new rice varieties are made available to the farmer cooperatives each season by RAB where the institution in charge of foundation seed production. The Rwanda seed commodity chain is characterized by coexistence of formal and informal seed systems. The major source of *breeder seed* is RAB's rice research program, and this is passed over to RAB's Seed Production Unit, which is responsible for the primary stage of bulking/multiplication into the *foundation seed*.

RAB contracts out the secondary bulking stage to the private sector, as either individual rice and/or rice producers' cooperatives for production of *certified/commercial seed*. RAB plays the highly critical role of supervising and carrying out rigorous inspections of the seed multipliers/bulkers countrywide, so as to ensure production and distribution of adequate quality rice seed stocks to Rwanda rice schemes. Currently, guidance associated with some funding is provided for the development of private and cooperative nurseries, and this needs to be scaled up.

Although Rwanda has seed legislation, seed sources vary from farmer to farmer. Many farmers use their own seed over several seasons/years while others buy seed from lead farmers within their

vicinity, and a few buy from certified seed producers. In order to increase the availability of quality rice seed that is required for increased rice production, there is an urgent need to carry out the following major actions:-

#### 7.1.2. Required actions

In order to be able to satisfy the increasing rice seed demand that will result from the envisaged NRDS aiming at boosting rice production from 66,000 MT of paddy (42,900 MT of milled rice in 2008) to the 369,000 MT/year (239,850 MT milled rice) for 2018. To achieve coherence, the required actions are classified under the following sets of objectives, expected outputs and proposed activities.

##### 7.1.2.1. Objective 1: *To breed quality rice varieties*

In Rwanda existing rice varieties are cultivated in low and medium altitude ecological zones. Most of these zones are characterized by low temperatures. The available varieties have long vegetative cycle (between 150 and 180 days). There is need to support RAB in developing early maturing, low temperature tolerant and disease resistant varieties. It is important to evaluate the rice varieties in terms of cooking characteristics, taste and palatability as determined by the consumer.

Output 1: At least eight (8) high yielding, early maturing, disease-resistant rice varieties that are adapted to low temperatures produced by 2018

##### *Proposed activities*

- (1) Carry out training needs in rice breeding and associated disciplines within the National Agricultural Research System (RAB, ISAE, NUR, etc.)
- (2) Provide infrastructure and equipment support to rice seed chain (foundation, breeder and certified)

*Estimated Budget*: USD 1,096,000

Output 2: At least five (5) lowland rain-fed rice varieties for season B are developed and diffused

##### *Proposed activities*

- (1) Introduce and test lowland rain-fed rice varieties within selected lowland areas
- (2) Diffuse recommended rice varieties in the identified rice schemes

*Estimated Budget*: USD 218,000

##### 7.1.2.2. Objective 2: *To ensure maintenance of released rice varieties within the farming system*

Although RAB undertakes the role of tracing released varieties, the seeds of different varieties are often mixed up due to the existence of informal seed systems within the rice schemes. To ensure the maintenance of released varieties and to allow exploitation of their genetic potential, RAB in collaboration with other key stakeholders, needs more support in capacity building in terms of financial and technical expertise.

Output 1: All released high performing rice varieties maintained for a minimum of three (3) years within the Rwandan farming systems

### *Proposed activities*

- (1) Enlist positive attributes of all released rice varieties
- (2) Sensitize and train farmers on use and maintenance of certified seed
- (3) Recruit qualified and experienced seed technicians (seed technologists, inspectors, extension agents, agronomists, pathologists, entomologists)
- (4) Carry out continuous tailor-made training modules for RAB rice program staff, seed multipliers, and seed distributors

*Estimated Budget:* USD 6,987,000

#### *7.1.2.3. Objective 3: To ensure availability of adequate certified rice seed to satisfy national demand*

Private grower's role in rice seed multiplication is vital to avail adequate certified seeds, both in quantity and quality. So far the current demand of certified rice seed is estimated at 340 MT/year (2011 A+B) for a total area under rice equivalent to 8,500 Ha. Considering the target annual increase in area of 2,500 ha, there should be a corresponding annual increase of 100 MT to cover this area expansion. It is important to stimulate and encourage private initiatives in producing certified rice seeds required to satisfy the continued expansion of areas cultivated for rice production.

Output 1: Adequate certified rice seed produced and distributed to satisfy the seed requirements estimated at 1,090 MT for 2011 (seasons A+B), with annual increases in seed supply

### *Proposed activities*

- (1) Identify reliable seed multipliers within the rice schemes countrywide
- (2) Identify their needs/constraints associated with rice seed production
- (3) Facilitate access to requisite infrastructural & equipment support
- (4) Facilitate access to financial support to seed bulkers, distributors and stockists, and
- (5) Provide continuous tailor-made training to seed bulkers, distributors and stockists

*Estimated Budget:* USD 71,000

*Total estimated budget for the proposed activities under Seed subsector:* USD 8,372,000

## 7.2. Fertilizers

### 7.2.1. On-track actions

The marshland ecological zones in which rice is widely grown in Rwanda, is recognized as the most fertile environment. It is supported by the high yield of paddy rice that farmers are currently harvesting (5.8 t /Ha). However, fertilizers are continuously applied as a blanket recommendation based on rates available in literature, without carrying out seasonal soil testing. To sustainably maintain marshland fertility, there is a need to invest in research based fertility restoration than rely on only existing recommendations.

The intensive use of fertilizers in Rwanda is in early stages. Farmers generally have inadequate experience to handle fertilizers, particularly inorganic fertilizers. To be familiar with effective utilization of fertilizers, there is a need to assess its use adoption in order to timely tackle challenges that may arise along the NRDS implementation period. Effective 2006, the GoR took over from the

private sector service providers (SPs) the responsibility of fertilizer importation, with the aim of delivering it to all the categories of customers countrywide, so as to facilitate increased fertilizer application in farming. After importing the fertilizer, the government auctions the stocks to private bidders for distribution. To smoothly transfer the procurement function to the private sector, there is an urgent need to:-

- (i) develop an enabling investment environment for the fertilizer market
- (ii) strengthen the capacity of the private sector and
- (iii) stimulate the demand for fertilizer utilization amongst the rice growers

It is important to note that, the GoR currently subsidizes the transport cost, and that, a fixed uniform sale price is applied countrywide. Three types of fertilizers are available, and used in Rwanda's rice production activities, and these include, NPK and DAP applied as basal fertilizers, and urea applied as a top dress. There has been little testing of soils to see what fertilizers in what combinations should be most profitably applied in different locations. As a result, farmers often perceive this and do not apply the recommended fertilizer rates.

Most often, the fertilizer application rates are based on a blanket recommendation across all the rice producing areas/schemes of the country, disregarding the soil nutrient content of the different schemes. The other feature of the Rwandan rice production sub-system is the common disposal of the rice residues (straws and chaff) through burning, and this minimizes recycling of the soil nutrients, and this has a negative influence on the fertility status of the rice producing marshlands.

#### 7.2.2. Required actions

It is well established that increased use of both organic and inorganic fertilizers and other agricultural inputs is necessary for increased rice yields. However, intensive use of fertilizers in rice is still below average requirements in most of the rice schemes. The present blanket recommendations lead to inefficient production, and lacks cost effectiveness as a result of either under or overdose of the soil nutrients required by the crop under specific soil-rice crop environments. In order to maintain sustainable marshland fertility management, it is important to carry out soil analysis for the different rice schemes to provide appropriate fertilizer recommendations.

##### 7.2.2.1. Objective 1: To procure adequate quantity and quality fertilizers

The government of Rwanda has recently started to promote the use of fertilizers in order to boost agricultural production. However, the intensive use of fertilizers in rice schemes is still below requirement and in some cases not used or based on a blanket recommendation which lead to inefficient production. Facilitation of private sectors in procuring and distributing enough quantity and quality fertilizers shall help increase efficiency in rice production.

Output 1: Facilitation of procurement and distribution of fertilizers for use in rice production in all rice schemes.

It is estimated that 545,000MT of organic manure and 10,900MT of NPK, and 5,450MT of urea, will be required in annual increments for the projected area for rice production by 2018.

#### *Proposed activities*

- (1) Determine soil nutrient status for all rice schemes through soil analyses, consultation of pedological map of Rwanda and other sources

- (2) Validate fertilizer types and fertilizer rates and give recommendations to rice farmers within respective schemes
- (3) Carry out procurement procedures in view of identified fertilizers
- (4) Conduct fertilizer demonstrations across all rice schemes
- (5) Support RAB, decentralized structures, rice producers' cooperatives and other CBOs through organized tailor-made training courses
- (6) Sensitize and train farmers on benefits associated with soil-crop nutrient recycling through proper utilization of rice straws and other residues (mulching, composting, livestock feeds and use of animal manure)

*Estimated Budget:* USD 1,372,000

7.2.2.2. Objective 2: *To promote private sector service providers (SPs) invest in bulk fertilizer procurement and distribution*

The government encourages the private sector to take over the function of fertilizer importation, distribution and sale to farmers by developing a strong fertilizer business network countrywide. GoR has started to increase the farmers' awareness on access, affordability and benefits of fertilizer use by introducing voucher system. The recently initiated program on Privatization of Rwanda's Fertilizer Import and Distribution System (PReFER) will strengthen the private sector's capacity to take over the responsibility for fertilizer procurement and distribution from the government.

Output 1: At least five (5) private service providers procure fertilizers by 2018

*Proposed activities*

- (1) Identify interested and capable private SPs in undertaking fertilizer procurement & distribution by location within rice producing zones
- (2) Identify and sensitize private sector that are already in fertilizer business or are interested in such enterprise
- (3) Carry out tailor-made training courses for the identified private enterprises/entrepreneurs
- (4) Facilitate access to credit and other available financing facilities

*Estimated Budget:* USD 108,000

Output 2: Capacity building of fertilizer traders at all levels through training of at least 1 wholesaler, 3 retailers and 5 stockists on a continuous basis till 2018

*Proposed activities*

- (1) Identify and sensitize fertilizer traders and distributors and other players at grass root levels in all rice schemes;
- (2) Facilitate experienced cooperatives to become input suppliers
- (3) Carry out continuous tailor-made trainings to fertilizer traders, distributors, stockists and rice farmers, across rice schemes, and
- (4) Facilitate access to credit and available financing facilities for the stakeholders in the fertilizer sub sector

*Estimated Budget:* USD 69,000

7.2.2.3. Objective 3: *To provide site specific fertilizer recommendations across all rice schemes*

The current blanket recommendations disregard the soil nutrient profiles of the different marshlands. However, recent work commissioned by RSSP involved soil analysis for samples collected across 12 schemes. The results shall form a basis of fertilizer demonstration trials in different schemes.

Output 1: At least one (1) fertilizer rate trial is carried out per scheme during years 1 & 2 of NRDS implementation, and subsequently specific fertilizer rate recommendations are provided and applied across all rice schemes by 2018.

*Proposed activities*

- (1) Identify sites that require soil analysis for purposes of completing the work initiated by RSSP
- (2) Carry out fertilizer trials at selected representative sites covering all rice schemes, and
- (3) Provide site-specific fertilizer recommendations for all rice schemes

*Estimated Budget*: USD 1,235,000

*Total of estimated budget for the proposed activities under Fertilizer Sub-Sector*: USD 2,784,000

### 7.3. Irrigation/Water Management

#### 7.3.1. On-track actions

About a total of 17,363 Ha<sup>9</sup> of marshland have been developed nationwide through rural development projects such as RSSP, PAPSTA that were supported by the GoR in collaboration with development partners such as World Bank and IFAD. In addition, NGOs such as Agro Action Allemande developed marshlands in various rice schemes. In season B of 2010, physical area of 6,838 Ha of marshlands is used for rice cultivation. Gravitational surface irrigation method is commonly used within all the irrigated marshlands, with intake either directly from a river, from a dam, from a spring at the foot of the hills. Often times, water control inlets and irrigation canals into the paddy fields are not efficiently controlled, and hence water shortage is often felt as a problem, especially during the dry season.

The GoR is promoting increased rice production through increased investment in reservoir dams, irrigation canals, and drainage systems. Currently, marshland reclamation costs about US\$ 8000/Ha. Although farmers pay the district a tax for the use of irrigated land, which varies from 10,000 RWF/Ha to 60,000 RWF/Ha, the capital charge on new investment, inclusive of interest and amortization at a 10% real rate of interest, is much greater - about 536,000 RWF/Ha per annum over 20 years. Thus there is a very substantial rate of subsidization. Much of the area is left unexploited due to shortage of the irrigation water over the second season thus almost half the area is exploited.

In addition, the GoR pays for extension services offered by agronomists and other field technicians who assist the farmers within the marshland system. According to the Strategic Plan for Agricultural Transformation (PSTA 2), the objectives of Sub Program 1.4 (Irrigation Development) are to develop sustainable irrigation experiences in Rwanda by: (1) establishing an appropriate legal framework for water use rights and ownership of irrigation systems, (2) developing modern

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<sup>9</sup> Irrigation MasterPlan Outlook & Implementation, MINAGRI, ASWG at 28-Jun, 2011



techniques of irrigation centered on pressurized irrigation, and (3) developing farmers' capacity to manage, in associative form, irrigation systems.

### 7.3.2. Required actions

Increase in area under rice cultivation is an important strategy in achieving self-sufficiency of rice production. It is estimated that Rwanda will require 26,000 Ha of marshland area for rice cultivation. During season B in 2010, about 6,838 Ha of marshlands was cultivated with rice. A number of projects are in pipe-line, but the gaps remain in reaching the target. The phase II of RSSP aspires to develop 4,958 Ha before its completion. While the phase III of RSSP is still under planning stage, it is expected to develop 4,474 Ha of marshlands. Additional marshlands will be reclaimed by projects such as PADAB (1000 Ha), KWAMP (700 Ha), PAIRB (1,500 Ha), IMP (1000 Ha) and German Agro Action Allemande (200 Ha). Thus, of the total target of 26,000 Ha, about 13,832 Ha will be developed by RSSP and other projects. Since 6,838 Ha of marshlands is currently available, there is a need to reclaim 5,330 Ha of new marshlands in order to achieve the production targets set under the NRDS.

Also, it is worth noting that, only about 70% of the total area under rice is cultivated twice a year (seasons A & B) due to water shortage during the dry season. The lack of systematic water utilization coupled with inefficient water control, and deterioration of existing water reservoir and irrigation canals, have remained a major constraint in irrigated rice production. The water use efficiency in most of the marshlands is low. This is mainly due to poor maintenance of the catchment areas, watersheds, and irrigation canals within marshlands. It has not been possible to produce two rice crops per year due to lack of irrigation water during the dry season.

#### 7.3.2.1. Objective 1: *To increase area under rice production in irrigated conditions*

The arable marshlands that constitute about 219,791 ha<sup>10</sup> of the Rwandan territory are regarded as the most ideal environment for rice production in Rwanda. The Irrigation & Mechanization taskforce of MINAGRI has been developing irrigation plans in both marshlands and hillsides. Various projects are planned to reclaim marshland such as GoR financed Quick-wins marshland development (QW-MDA), WB financed RSSP III, AfDB financed PADAB and PAIRB, IFAD/DFID financed KWAMP and PAPSTA, GAA, etc. While some of the reclaimed marshlands will be used for other crops, most of the reclaimed areas are planned to be used for rice cultivation.

Output 1: Area under rice production in irrigated conditions increased 26,000 ha by 2018

#### *Proposed activities*

(1) Develop an estimated 5,330 Ha of marshland area for rice production by 2018

*Estimated Budget*: USD 50,000,000

Output 2: Irrigation system is installed together with rehabilitation of irrigation facilities

#### *Proposed activities*

(1) Carry out an inventory of existing irrigation facilities for each of the rice schemes for rehabilitation purposes and

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<sup>10</sup> Rwanda Irrigation Master Plan, MINAGRI, August 2010.

(2) Install irrigation structures and system for regular maintenance

*Estimated Budget: USD 8,430,000*

Output 3: Private sector investment in marshland reclamation and development promoted

*Proposed activities*

(1) Sensitize private sector on the importance of developing and rehabilitating the marshlands for rice production, in view of the existing unexploited agricultural potential within Rwandan marshlands

(2) Establish the required policy and financial support environments for investment within marshlands

*Estimated Budget: USD 122,000*

7.3.2.2. Objective 2: To rehabilitate old and run-down rice schemes within the developed marshlands

Most of the high potential marshlands are over a decade old, and their infrastructure has deteriorated as a result of poor maintenance. It is important that these rundown infrastructures be systematically rehabilitated in order to improve the water use efficiency and rice productivity within existing marshlands.

Output 1: Infrastructure within all developed rice schemes rehabilitated by 2018

*Proposed activities*

(1) Identify and evaluate all old and rundown rice schemes

(2) Design and implement rehabilitation and maintenance strategies

*Estimated Budget: USD 121,000*

7.3.2.3. Objective 3: To improve irrigation water use efficiency within existing and new marshlands

MINAGRI in collaboration with other stakeholders is currently preparing a Ministerial Order establishing *Irrigation Water Users Association (IWUA)*. However most of the rice growers are not aware of the importance of association and its potential impacts in water usage pattern in marshlands.

Output 1: Irrigation Water users association (IWUA) established and functioning by 2011

*Proposed activities*

(1) Disseminate the importance of regulations under IWUA transparent water use, management and maintenance guidelines/by-laws;

(2) Sensitize and train members of the IWUA and local administrators on the rationale of equitable water use for increased rice production

*Estimated Budget: USD 1,590,000*

*Total of estimated budget for the proposed activities under Irrigation/Water management Sub-Sector: USD 60,263,000*

## 7.4. On-Farm Technology Dissemination (Extension)

### 7.4.1. On-track actions

The flagship PSTA II program recognizes rice as one of the high value crops in the country, and envisages its intensification under Program 1 through increased use of agricultural inputs such as quality seeds, fertilizers, soil and water. The on-farm technology dissemination is however constrained by the lack of human capacity and the lack of appropriate technological packages for the sector to improve rice commodity chain. It is generally recognized that, the Rwandan rice farmer learns from his/her neighbor, and/or from across other marshlands. The lack of human capacity has weakened the extension system in the country. The system is currently struggling to raise its technical capacity on effective and timely dissemination of improved soil, water and crop management practices that have been shown elsewhere to increase the productivity of rice production.

Pests and diseases pose serious challenges in marshland eco systems of Rwanda. This is mainly due to the intensive mono-cropping. Inadequate knowledge of appropriate control measures against pests and diseases amongst farmers is a major impediment to increased production of quality rice in Rwanda. The limited choice of adaptable rice varieties, coupled with poor access to recommend pesticides also affect the readiness of farmers towards control of the most common epidemics of blast and *Diopsis* in the marshlands.

The pests and diseases in rice production schemes in Rwanda is exacerbated by lack of knowledge of appropriate control measures, and this has a serious negative influence on rice production in Rwanda, both quantitatively and qualitatively. Furthermore, lack of awareness and access to recommend pesticides also affect the readiness of farmers towards mitigating the effects on rice production.

The plant protection unit under RAB in collaboration with FAO, International Rice Research Institute (IRRI), and regional centers such as Africa Rice Center, undertake a variety of research and development activities on rice including the integrated pest management (IPM) practices. Under the FAO-financed Integrated Pest Management (IPM) project, RAB's plant protection unit has completed piloting implementation of IPM for rice farmers in Rwamagana, Huye/Nyanza and Bugarama rice schemes through FFS.

### 7.4.2. Required actions

Rice production benefits significantly from the subsidized cost on agricultural inputs through tax exemption and subsidized transport cost on imported inorganic fertilizers under crop intensification program (CIP). The efficiency and effectiveness of extension services within the rice sub-sector need to be improved by building human- and technical capacities. There is also a strong need to screen/identify and develop rice varieties with improved tolerance/resistance to the pests and diseases. In addition, technology packages that shall prevent/combat the incidence of major pests and diseases need to be developed and disseminated to farmers.

#### 7.4.2.1. Objective 1: *To increase adoption of appropriate rice improvement technologies*

Increased rice production is limited by the lack of appropriate technological packages required for the sub-sector to improve its commodity chain. The lack of efficient and effective extension services within the rice sub-sector, calls for promoting and scaling up "Farmer Field School (FFS)" and other participatory approaches for research-extension system in all rice schemes. The

facilitation and support on adoption of private-public partnership (PPP) is one the major strategies. While the extension services shall be carried out by private sector, other supplementary actions such as the training of farmers and service providers paid shall be facilitated by the public sector (GoR and DPs and/or by beneficiary farmers).

Output 1: Appropriate rice improvement technologies applied across all rice schemes through wider adoption of FFS approach by 2015

*Proposed activities*

- (1) Promote and scale-up “Farmer Field School (FFS)” and other participatory research-extension system in all rice schemes
- (2) Identify agronomists and lead farmers (LFs) from the rice schemes (cooperatives, unions, NGOs, FBOs) to participate on the training of trainers (ToT) sessions
- (3) Train them on the latest and appropriate technologies in rice development (production through to harvesting and post-harvest)
- (4) Furnish them with the requisite training facilities and necessary support to enable them disseminate the technologies learnt
- (5) Develop and implement a program of certifying farmers, including women farmers, as trainers and facilitators after they have been involved in participatory research and extension activities and receive specified types of additional training afterwards
- (6) Strengthen programs of mass extension messages within rice development schemes, including newspapers, brochures, films & video shows, local/national radio broadcasts, TV shows, etc.

*Estimated Budget:* USD 5,151,000

Output 2: Private-public partnerships (PPP) in dissemination of rice extension services amongst the farming community promoted by 2018

*Proposed activities*

- (1) Identify interested and capable private sector companies and/or individuals
- (2) Systematically provide capacity support in terms of finance and human resource development

*Estimated Budget:* USD 1,468,000

Output 3: Farmer Service Centers established in main rice schemes

*Proposed activities*

- (1) Identify main rice schemes to establish at least one farmers training center per province (except Northern province)
- (2) Develop the required capacities (human and infrastructure)

*Estimated Budget:* USD 4,425,000

7.4.2.2. Objective 2: *To scale-up identification and characterization of major pests and diseases of rice in all rice schemes in Rwanda*

Output 1: Major pest & diseases across major rice schemes identified and characterized by end of 2012, and reviewed after every three (3) years

*Proposed activities*

- (1) Identify and characterize major pests and diseases across all rice schemes of Rwanda
- (2) Improve the awareness and preparedness of rice growers against outbreaks of pests and diseases in rice schemes

*Estimated Budget*: USD 351,000

7.4.2.3. Objective 3: *To design and implement pests and diseases control measures*

Output 1: Rice pests and diseases control strategy designed for each of rice scheme by 2012 and regularly reviewed

*Proposed activities*

- (1) Recommend and demonstrate identified pests and diseases mitigation measures such as the use of diseases resistant varieties
- (2) Create awareness, and provide training and extension services on pests and diseases identification and control measures including integrated pest management (IPM), safe handling and utilization of pesticides to field extension agents and farmers
- (3) Facilitate research & development (R&D) efforts in the field of pesticide production, safe handling and utilization, with the aim of diversifying pesticide use
- (4) Facilitate procurement and distribution of the recommended pesticides to farmers through agro-dealers and SPs, and
- (5) Provision/support to farmers on small tool requirements for sustainable management of pests and diseases through IPM

*Estimated Budget*: USD 3,076,000

*Total of estimated budget for the proposed activities under On-Farm Technology Dissemination (Extension) Sub-Sector*: USD 14,471,000

## 7.5. Mechanization

Rice production in Rwanda is extremely labor intensive. However, the real wage rates are rising rapidly. This calls for exploring into the possibilities of adopting intermediate mechanization options in rice production activities including use of power tillers, herbicide for weed control, mechanical harvesters and threshers, carts either tractor-hoisted or oxen/donkey-drawn for farm transportation of paddy. Farm mechanization is still in the early phase of acceptance in Rwanda. Most of the field operations in marshlands are carried out by human labour. Use of hand tools accounts for 98.5% of all land tilled in Rwanda. Use of animal traction or tractors is negligible and does not significantly contribute to rice production. The government has recently drawn the agricultural mechanization strategies to enable the transformation of farming towards market-oriented agriculture.

### 7.5.1. On-track actions

In September-October, 2009, MINAGRI imported 20 tractors, 50 power tillers (15 HP), 5 rice transplanters and associated spare parts from Tong Yong Moolsan (TYM) Inc., South Korea, and they were officially launched in February, 2010. These machineries are currently being sold to individual farmers and farmer cooperatives. Additionally, there are 2 more power tillers used in rice production that has been donated by South Korea Republic. MINAGRI has set up a workshop facility at Kabuye, Kigali City, and a mobile workshop to address technical problems met by the new buyers and existing owners of farm machineries.

It is worth noting that, the repair and maintenance services currently available do not however support the efficient exploitation of farm machinery and equipment. Retail outlets in the country do not sell spare-parts or tractor-drawn implements, because the demand is still very low. These could however be sourced from Uganda and Kenya.

### 7.5.2. Required actions

For the successful mechanization of rice production in marshlands, there is a need to carry out extensive reorganization of the layout of marshland farm units. Land use consolidation and reconstruction of marshland bunds shall allow maneuverability of farm machineries. In addition, exploration of cost efficient and ergonomically efficient mechanization options in parallel with standard mechanization will significantly lead to profitable rice production.

Enabling access to various farm mechanization options to farmers should serve as one of the key drivers in implementing mechanization strategies. This should be done by facilitating the private sector to set up workshops and strengthening their technical abilities and knowledge on farm machineries, implements, and other improved agro-processing equipments.

#### 7.5.2.1. Objective 1: *To increase rice productivity through efficient land use*

Output 1: Land use consolidation adopted within all rice schemes for efficient mechanization by 2015

#### *Proposed activities*

- (1) Determine appropriate mechanization options for all rice schemes and
- (2) Sensitize and demonstrate benefits of mechanization and land consolidation on mechanized rice production within the marshlands

*Estimated Budget*: USD 1,942,000

#### 7.5.2.2. Objective 2: *To reduce human labor cost in rice production and post-harvest handling activities*

Output 1: Increased demand and adoption of agricultural machineries in marshlands by 2018

#### *Proposed activities*

- (1) Facilitate capacity building for both private and public personnel, through focused/tailor-made short and medium term training activities within and outside Rwanda



(2) Sensitize the stakeholders on the benefits associated with increased adoption of farm machinery and equipments in the marshlands

*Estimated Budget: USD 1,957,000*

*7.5.2.3. Objective 3: To improve access and availability of farm machineries and implements for rice production*

Output 1: Availability of appropriate farm machinery and implements for rice operations increased

*Proposed activities*

- (1) Identify the limitations in farm machineries and equipments that are recommended for rice schemes
- (2) Facilitate procurement of the recommended farm machineries and implements through private sector participation
- (3) Encourage provision of mechanization services in marshlands by directly promoting private service providers
- (4) Support establishment of workshops for fabricating prototypes across the rice schemes
- (5) Train engineers, technicians and rural artisans in fabrication/maintenance of prototypes and other operations, and
- (6) Establish farm machinery workshop posts close to all rice schemes

*Estimated Budget: USD 7,519,000*

*Total of estimated budget for the proposed activities under Mechanization Sub-Sector: USD 11,418,000*

## 7.6. Quality Improvement

Quality of locally produced rice grains by improving the handling at harvesting, threshing, winnowing, drying and milling operations. Currently harvesting, threshing, winnowing and drying are done manually by most of the farmers. In some marshlands, few machines are available for threshing and winnowing operations. Paddy grains are generally sun-dried by spreading on the ground or plastic/canvas sheeting. Concrete drying slabs are generally in short supply in most of the marshlands. Often the grains are not dried to the prescribed moisture content of <14%. The higher moisture content hence affects storage life and milling qualities.

The lack of mechanized harvesting and post-harvest handling operations in Rwanda continues to create serious negative effects on rice productivity. Post harvest losses of rice production range up to 30% of paddy harvested. Milling of grains is generally done by hullers and/or hand pounding by farm families. The small hullers with installed capacity of up to 200 kg/hour often lack the capability for cleaning, whitening, polishing and grading. Such milling operations lead to accumulation of high percentage of broken grains in the finished product.

### 7.6.1. On-track actions

The GoR in collaboration with development partners have been investing in construction of more reliable drying and storage infrastructure within most of the rice schemes. In addition, construction of covered drying pads and warehouses for storing rice is also taking place in some marshlands.

However, at the farmer level, this should be done through the cooperatives since the scale of these facilities far surpasses the needs of individual farmers.

Presently the rice milling is regulated by the Government by both imposing new regulations and banning of those small rice hullers that produce a very high percentage of broken grains and/or have no grading capacity. The grading regulations involve conforming to acceptable Rwanda Bureau of Standards (RBS) of milling and grading. Furthermore, new mills are required to produce <15% broken grains upon milling, and to possess the technical capacity for grading. RBS also applies quality control on both imported and locally milled rice.

#### 7.6.2. Required actions

However, it is important to realize that the small hullers have been banned by the GoR through MINAGRI effective 2009, due to their poor milling efficiency. Currently, the numbers of mills with up to medium capacity are very few, and most of them are not well managed. Despite the ban on inefficient small rice mills however, some exceptions have been made in relatively isolated areas and in places where no approved mill is available within a reachable distance. These mills require further provision/support of machineries for grading and training on milling regulations. Currently, RBS does not set formal standards on milling machineries and equipments. It is hence necessary for the millers to be aware of the technical standards of the machineries. RBS also lacks the required human capacity for inspection of quality of milling operations and grading in the entire country.

##### 7.6.2.1. Objective 1: *To increase the milling quality of Rwandan rice*

Output 1: Proportion of grades 1 & 2 increased by 2018

#### *Proposed activities*

- (1) Sensitize and train rice producers and millers on the benefits associated with producing high quality rice
- (2) Enforce quality standards/norms for rice through RBS and related stakeholders, through banning of inefficient hullers/mills
- (3) Encourage routine/regular servicing and maintenance of machinery and equipments for increased efficiency, and
- (4) Provide concessions and financial support for entrepreneurs on residue management and value addition

*Estimated Budget*: USD 921,000

##### 7.6.2.2. Objective 2: *To minimize the harvest and post-harvest losses of rice*

Output 1: Losses during the handling at harvest, post-harvest and storage reduced from 20% to < 5% by 2018

#### *Proposed activities*

- (1) Identify and recommend appropriate threshing, drying, winnowing machines and other equipment that could be used by smallholder farmers

- (2) Scale up availability and usage of intermediate machineries and equipments in post harvest handling operations such as drying and storage
- (3) Facilitate scaling up and promotion of Ware House Receipt System in all rice schemes, and
- (4) Increase number of milling facilities capable of producing grades 1 and 2

*Estimated Budget:* USD 11,789,000

*Total of estimated budget for the proposed activities under Quality Improvement Sub-Sector:* USD 12,710,000

#### 7.7. Access to market

Traders and Millers are the major buyers of grains from the rice growers. By products such as straws do not have markets in Rwanda. The accessibility to national/regional markets for both the paddy and the milled grains of locally produced rice plays a pivotal role in sustaining rice production. Presence of vibrant, transparent and large distribution networks in the country will reduce the variability in farm gate prices for paddy grains through competition. In the presence of competitive marketing networks, the consistency in demand shall also help reduce the volatility in prices.

##### 7.7.1. On-track actions

Until recently most of the large rice mills in major rice growing schemes were owned by the government. The government has privatized of such mills to improve the efficiency of markets for trading rice in the country. Further invitation of entrepreneurs to establish new high throughput rice mills will promote competition amongst millers and to facilitate transparency in markets. Such privatization measures were intended to enable reliable and sustainable access for locally produced rice. The government also allows the millers to provide price incentives for buying the grains with desired quality features such as the type of rice, purities and moisture content.

##### 7.7.2. Required actions

Physical distance between rice growing areas and market (mills or traders) determines the accessibility for locally produced rice. Since the ban of small rice mills that were previously existed in villages, the rice growers need to be aware of the alternate avenues to markets. To supplement such efforts, millers and traders also need to be encouraged to reach out to the rice producing areas in order to enable the marketing of paddy grains by the farmers in such marshlands. Price incentives for improved paddy production needs to become more transparent for the rice producers in various parts of the country in order to sustain the efforts in improving quality and competitiveness of locally produced rice. It is also important that the farmers in marshlands have access to timely and accurate market information. Linkages between components of value chains and the rice growers will facilitate farmers efficiently access various farm inputs and finding markets where the farmers can sell the outputs.

##### 7.7.2.1. Objective 1: *To improve physical access to national/regional markets*

Output 1: Transport and mobility of rice produced by growers in the marshlands improved

##### *Proposed activities*

- (1) Rehabilitate and construct feeder roads within existing and newly reclaimed marshlands

(2) Encourage private millers and traders to reach out to rice producers in remote and inaccessible areas through incentives

*Estimated Budget:* USD 42,842,000

Output 2: Marketability of locally produced rice at national, regional and international markets increased.

*Proposed activities*

- (1) Facilitate transparency in trading, pricing and price incentives for quality products through networking of farmer cooperatives, and communication and extension services
- (2) Improve linkages between input and output markets by integrating players in the value chain with millers and traders, and
- (3) Conduct surveys on household consumption, consumer preference, demand trends and price sensitiveness of traders and consumers

*Estimated Budget:* USD 475,000

*Total of estimated budget for the proposed activities under Access to market Sub-Sector:* USD 43,317,000

## 7.8. Access to Finance

In most of the rice producing schemes, inputs such as seeds and fertilizers are furnished on credit, with farmers repaying when the harvest is sold. Farmers' cooperatives play the role of middlemen. This is one of the reasons why farmers are encouraged to deliver their paddy to the cooperatives, which is responsible for repayment. In some instances, such as in Bugarama, farmers buy fertilizers directly from the SP for cash.

### 7.8.1. On-track actions

GoR has been providing several schemes to finance both the farmers and the service providers through its national banks. Currently the central bank (BNR) provides two financing support facilities for milling sector viz., (i) Agricultural Guarantee Fund (AGF), which provides guarantees of up to 30% of the loan value for short-term loans and 50% for medium and long-term loans, with a ceiling of 500 million RWF on any guarantee, and (ii) Rural Investment Facility (RIF), which provides outright grants of 10% to 25% of the loan value depending on the role in the value chain.

### 7.8.2. Required actions

Although most of the rice cooperatives and rice mills have access to credit from banks and/or microfinance institutions (MFIs), the high cost and fragmentation of the rural financial market pose a major constraint. The rice cooperatives borrow at variable interest rates and on different terms according to the lender. For example, whereas some cooperative pay a 4% interest on loan, most of them pay about 13 – 14% in nominal terms (RSSP, 2010). Furthermore, bank loans are only approved on condition that the rest of the funds are available. It is essential to establish linkages between farmers and institutions offering agricultural financing as well as the markets.

While a grant may be used for the purchase of inputs, and production and processing equipments, it shall not be used for trade. In case of the AGF and RIF, the grant percentage applies only to the

non-guaranteed part of the loan. Even though the loan facilities were designed primarily for medium-term investment in procurement of inputs, they have occasionally been used by some of the more advanced cooperatives as capital for other operations. Thus there is a need for streamlining of credit schemes/facilities and their norms.

*7.8.2.1. Objective 1: To increase access to agriculture finance by rice farmers and other players in the rice value chain*

The lack of ready cash by authorized traders for purchase of paddy during the harvesting period poses one of the major constraints to rice marketing. For this reason, the farmers sell their paddy to unauthorized traders at give-away prices. Therefore, the need to introduce and facilitate application of *Working Capital* credit like in the coffee sector will significantly boost rice marketing.

Output 1: Access to agriculture finance increased from 30% to 100% by 2018

*Proposed activities*

- (1) Sensitize rice farmers on benefits associated with the use of agriculture finance and available financing products (credit and savings products)
- (2) Link farmers to available credit and other financing facilities
- (3) Train and/or facilitate farmers, cooperatives and service providers in preparation of bankable projects and acceptable business plans
- (4) Train and/or facilitate farmers in acquiring basic farm management skills that enable them operate efficiently and fulfill credit servicing requirements
- (5) Assist cooperatives keep proper inventory of the assets that are used as collateral
- (6) Facilitate commercial banks and MFIs prepare and present attractive credit and savings products

*Estimated Budget:* USD 910,000

Output 2: Working capital credit for rice traders introduced and facilitated

*Proposed activities*

- (1) Categorize authorized rice traders, millers and other service providers including rice cooperatives based on their financial performance
- (2) Provide linkage amongst rice traders, millers, service providers and financial institutions (commercial banks, MFIs etc.), and
- (3) Facilitate financing institutions to provide working capital credits to rice traders including cooperatives and unions that buy paddy during the harvesting period

*Estimated Budget:* USD 299,000

*Total of estimated budget for the proposed activities under Access to Finance Sub-Sector:* USD 1,209,000

## 7.9. Policy Tools

Rwanda's rice sector has made the fastest progresses in the region. With the help of government's investments in marshlands and modest contributions from national and international research initiatives, the production has leaped several folds in the last decade (table 1). The sector has grown

faster than what the system could handle. For instance, the human and technical capacities in the country are not sufficient enough to provide coherence to the wide spectrum of developments in rice sector. To accomplish the goals and objectives set in NRDS, there is a strong need to fill gaps in human capacities (table 4).

Table 4: Present and projected requirements of human capacity in Rwanda’s rice sector

	Rice Researchers <sup>a</sup>			Research Technicians <sup>b</sup>			Extension Workers <sup>c</sup>		
	Total	Full time	Part time <sup>d</sup>	Total	Full time	Part time <sup>d</sup>	Total	Full time	Part time <sup>e</sup>
2008	3	3	0	9	9	0	6	6	0
2010	3	3	0	9	9	0	10	10	0
2011	4	4	0	11	11	0	43	43	0
2013	9	7	2	27	21	6	30	24	6
2018	20	16	4	60	48	12	60	48	12

*Estimated Budget:* USD 1,584,000

<sup>a</sup> Staff working for research institutes/projects (currently only under RAB/Research), with university degree(s)

<sup>b</sup> Staff working for research institutes/projects (currently only RAB/research) with diploma or certificate programs in agriculture related subjects.

<sup>c</sup> Staff working for RAB/Extension or for farmers’ cooperative as an agronomist

<sup>d</sup> Part time researchers and research technicians working on interdisciplinary programs/units

<sup>e</sup> Agronomists engaged by administrative district/sector work in the rice schemes on part-time basis

#### 7.9.1. On-track actions

The newly constituted Rwanda Agriculture Board (RAB) has the mandate of conducting research and dissemination of appropriate technologies to the rice growers. Rice program under RAB is expected to conduct research and evaluation of varieties and production techniques. RAB’s interdisciplinary units/departments such as agronomy, soil and water management, post harvest handling and storage shall contribute to development of fertilizer recommendations, water efficient technologies and crop protection.

#### 7.9.2. Required actions

##### 7.9.2.1. Research for sustainable development of rice sector in Rwanda

It is important that RAB conducts research and development for sustainable rice production and expansion of rice ecosystems such as upland rice where applicable. This would require developing a critical mass of researchers and technicians within the national research system. Some of the R&D topics for future development of rice sector would include the following;

- (1) Promotion and facilitation of demand-driven research approach coupled with strengthening Research-Extension linkage
- (2) Support for the development of early and medium maturing best-bet rice varieties that are highly palatable, across all the rice schemes
- (3) Promotion of the usage of rice by-products including rice straws, rice husks and rice bran for soil fertility restoration through nutrient recycling

- (4) Diversify the options in usage of machinery, equipments, agricultural inputs (quality seed, fertilizers, pesticides etc.
- (5) Designing/formulating the most appropriate implementation framework that would foster the achievement of national development aspirations
- (6) Training of all beneficiaries and stakeholders along the rice value chain

## 8. Governance of the NRDS

To obtain coherence of the initiatives described in NRDS, it is important to put in place an appropriate governance structure overseeing the implementation of NRDS. While the execution of the activities will require the participation of all stakeholders along the rice value chain, an NRDS secretariat shall be created to organize and supervise the activities/projects and make appropriate amendments through feed backs from the stakeholders. Fig.3 illustrates how the implementation framework shall be organized.

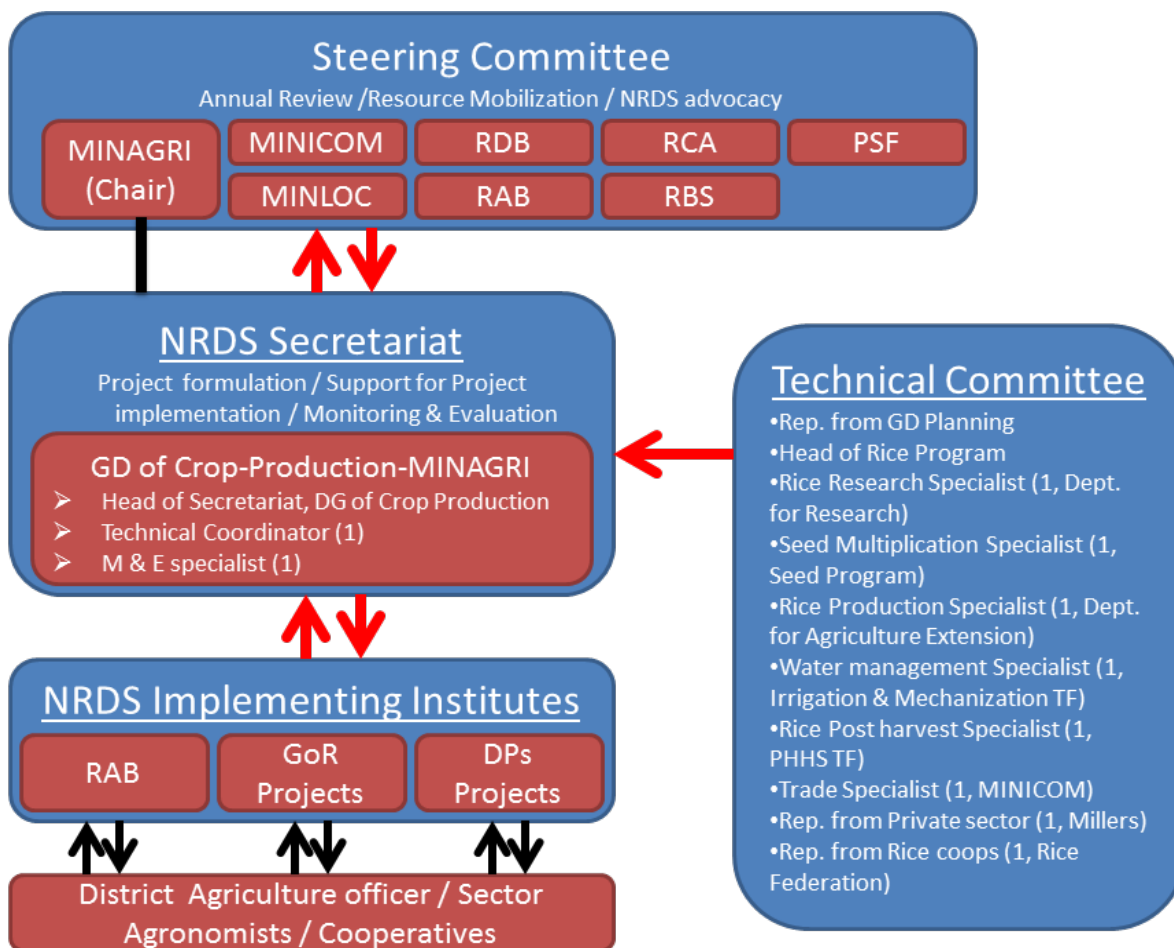


Fig.3. Proposed structure of governance of NRDS (MINAGRI: Ministry of Agriculture and Animal Resources, MINALOC: Ministry of Local Government, RAB: Rwanda Agricultural Board (Former ISAR, RADA and RARDA), RDB: Rwanda Development Board, RBS: Rwanda Bureau of Standard, RCA: Rwanda Cooperative Agency, PSF: Private Sector Federation)

### Role of Steering Committee

To enable increased accountability and effective implementation, a steering committee (SC) shall oversee the process. SC expedite decision making and foster the growth of the sector through increased participation of key stakeholders. While serving as the guardian for the rice sector, the responsibilities of SC include but are not limited to:

- 1) Setting the vision, goals, projects, and monitoring processes of NRDS
- 2) Annual review of the progress of various rice related projects/programs under NRDS to ensure appropriate coherence and alignment of projects with overall NRDS objectives
- 3) Mobilization of resources
- 4) Advocacy in all rice related sub sectors for the government and other stakeholders

#### Role of NRDS Secretariat

General Directorate of Crop Production in MINAGRI shall chair the secretariat of NRDS. The chair will receive support from Technical Committee member in developing new projects and assessing the progress and outcome of on-going and pipeline projects in rice sector. The NRDS secretariat will have the following responsibilities:

- (1) Project formulation
  - o Initiate new project formulations
  - o Coordinate research and development projects in rice sector and
  - o Facilitate SSWG consultations to ensure stakeholders' needs/concerns are addressed through on-going/new projects
- (2) Support for Project implementation
  - o Oversee effective management of projects to ensure efficient resource utilization
  - o Provide recommendations to the NRDS implementing institutions on how to improve the implementation process
- (3) Monitoring & Evaluation
  - o Scrutinize and assess the operations and outputs of various rice projects with in the light of the corresponding logical frameworks
  - o Prepare and circulate half-yearly report on implementation of rice related projects/programs to ensure alignment with NRDS
  - o Compile half-yearly M&E report for NRDS implementing institutions
  - o Accumulate experiences of NRDS projects for future projects formulation as well as implementations

#### Role of Technical Committee (TC)

TC is set up to facilitate consultations and share technical experience of the various stakeholders along the rice value chain and institutions. TC shall have representatives from the various sub sectors and institutions engaged in the development of rice sector. Meeting with TC members shall be organized every quarter and on ad-hoc basis shall be chaired by NRDS Secretariat.

#### Role of NRDS Implementation Institutes

The NRDS will largely be implemented through projects/programs in such institutions/organizations as RAB, NGOs, development partners, international research/developmental units and private sector in the country.

*Estimated Budget for Human Resources at NRDS secretariat: USD 394,000*

*Total of estimated budget for the proposed activities under Policy tools: USD 1,209,000*



## 9. NRDS Budget

The NRDS has taken a value chain approach in which various outputs are outlined to achieve the objective(s) proposed under each sub sector of rice in Rwanda. To obtain these outputs, various sets of activities have been proposed. The cost for carrying out the activities proposed under each output was estimated in USD using current rates of unit value. Based on the nature of activities, the number of unit values required was determined. For grass root level activities, the rice growing schemes were given representation in the activities. Cost of coordination of such activities however was allocated to units in major rice growing provinces (South, East, West and Kigali City).

Costs for marshland reclamation were based on the current empirical value of 7,500 USD/ Ha experienced by the RSSP. For rehabilitation of existing marshlands and rice schemes, 5,000 USD/ Ha were used to estimate the total cost. The cost of recruitment of researchers/extension workers with graduate degree(s) was estimated as USD 1,500 per month and that for technicians/agronomes with diploma/certificate was estimated as USD 600 per month. Compensation of farmers in field demonstrations and research trials was calculated as 50-75% of the expected yield of 5.0 t/ Ha. Training sessions for the dissemination of on-farm technologies involve 3-5 days. Cost of construction of screen houses, storage/warehouses and laboratories was based on empirical expenditures for square feet units.

Analyses of soil samples shall be outsourced to accredited laboratories in the region. It is estimated that 100 USD will be required for each soil sample. To carry out analyses, appraisals, surveys and exploration of potential amongst the stakeholders, and identify gaps, policies and strategies, the cost for national and international consultancies are included. A standard daily fee of 250 USD for National consultant and 650 USD for Experts/International consultants were used. The cost of logistical arrangements such as transportation, communication, stationeries and other administrative requirements is estimated as 10% of the projected expenditure.

The details of the budget estimation are shown in Appendix 11. A synopsis of budget estimation for the various sub sectors along the rice value chain for the implementation of activities outlined in this document is shown in the table below.

Table 5: Summary of estimated budget requirements for the different sub sectors of rice value chain (2011-2018)

Sl. No	Sub Sector	Estimated Budget
1	Seeds	8,372,082
2	Fertilizer	2,784,725
3	Irrigation/Water Management	60,262,200
4	On-farm technology dissemination (Extension)	14,469,934
5	Mechanization	11,418,313
6	Quality Improvement	12,709,822
7	Access to Market	43,316,975
8	Access to Finance	1,209,047
9	Human Resource Development, NRDS secretariat (recurring)	1,977,600
	<b>Grand Total</b>	<b>156,520,697</b>

## Appendix 1: Composition of Task Force and staff of PAO (Process Assistance Organization) of CARD

	<b>Names</b>	<b>Title</b>	<b>Contact Address</b>	<b>Position in NRDS taskforce</b>
<b>1</b>	Sendege Norbert	Director General, Crop Production, MINAGRI	+250 0788521320 senor@yahoo.fr	Focal point and Member
<b>2</b>	Cyubahiro Edouard	Head of Rice Development Unit, RAB	+250 0788748357 cyubahiroe@yahoo.fr	Member
<b>3</b>	Nsegiyumva Francis	Chair, Post Harvest Handling and Storage Taskforce, MINAGRI	+250 0788306812 mfnfsef@yahoo.fr	Member
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## Appendix 2: The needs of Rwandan rice sector categorized under subsector and their intervention elements

Sub-sector	Policy/ Institutional	Infrastructure	Human resource/ Capacity	Provision/ Support	Information/ Knowledge
Seed	<ul style="list-style-type: none"> <li>• Seed Certification</li> <li>• Regulation on seed multiplication</li> <li>• Timely supply of seeds</li> <li>• Private Sector Involvement</li> <li>• Promote quality rice (long grain, aromatic, stress tolerance, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Breeding facilities</li> <li>• Germplasm storage</li> <li>• Seed quality testing laboratory</li> </ul>	<ul style="list-style-type: none"> <li>• Researchers (breeder, agronomist)</li> <li>• Seed Inspectors</li> <li>• Technicians (production)</li> <li>• Training for seed producers</li> <li>• Training of farmers on seed use</li> </ul>	<ul style="list-style-type: none"> <li>• Incentives for quality seeds</li> <li>• 340 MT of certified seeds</li> <li>• Foundation seeds of 8 improved varieties</li> </ul>	<ul style="list-style-type: none"> <li>• Regional/ International research collaborations</li> <li>• Admixtures of foundation and certified seeds</li> </ul>
Fertilizer	<ul style="list-style-type: none"> <li>• Tariff reduction/exemption for fertilizer imports</li> <li>• Encourage private sector participation by facilitating bulk and distribution</li> </ul>	<ul style="list-style-type: none"> <li>• Blending, storage and transportation facilities (private sector)</li> <li>• Soil testing laboratories and equipments</li> </ul>	<ul style="list-style-type: none"> <li>• Training of farmers, stockists, distributors, traders</li> <li>• Technicians (soil testing, demonstrations)</li> <li>• Training courses for technicians</li> </ul>	<ul style="list-style-type: none"> <li>• Organic manure (3.6 m MT), NPK (71,500 MT), Urea (35,750 MT)</li> <li>• Micronutrients</li> </ul>	<ul style="list-style-type: none"> <li>• Site-specific recommendations</li> <li>• Additional types of fertilizers</li> <li>• Effectiveness of rice by-products (straws, husks, etc) as organic fertilizers</li> </ul>

Sub-sector	Policy/ Institutional	Infrastructure	Human resource/ Capacity	Provision/ Support	Information/ Knowledge
Irrigation / Water Management	<ul style="list-style-type: none"> <li>• Marshland development plan (to be upgraded)</li> <li>• Policy on water user association (to be approved)</li> <li>• Private sector participation in marshland development/maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation and maintenance of old and new marshlands</li> <li>• Water sheds, Rainwater harvesting structures</li> </ul>	<ul style="list-style-type: none"> <li>• Training Irrigation WUA members, agronomists, supervisors, administrators</li> <li>• Agronomists, Soil Technicians for new marshlands</li> </ul>	<ul style="list-style-type: none"> <li>• 14,000 Ha new marshlands</li> <li>• Annual increment of cultivated area (1,750 Ha)</li> </ul>	<ul style="list-style-type: none"> <li>• Water requirements of different varieties</li> <li>• Alternate wetting and drying technologies</li> </ul>
On farm technology dissemination (E)	<ul style="list-style-type: none"> <li>• Review of major pests &amp; diseases every 3 years</li> <li>• Private-Public partnerships in Extension services</li> <li>• Monitor &amp; Evaluate the effectiveness of extension service delivery systems</li> <li>• Regular and routine farmers training schedules</li> </ul>	<ul style="list-style-type: none"> <li>• Screen houses</li> <li>• Plant Protection Laboratories</li> </ul>	<ul style="list-style-type: none"> <li>• Entomologists, Pathologists, Rice Extension agents</li> <li>• Training of technical, extension staff and service providers</li> <li>• Training of farmers through Farmer Field School approach</li> </ul>	<ul style="list-style-type: none"> <li>• Surveillance of pests and diseases</li> <li>• Pesticides, Fungicides</li> <li>• Routine farmers training programs</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated pest management packages</li> <li>• Appropriate production technologies</li> </ul>

Sub-sector	Policy/ Institutional	Infrastructure	Human resource/ Capacity	Provision/ Support	Information/ Knowledge
Mechanization	<ul style="list-style-type: none"> <li>• Land Use Policy</li> <li>• Cooperative farming</li> <li>• Contractual Farming</li> <li>• Encourage private Sector in provision of mechanization services</li> <li>• Tariff reduction for imported machineries</li> </ul>	<ul style="list-style-type: none"> <li>• Electricity in rural areas (public)</li> <li>• Workshops in rural areas (private)</li> <li>• Assembly centers (private)</li> </ul>	<ul style="list-style-type: none"> <li>• Training and motivation of farmers, agro dealers, stockists, rural artisans, operators, and service providers</li> <li>• Recruitment of Engineers and technicians</li> </ul>	<ul style="list-style-type: none"> <li>• Small tools (levellers, weeders, cutters, threshers, winnowers)</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanization options for rice farming systems</li> <li>• Ergonomic designs and sources</li> <li>• Socioeconomic impacts</li> <li>• Profitability</li> </ul>
Quality Improvement	<ul style="list-style-type: none"> <li>• Standards of harvested paddy and milling activities</li> <li>• Regulation of milling plants</li> </ul>	<ul style="list-style-type: none"> <li>• Drying yards</li> <li>• Storage/Paddy Collection Centers in marshlands</li> </ul>	<ul style="list-style-type: none"> <li>• Training on quality testing</li> <li>• Supervisors for milling/grading standards</li> </ul>	<ul style="list-style-type: none"> <li>• Quality testing equipments/tools for cooperatives</li> </ul>	<ul style="list-style-type: none"> <li>• Improved post harvest, handling and storage practices</li> </ul>
Access to Market	<ul style="list-style-type: none"> <li>• Predetermined contracts between growers and millers/traders</li> <li>• Transparent and organized rural trading regulations</li> </ul>	<ul style="list-style-type: none"> <li>• Communication network</li> <li>• Road network</li> </ul>	<ul style="list-style-type: none"> <li>• Training of post-harvest technologists, traders, farmers</li> </ul>	<ul style="list-style-type: none"> <li>• Registration of millers and other rural traders</li> </ul>	<ul style="list-style-type: none"> <li>• Market information on prices of farm inputs and paddy grains</li> <li>• Consumer preference</li> <li>• Survey on household consumption of rice</li> </ul>

Sub-sector	Policy/ Institutional	Infrastructure	Human resource/ Capacity	Provision/ Support	Information/ Knowledge
Access to Finance	<ul style="list-style-type: none"> <li>• Short-term Loans on inputs, machineries to farmers, service providers</li> <li>• Crop Insurance schemes</li> <li>• Soft Loans</li> <li>• Working credit</li> </ul>	<ul style="list-style-type: none"> <li>• Rural development banks</li> <li>• Microfinance institutions (MFIs) in rural areas</li> </ul>	<ul style="list-style-type: none"> <li>• Bank field officers (credit field evaluation officers)</li> <li>• Training of lenders</li> <li>• Training of farmers' cooperatives on business skills and financial management</li> </ul>	<ul style="list-style-type: none"> <li>• Business models/ Financial plans for cooperatives</li> <li>• Mortgages against stored paddy for performing cooperatives (WRS)</li> <li>• Awareness on credit schemes</li> </ul>	
Policy Tools	<ul style="list-style-type: none"> <li>• Establish "Rice Secretariat" for overseeing implementation of NRDS</li> <li>• Continuous monitoring and Evaluation of environmental degradation in marshlands</li> </ul>		<ul style="list-style-type: none"> <li>• Sector coordinator</li> </ul>		<ul style="list-style-type: none"> <li>• Post impact analyses of NRDS implementation and rice-related policies</li> <li>• Profitability studies in rice value chain</li> </ul>

### Appendix 3: Priority intervention areas for Rwanda's rice sector

No	Sub sector	Intervention Topic
1.	Seed	<p><b>Private Sector Involvement:</b>            Promote participation of private (national and international) companies, entrepreneurs and cooperatives in producing and marketing foundation and certified seeds of all released rice varieties in the country  <i>Suggested Source(s) of Funding:</i> GoR., DPs and Private Sector  <i>Champions:</i> Rwanda Agriculture Board (RAB), Cooperatives</p>
2.	Seed	<p><b>Promote quality rice (long grain, aromatic, stress tolerance, etc.):</b>            Promote rice types that will meet the consumer demand/preference (by gradually displacing short- and bold with long and grain) and improve the competitiveness and performance of local rice varieties by integrating quality attributes such as aroma, cooking quality, early maturing varieties (4 months), disease resistance, cold tolerance, drought tolerance, and higher yields  <i>Suggested Source(s) of Funding:</i> DPs, AfricaRice, IRRI, GoR  <i>Champions:</i> RAB, AfricaRice</p>
3.	Seed	<p><b>Breeding Facilities:</b>            Establish glass houses, screen houses and equipments that will enable (i) screening of varieties for pest- and disease resistance, and (ii) breeding for new and improved rice cultivars in Rwanda using local and international germplasm  <i>Suggested Source(s) of Funding:</i> DPs  <i>Champions:</i> RAB</p>
4.	Seed	<p><b>Seed quality testing laboratory:</b>            Establish laboratories and equipments that will allow testing of the quality of basic, foundation and certified rice seeds from the seed producers  <i>Suggested Source(s) of Funding:</i> GoR, DPs  <i>Champions:</i> RAB</p>
5.	Fertilizer	<p><b>Inorganic Fertilizers: NPK, Urea</b>            Facilitate private sector in procurement and distribution of adequate quantities of recommended organic manures and inorganic fertilizers such as NPK, Urea and others to farmers in a timely fashion, and encourage use of fertilizers in rice production systems</p>

No	Sub sector	Intervention Topic
6.	Fertilizer	<p><i>Suggested Source(s) of Funding:</i> GoR, DPs, Private sector  <i>Champions:</i> CIP, IFDC, RAB, WB</p> <p><b>Micronutrients:</b>  Identify the deficiency of soil micronutrients in marshlands, and procure, blend and distribute appropriate micronutrients to rice growers  <i>Suggested Source(s) of Funding:</i> GoR, DPs  <i>Champions:</i> IFDC, RSSP</p>
7.	Irrigation/ Water Managem ent	<p><b>Rehabilitation and maintenance of old and new marshlands:</b>  Survey and identify marshlands that require rehabilitation of irrigation and water management structures, and rehabilitate the marshlands and put in place mechanisms (cost, responsibility and monitoring) of regular and periodical maintenance of irrigation structures that will enable cultivation of two rice crops a year  <i>Suggested Source(s) of Funding:</i> GoR, DPs, IWUA (Cooperatives)  <i>Champions:</i> RSSP, IWUA (Cooperatives), AfDB</p>
8.	Irrigation/ Water Managem ent	<p><b>New reclamation of marshlands and irrigation structures:</b>  Identify potential valleys and inland swamps suitable for rice production, reclaim and develop marshlands for expanding area under rice cultivation  <i>Suggested Source(s) of Funding:</i> DPs, GoR., Private sector  <i>Champions:</i> RSSP (WB), Agro Action Allemande, IFAD, AfDB</p>
9.	Irrigation/ Water Managem ent	<p><b>Training Irrigation WUA members, agronomists, supervisors, administrators:</b>  Training of irrigation WUA members, agronomists, supervisors, administrators of marshland irrigation systems on (i) water requirements of rice crop, (ii) soil and water management, (iii) soil and water conservation techniques, (iv) maintenance of irrigation structures, (v) management of revenues, (vi) management of water user associations and (vii) regulatory laws related to water usage in the marshlands  <i>Suggested Source(s) of Funding:</i> GoR., DPs  <i>Champions:</i> RSSP</p>
10.	Irrigation/ Water Managem ent	<p><b>Capacity building of Agronomists, Soil and Water Management technicians for all (old &amp; new) marshlands:</b>  Build human capacity in reclamation and management of marshlands through recruitment of soil technicians, agronomists to create awareness of improved soil and water management practices and facilitate sustainability of</p>



No	Sub sector	Intervention Topic
11.	On-farm technology dissemination (R&E)	<p>marshland ecosystems for continued rice production  <i>Suggested Source(s) of Funding:</i> DPs, Cooperatives, NGOs  <i>Champions:</i> GoR., NGOs</p> <p><b>Private-Public partnerships in Extension services:</b>            Improve the efficiency and professionalism of extension and delivery systems of appropriate technologies by strengthening the capacity of services and skills of extension personnel of private sector across the entire rice value chain through public-private partnerships  <i>Suggested Source(s) of Funding:</i> DPs, GoR., Private sector  <i>Champions:</i> IFDC, AGRA, GoR.</p>
12.	On-farm technology dissemination (R&E)	<p><b>Monitor &amp; Evaluate the effectiveness of extension service systems:</b>            Put in place an effective monitoring and evaluation system of assessing the quality of information/technologies, their impact and effectiveness of delivery of extension services in rice growing areas  <i>Suggested Source(s) of Funding:</i> GoR., DPs, NGOs  <i>Champions:</i> - (None)</p>
13.	On-farm technology dissemination (R&E)	<p><b>Training of technical, extension staff and service providers:</b>            Capacity building of rice growers through scheduled training on production, evaluation of new techniques, soil and water management, integrated pest management, mechanization, post harvest handling and storage, trading, quality, market information, and credit schemes through training modules (in and around the PHHS facilities established by government in high production areas) such as FFS and other approaches  <i>Suggested Source(s) of Funding:</i> DPs, GoR., NGOs  <i>Champions:</i> JICA, KOICA, ETC (China)</p>
14.	On-farm technology dissemination (R&E)	<p><b>Regular and periodical training of farmers through Farmer Field School and other approaches:</b>            Capacity building of rice growers through scheduled training on production, evaluation of new techniques, soil and water management, integrated pest management, mechanization, post harvest handling and storage, quality, market information, and credit schemes through training modules such as FFS and other approaches.  <i>Suggested Source(s) of Funding:</i> GoR., DPs  <i>Champions:</i> FAO, RSSP, JICA</p>
15.	Quality Improvement	<p><b>Training on quality testing:</b>            Train the farmers, traders and processors on improved practices of harvesting, post harvesting and storage in</p>

No	Sub sector	Intervention Topic
16.	Quality Improvement	<p>order to improve the quality of milled rice grains and by-products.  <i>Suggested Source(s) of Funding:</i> DPs, GoR., Private sector, NGOs  <i>Champions:</i> - (None)</p> <p><b>Recruitment of supervisors for milling/grading standards:</b>  Build and enable capacity to monitor and inspect standards, procedures and hygiene of rice milling facilities and grading practices of milled rice by millers, wholesalers, traders and retailers by placing adequate numbers of supervisors  <i>Suggested Source(s) of Funding:</i> GoR.  <i>Champions:</i> MINICOM, RBS</p>

#### Appendix 4: Rice cultivation area, yield and production in Rwanda

Year	Cultivation area (Ha)	Yield (t/Ha)	Production (Paddy, t)	Production (Milled Rice, t)
2000	3,549	3.4	11,925	7,751
2001	7,100	3.5	24,851	16,153
2002	7,844	4.1	31,769	20,650
2003	8,877	4.6	41,011	26,657
2004	9,708	5.1	49,942	32,462
2005	11,610	4.8	55,881	36,323
2006	12,025	4.3	51,958	33,773
2007	11,224	4.5	50,223	32,645
2008	12,000	5.5	66,000	42,900
2009	14,000	5.8	81,200	52,780
2010	12,186	5.8	70,680	45,942

## Appendix 5: Retail Market Prices of rice <sup>11</sup>(FRW/Kg)

Year	Local Rice	Imported Rice	Price Difference (%)
2000	226	258	14.2
2001	239	254	6.3
2002	219	258	17.8
2003	290	328	13.1
2004	338	360	6.5
2005	357	451	26.3
2006	361	426	18.0
2007	412	513	24.5
2008	500	653	30.6
2009	575	692	20.3
2010	523	633	21.0

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<sup>11</sup> Rwanda in Statistics and Figures (2008), National Institute of Statistics of Rwanda

## Appendix 6: Consumption and Importation (Milled Rice, tons)

Year	Consumption	Production	Importations
2001	44,030	16,151	27,879
2002	34,665	20,650	14,015
2003	38,777	26,657	12,120
2004	45,742	32,462	13,280
2005	47,910	36,323	11,587
2006	50,435	33,773	16,662
2007	55,532	32,645	22,887
2008	60,825	42,900	17,925
2009	84,440	52,780	31,660
2010	90,487	45,942	44,545

## Appendix 7: Targets for cultivation area and production of rice

Reclaim 2,500ha of physical cultivation area / year

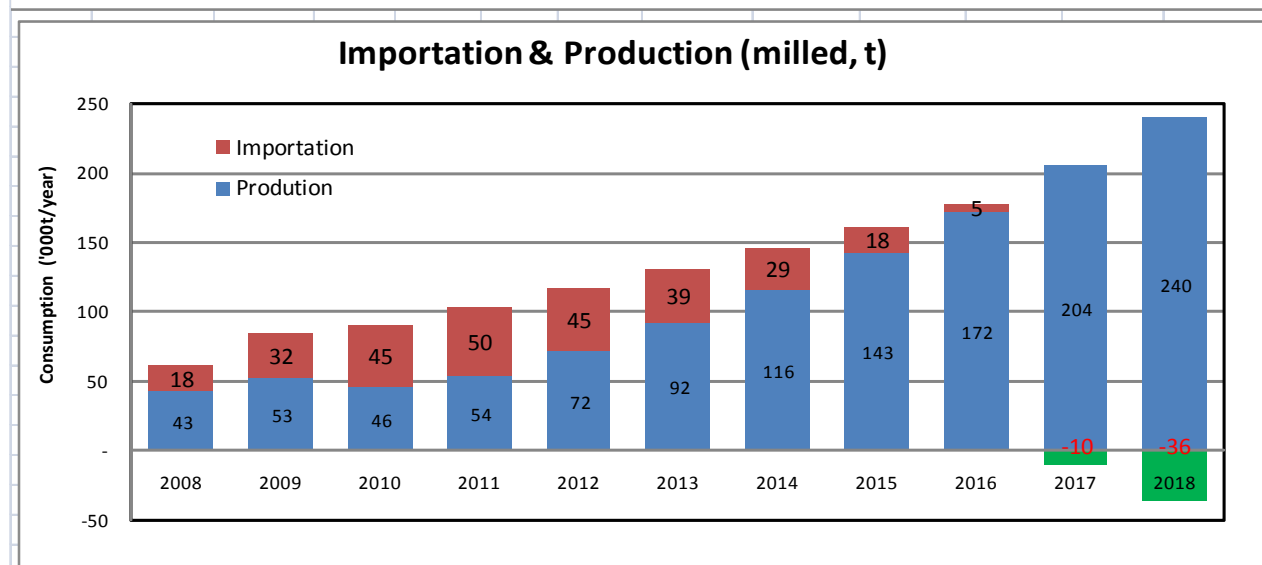
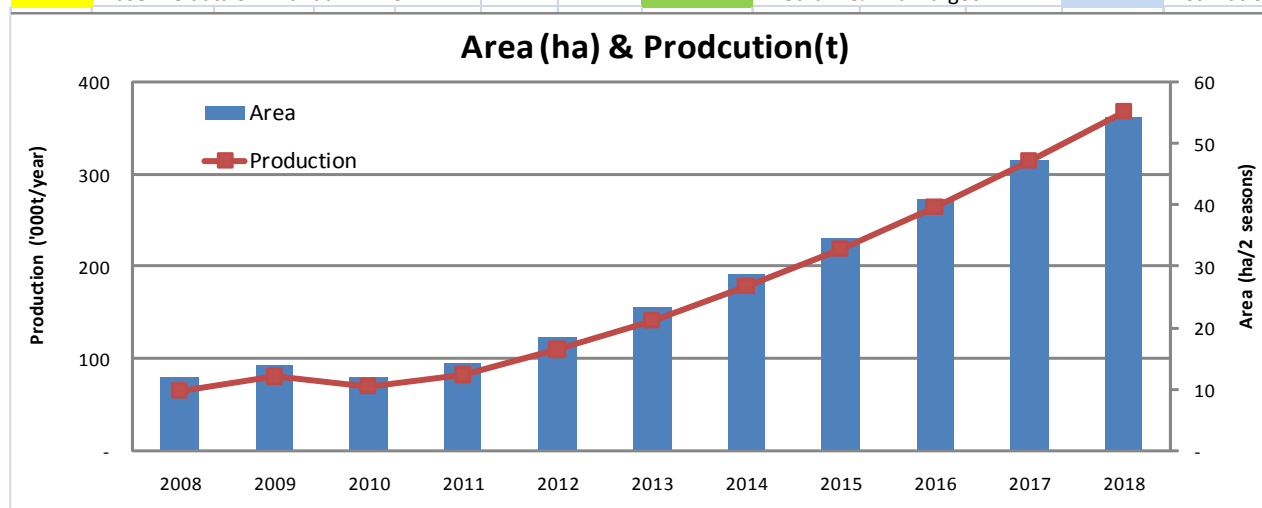
	Area (ha)				Yield*2 (t/ha)		Production (t)		Import*2 (milled, t)	Consumption (t)		Population *3 ('000)
	IR		RF-low	Total	IR	RF-low	Paddy*2	milled*2		milled	/person	
	Physical*1	Total*2										
2008		12,000		12,000	5.5		66,000	42,900	17,925	60,825	6.2	9,832
2009		14,000		14,000	5.8		81,200	52,780	31,660	84,440	8.3	10,117
2010	6,838	12,186		12,186	5.8		70,680	45,942	44,545	90,487	8.7	10,413
2011	8,500	14,245		14,245	5.8		82,621	53,704	49,523	103,227	9.6	10,718
2012	11,000	18,700		18,700	5.9		110,330	71,715	44,932	116,647	10.6	11,033
2013	13,500	23,625		23,625	6.0		141,750	92,138	38,614	130,752	11.5	11,356
2014	16,000	28,800		28,800	6.2		178,560	116,064	29,488	145,552	12.5	11,686
2015	18,500	34,225	500	34,725	6.4	1.0	219,540	142,701	18,353	161,054	13.4	12,022
2016	21,000	39,900	1,000	40,900	6.6	1.5	264,840	172,146	5,143	177,289	14.3	12,365
2017	23,500	45,825	1,500	47,325	6.8	2.0	314,610	204,497	-10,251	194,246	15.3	12,713
2018	26,000	52,000	2,500	54,500	7.0	2.0	369,000	239,850	-35,740	204,110	15.6	13,084

\*1 Data in 2010 = Season 2010B Cultivation area

\*2 Info source (2001 to 2011): RADA / Rice Development Unit

\*3 Info source: P19, Medium senario, NATIONAL POPULATION PROJECTION 2007-2022 (NISR, 2009)

Baseline data of Rwandan NRDS Medium & Final Target Estimation



## Appendix 8: Government strategies and policies to improve the rice sector

Vision 2020	The government intends transform Rwanda into a middle income economy (with a per capita income of 900 USD), decrease the poverty to 30%, and increase the average life expectancy to 55 years by the year 2020. The government seeks to accomplish this vision by transforming agriculture into a productive, high value, market oriented sector, with forward linkages to other sectors. The government recognizes the need to devise ways and means to promote development of industrial scale agro-processing industries by developing an efficient private sector that is driven by the spirits of competitiveness and entrepreneurship.
Government Program (2010-2017)	With an aim to shift Rwanda to a middle income country by 2017, the Government of Rwanda has set out an ambitious program. The program is pinned on to the four pillars namely Good governance, Justice, Economic Development and Social well being of the citizens. It aspires to achieve sustainable economic development through increased agricultural production. Through program 1 under Economic Development, the government intends to promote modern farming by raising the profitability of farmers. It endorses the need for increments in quality and quantity of production, processing, storage and marketing. The programs seek to transform agriculture through improved land use consolidation, soil erosion control, inputs (such as seeds and fertilizers), mechanization, irrigation, post harvest storage systems, human resources, cooperatives, and agricultural finance.
Economic Development and Poverty Reduction Strategies (EDPRS)	Setting the framework for the medium term (2008-2012), the EDPRS seeks to raise agricultural productivity and improve food security. EDPRS plans to expand the area under rice cultivation in the marshlands to 16,442 hectares by reclaiming more marshland. EDPRS acknowledges that the low level of agricultural productivity in Rwanda is due to the low level of agricultural technology. EDPRS intends to assign a greater role in policy implementation to markets and the private sector. To promote commodity chains and support the development of agribusiness, EDPRS intends to subsidize the acquisition of key inputs by farmers' cooperatives. Under EDPRS, public investments are being directed into the construction and rehabilitation of feeder roads.
National Agricultural	National Agricultural Policy (NAP) identifies rice as one of the

Policy	priority agricultural commodities. It proposes that appropriate technological packages need to be developed for the sector to improve its commodity chain. NAP recognizes that rice offers a potential market in the country and in the EAC region. NAP also envisages development of improved post-harvest technologies to enhance quality and value of rice commodity.
Rice Policy	The Rice Policy is one of the latest policies ratified by the Government in respond to increase in rice national demand. The policy document defines new ways to enhance the rice value chain. The NRDS is recognized as the strategic working document of this policy.
Strategic Plan for the Transformation of Agriculture – Phase II (PSTA-II)	The PSTA-II plan acknowledges that rice is one of the value crops in the country. It includes rice as one of the cereal commodity chains that will serve as a major source of internal agricultural markets in Rwanda. Under Program 1, the strategic plan intends to intensify production of rice in Rwanda. Through various sub-programs, it aims to improve the efficiency of use of inputs such as seeds, fertilizers, soil and water. Under sub-program 1.3, it intends to develop marshlands and raise the total area under rice cultivation. It intends to reduce the importation of rice in the country. PSTA-II seeks to energize activities to improve the production and productivity of rice crop.



## Appendix 9: Projected seed and agro-chemical requirement

Year / Item	Land area (Ha)	Seed (tons)	Fertilizer (tons)		Insecticide(L)	Fungicide (L)
			NPK (tons)	Urea (tons)		
2008	12,000	240	2,400	1,200	12,000	12,000
2009	14,000	280	2,800	1,400	14,000	14,000
2010	12,186	244	2,437	1,219	12,186	12,186
2011	14,245	285	2,849	1,425	14,245	14,245
2012	18,700	374	3,740	1,870	18,700	18,700
2013	23,625	472	4,725	2,363	23,625	23,625
2014	28,800	576	5,760	2,880	28,800	28,800
2015	34,725	694	6,945	3,473	34,725	34,725
2016	40,900	818	8,180	4,090	40,900	40,900
2017	47,325	946	9,465	4,733	47,325	47,325
2018	54,500	1,090	10,900	5,450	54,500	54,500

Seed rate per hectare = 20 kg  
 Fertilizer application rate per hectare = 200 kg NPK (17:17:17)  
 100 kg Urea (46%N)  
 Insecticide application rate per hectare = 1 liter  
 Fungicide application rate per hectare = 1 liter

## Appendix 10: Projected requirement numbers of on-farm equipments

Land Area (Ha)		7,000	13,500	28,500	Total
Operation	Equipment	2008	2013	2018	
Land preparation	Power-tiller <sup>12</sup>	625	1205	2545	2545
Planting/ Transplanting	Transplanter <sup>13</sup>	500	964	2036	2036
Harvesting	Thresher <sup>14</sup>	833	1607	3393	3393
	Winnow <sup>15</sup>	1042	2009	4241	4241
Processing	Milling Machine <sup>16</sup>	12	23	48	48

<sup>12</sup> Operational capability of power tiller in land preparation (0.8 H/day; 14 days/season) Ref:  
<http://www.nabard.org/modelbankprojects/powertiller.asp>

<sup>13</sup> Operational capability of Transplanter (28 Ha/year; 14 Ha/season) Ref:  
<http://203.129.218.157/ojs/index.php/kjas/article/viewFile/1078/1024>

<sup>14</sup> Operational capability of pedal thresher (3 t/day; 14 days) Ref:  
[http://www.archive.org/stream/ricepostharvestl022689mbp/ricepostharvestl022689mbp\\_djvu.txt](http://www.archive.org/stream/ricepostharvestl022689mbp/ricepostharvestl022689mbp_djvu.txt)

<sup>15</sup> Operational capability of Hand operated winnow (0.3 t/Hr; 8 hrs; 14 days) Ref:  
[http://www.banglapedia.org/httpdocs/HT/A\\_0077.HTM](http://www.banglapedia.org/httpdocs/HT/A_0077.HTM)

<sup>16</sup> Operational capability of Medium scale mill (3t/Hr; 6 hrs; 250 days/year) Ref:  
<http://www.card.com.vn/news/Projects/026VIE05/Appendixes%20on%20Milling.pdf>

## Appendix 11: Budget Estimation for activities proposed under the NRDS

<b>7.1.2.1. Objective 1: To breed quality rice varieties</b>					
Proposed Activities (PA)					
<b>Objective 1: Output 1: PA (1) Carry out training needs in rice breeding and associated disciplines within the National Agricultural Research System (RAB, ISAE, NUR, etc.)</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Seeds	Human Resource/Capacity Development	Skill Development	Short-term courses for 2 staffs per year; 5 years; IRRI, Africa Rice		
				Course Fee	2000
				Transportation	1500
				Accommodation/Per diem (21 days)	1575
				Sub-total	5075
				2staffs/year; 5 years	50750
				Total_1.1.1	50750
<b>Objective 1: Output 1: PA (2) Provide infrastructure and equipment support to rice seed chain (foundation, breeder and certified)</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Seeds	Infrastructure	Capacity Building	Infrastructure and equipments		
				Cold (germplasm) storage room	50000
				Centralized Laboratory (1000 sq.ft; \$500 per sq. ft)	500000
				Equipments (Weighing Scales, Drying Oven, Counters, Stationeries)	200000
				Field renovation ( Reclamation costs, 1500000 FRW/Ha, 4 Ha x 6 Zones)	60000
				Foundation Seed production (60% of yield; 3.5 Ha; 2011-2018; 8 years)	35000
				Seed Storage (4 warehouses; 50,000 each)	200000
				Total_1.1.2	1045000
				<b>Total_Seeds_Objective_1_Output_1</b>	<b>1095750</b>
<b>Objective 1: Output 2: PA (1) Introduce and test lowland rain-fed rice varieties within selected lowland areas</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Seeds	Information/ Knowledge	R&D	Introduction/Selection		
				<u>Germplasm screening (100 cultivars; dry season only; 2 sites per year; 2 years)</u>	
				Field Costs (3 Ha)	30000
				Technical supervision/organization	30000
				Sub-total	60000

				<u>Multi location trial (dry season only; 8 sites per year; 2 years)</u>	
				Field Costs (8 sites; 10 varieties; 2 Ha each; Yield compensation for farmers)	66667
				Technical supervision/organization	50000
				Sub-total	116667
				Total_1.2.1	176667
<b>Objective 1: Output 2: PA (2) Diffuse recommended rice varieties in the identified rice schemes</b>					
<b>SubSector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Information/ Knowledge	Dissemination (E)	Varietal Release		
				Foundation Seed production (1 Ha; 3 years)	3750
				Multi Media (Posters, prints, visuals, etc.)	10000
				Demonstration (Farmers' fields; 22 schemes; 2 seasons; 1 Ha each)	27500
				Total_1.2.2	41250
				<b>Total_Seeds_Output_2</b>	<b>217917</b>
<b>7.1.2.2. Objective 2: To ensure maintenance of released rice varieties within the farming system</b>					
<b>Objective 2: Output 1: PA (1) Enlist positive attributes of all released rice varieties</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Information/ Knowledge	Maintenance Breeding	Characterization of released varieties		
				Field Operations (Cultivation of 10 varieties; 1 season)	1042
				Agronomic Trait Measurements (2 staffs; 90 field days)	1500
				Total_2.1.1	2542
<b>Objective 2: Output 1: PA (2) Sensitize and train farmers on use and maintenance of certified seed</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Human Resource/Capacity Development	Seed Maintenance	Training on Seed production practices		
				Sensitization Workshop for Seed Growers (40 farmers/3-days per workshop; 1 per year; 8 years; 2011-2018)	40240
				Training on Seed Production (through Farmers' visits (50 Seed producers; 7 visits/program); 5 organizers/program; 44 schemes)	67833
				Total_2.1.2	108073
<b>Objective 2: Output 1: PA (3) Recruit qualified and experienced seed technicians (seed technologists, inspectors, extension agents, agronomists, pathologists, entomologists)</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Human Resource/Capacity	Capacity Building	Recruitment		
				Seed technologists (2)	48000

	Development			Seed Inspectors (5)	60000
				Seed technicians (5)	60000
				Agronomists (5)	60000
				Pathologists/Entomologists (5)	60000
				Extension Agents (44 schemes, 1 new Agronomer/scheme)	528000
				Total_2.1.3	816000
<b>Objective 2: Output 1: PA (4) Carry out continuous tailor-made training modules for RAB rice program staff, seed multipliers, and seed distributors</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Human Resource/Capacity Development	Skill Development	Training		
			In-country Rotational training in 44 schemes, 11 schemes (group) per season		
			2 trainees/scheme; 3 crop growth stages; 1-week each; 2 organizers		16800
			Logistics (2 staffs + field arrangements)		5000
			Sub-total		21800
			2 training sessions per year, In rotation (every 2 years for a given scheme); 2011-18		348800
			Total_2.1.4		348800
			<b>Total_Seeds_Objective 2_Output 1</b>		<b>6987415</b>
<b>7.1.2.3. Objective 3: To ensure availability of adequate certified rice seed to satisfy national demand</b>					
<b>Objective 3: Output 1: PA (1&amp;2) 1. Identify reliable seed multipliers within the rice schemes countrywide, and 2. Identify their needs/constraints associated with rice seed production</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Policy/Institutional Support	Private Participation	Identification of Seed multipliers		
			Appraisals/Surveys (44 schemes; 7-days each)		17967
			Analyses and Finalization (44 schemes; 2-days each)		5133
			Communication		1000
			Total_3.1.1/2		24100
<b>Objective 3: Output 1: PA (3,4&amp;5) 3. Facilitate access to requisite infrastructural &amp; equipment support, 4. Facilitate access to financial support to seed bulkers, distributors and stockists, and 5. Provide continuous tailor-made training to seed bulkers, distributors and stockists</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Seeds	Policy/Institutional Support	Establishing Linkage	Facilitation of awareness between seed producers and finance/service providers		
			Assessment of financial/infrastructural/equipment needs (44 schemes; 4-days each)		10267
			Assessment of available schemes/services (10-days)		583
			Training Workshop on awareness and technologies (7-days; 2 representatives per scheme; 10 invitees, 5 organizers)		36050
			Total_3.1.3/4		46900

				<b>Total_Seeds_Objective 3_Output_1</b>	71000
<b>7.2.2.1. Objective 1: To procure adequate quantity and quality fertilizers</b>					
<b>Objective 1: Output 1: PA (1) Determine soil nutrient status for all rice schemes through soil analyses, consultation of pedological map of Rwanda and other sources</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Fertilizer	Information/Knowledge	Nutrient Profiling	Soil Nutrient Assays		
			Soil Sampling and Analyses from marshlands (44 schemes; 25 samples each)	110000	
			Data Interpretation and Validation (1 consultant; Re-sampling (44))	19400	
			<b>Total_1.1.1</b>	<b>129400</b>	
<b>Objective 1: Output 1: PA (2) Validate fertilizer types and fertilizer rates and give recommendations to rice farmers within respective schemes</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Fertilizer	Information/Knowledge	Site-specific fertilizers	Validation of fertilizer recommendations		
			Field assessment (50% of schemes will require field validation of new fertilizers)		220000
			Soil Expert/Consultant (1 year)		90000
			<b>Total_1.1.2</b>		<b>310000</b>
<b>Objective 1: Output 1: PA (3) Carry out procurement procedures in view of identified fertilizers</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Fertilizer	Policy/Institutional Support	Blending/Procurement	Facilitation of blending and/or procurement of non-standard and/or blended fertilizers		
			Assessment of Needs and Scopes (2 staffs; 4 provinces; 10-days each)		4667
			Facilitation of procurement/blending strategies (1 National Consultant; 30 days)		8500
			<b>Total_1.1.3</b>		<b>13167</b>
<b>Objective 1: Output 1: PA (4&amp;6) 4. Conduct fertilizer demonstrations across all rice schemes, and 6. Sensitize and train farmers on benefits associated with soil-crop nutrient recycling through proper utilization of rice straws and other residues (mulching, composting, livestock feeds and use of animal manure)</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Fertilizer	Human Resources/Capacity Development	Awareness	On-farm demonstrations and Training of farmers on Integrated soil fertility management practices		
			Farmer Compensations on fertilizer demonstrations (44 schemes; twice)		183333
			Logistics (44 staffs, 5 supervising staff, 150 days per training (44*2))		612500
			<b>Total_1.1.4/6</b>		<b>795833</b>
<b>Objective 1: Output 1: PA (5) Support RAB, decentralized structures, rice producers' cooperatives and other CBOs through organized tailor-made training courses</b>					

Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Fertilizer	Human Resources/Capacity Development	Skill development	Training for organizations involved in the fertilizer value chain			
			Workshop Meeting on Fertilizer- supply and use (1 Expert, 5-days; once a year; 2011-2018)		44000	
					Logistics	80000
					Total_1.1.5	124000
				<b>Total_Objective1_Output_1</b>	<b>1372400</b>	
<b>7.2.2.2. Objective 2: To promote private sector service providers (SPs) invest in bulk fertilizer procurement and distribution</b>						
<b>Objective 2: Output 1: PA (1,2&amp;3) 1. Identify interested and capable private SPs in undertaking fertilizer procurement &amp; distribution by location within rice producing zones, 2. Identify and sensitize private sector that are already in fertilizer business or are interested in such enterprise, and 3. Carry out tailor-made training courses for the identified private enterprises/entrepreneurs</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Fertilizer	Policy/Institutional Support	Private participation	Support to potential investors			
				Identification of capable private entrepreneurs (44 schemes; 5-days each)		12833
				Sensitization of investors on the scopes and potential (workshop; 5-days; twice)		10417
				Logistical support and Organizers (2; 1 Expert + National Consultant) for Workshop Meetings		60000
				Total_2.1.1/2/3	83250	
<b>Objective 2: Output 1: PA (4) Facilitate access to credit and other available financing facilities</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Fertilizer	Policy/Institutional Support	Financing	Investment Policy Facilitation			
				Analyses of policy and strategies of finance for potential investors in procurement (1 Consultant; 20 days)		14500
				Stakeholders' Workshop (Finance Institutions, Investors, Cooperatives, Govt.) (3-days; 3 support staff)		10175
					Total_2.1.4	24675
				<b>Total_Objective2_Output_1</b>	<b>107925</b>	
<b>Objective 2: Output 2: PA (1,3&amp;4) 1. Identify and sensitize fertilizer traders and distributors and other players at grass root levels in all rice schemes, 3. Carry out continuous tailor-made trainings to fertilizer traders, distributors, stockists and rice farmers, across rice schemes, and 4. Facilitate access to credit and available financing facilities for the stakeholders in the fertilizer sub sector</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Fertilizer	Human Resources/Capacity Development	Capacity building	Sensitization and Training of traders, dealers, cooperatives, stockists			
				Identification of traders, dealers, stockists, cooperatives for fertilizer distribution (44 schemes, 10-days each)		25667
				Training (4 provinces; 11 schemes per session; 4 sessions; 2 sessions per year; 3-days each; 20 participants, 5 staffs)		12500
					Total_2.2.1/3/4	38167

<b>Objective 2: Output 2: PA (2) Facilitate experienced cooperatives to become input suppliers</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Fertilizer	Human Resources/Capacity Development	Capacity building	Training on Business skills and organization		
				Recruitment (2 National Consultant; 30 days)	9000
				Workshop on business development (2 participants each; 44 schemes; 11 schemes/session; 4 sessions; twice; 3-days each)	22000
				Total_2.2.2	31000
				<b>Total_Objective2_Output_2</b>	<b>69167</b>
<b>7.2.2.3. Objective 3: To provide site specific fertilizer recommendations across all rice schemes</b>					
<b>Objective 3: Output 1: PA (1,2&amp;3) Identify sites that require soil analysis for purposes of completing the work initiated by RSSP, 2. Carry out fertilizer trials at selected representative sites covering all rice schemes, and 3. Provide site-specific fertilizer recommendations for all rice schemes</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Fertilizer	Information/Knowledge	Soil Analyses & Validation of Fertilizers	..(Covered under Objective 1, Output 1, PA 1,2,4 and 6)..		
				<b>Total_Objective3_Output_2</b>	<b>1235233</b>
<b>7.3.2.1. Objective 1: To increase area under rice production in irrigated conditions</b>					
<b>Objective 1: Output 1: PA (1) Develop an estimated 5,330 Ha of marshland area for rice production by 2018</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Irrigation/ Water Management	Infrastructure	Marshland reclamation	Reclaim additional marshlands providing 2 seasons of 5,330 Ha for rice cultivation		
				Pre-feasibility studies: (2-months) 2 International Consultants, 2 National Consultants, 2 support staff & Logistics	69000
				Feasibility studies: 4-months; Team (Agronomists (1 expert + 2 national consultants), Soil Specialists (1 expert + 2 national consultants), Engineers (2 experts + 4 national consultants), Socioeconomics (1 expert + 2 national consultants), Coordinator (1), Support staff (5) & Logistics	556893
				Reclamation @ 7500 USD/Ha	39975000
				Sub-total	40600893
				Administration (10%)	4060089
				Contingencies (10%)	5339017
				Total_1.1.1	50000000
				<b>Total_Objective1_Output_1</b>	<b>50000000</b>
<b>Objective 1: Output 2: PA (1) Carry out an inventory of existing irrigation facilities for each of the rice schemes for rehabilitation purposes</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Irrigation/ Water Management	Policy/Institutional Support	Marshland rehabilitation	Taking stock of conditions of irrigation facilities in marshlands		
				Appraisal; 4-months; Engineers (2+2), Agronomes (1+1), Soil and water experts (2+2), support staff (2)	362000
				Logistics	36200
				Total_1.2.1	398200



<b>Objective 1: Output 2: PA (2) Install irrigation structures and system for regular maintenance</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Irrigation/ Water Management	Infrastructure, Policy	Marshland rehabilitation	Re-establish irrigation facilities and introduce a viable system of maintenance		
				Marshland rehabilitation: Estimated 20% of existing physical marshland area (8000 Ha = 1600 Ha) @ US\$ 5000/Ha	8000000
			Options on mechanisms of irrigation structures : 2 consultants (National) & Logistics, 45-days		32000
				Total_1.2.2	8032000
				<b>Total_Objective1_Output_2</b>	<b>8430200</b>
<b>Objective 1: Output 3: PA (1) Sensitize private sector on the importance of developing and rehabilitating the marshlands for rice production, in view of the existing unexploited agricultural potential within Rwandan marshlands</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Irrigation/ Water Management	Policy/Institutional Support	Private Investments	Evaluate the private sector on their interests, scopes and benefits of rehabilitation of marshland and/or irrigation structures		
				Appraisal of private sector: 1 Expert + 2 consultants (National); 45-days	56250
					Logistics
				Total_1.3.1	67500
<b>Objective 1: Output 3: PA (2) Establish the required policy and financial support environments for investment within marshlands</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Irrigation/ Water Management	Policy/Institutional Support	Private Investments	Policy Issues and Options on financial support for private investments		
				Appraisal of private sector: 1 Expert + 1 consultants (National); 45-days	42750
					Logistics
				Total_1.3.2	54000
				<b>Total_Objective1_Output_3</b>	<b>121500</b>
<b>7.3.2.2. Objective 2: To rehabilitate old and run-down rice schemes within the developed marshlands</b>					
<b>Objective 2: Output 1: PA (1&amp;2) 1. Identify and evaluate all old and rundown rice schemes, and 2. Design and implement rehabilitation and maintenance strategies</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Irrigation/ Water Management	Policy/Institutional Support	Natural Resource Management	Evaluate the sustainability of natural resources in marshlands, design new strategies for rehabilitation and maintenance		
			Assessment of the water resources and management in rice schemes: 60 days; (Soil & Water(1 expert + 1 National staff), Natural Resource Management (1 expert + 1 National staff) and 1 support staff)		110000
					Logistics
				Total_2.1.1/2	121000
				<b>Total_Objective2_Output_1</b>	<b>121000</b>

Sub Sector	Element	Sub Component	Activity	Particulars	Cost
<b>7.3.2.2. Objective 3: To improve irrigation water use efficiency within existing and new marshlands</b>					
<b>Objective 3: Output 1: PA (1&amp;2) 1. Disseminate the importance of regulations under IWUA transparent water use, management and maintenance guidelines/by-laws, and 2. Sensitize and train members of the IWUA and local administrators on the rationale of equitable water use for increased rice production</b>					
Irrigation/ Water Management	Policy/Institutional Support	Irrigation water user association (IWUA)	Promote effective functioning of Irrigation Water Users' Association in Marshlands	Sensitization: 44 rice schemes, 2 support staff, 3 years	648000
				Training: 1-week/session, 1 session/scheme/year (for 2 years)	616000
				Policy: 1 consultant (2-months), 1 support staff, 4 M&E staff	237000
				Logistics	88500
				Total_3.1.1/2	1589500
				<b>Total_Objective3_Output_1</b>	<b>1589500</b>
<b>7.4.2.1. Objective 1: To increase adoption of appropriate rice improvement technologies</b>					
<b>Objective 1: Output 1: PA (1) Promote and scale-up "Farmer Field School (FFS)" and other participatory research-extension system in all rice schemes</b>					
On-farm Technology Dissemination (Extension)	Human Resource/Capacity Development	Farmers' Field School	Scaling up and Promotion of FFS	Promotional activities (4 provinces, 5 staffs each); 5 years (from 2013)	1800000
				Extending FFS; Scaling up (Cost reference: Objective 1, Output 1, PA 3)	1502222
				Total_1.1.1	3302222
<b>Objective 1: Output 1: PA (2) Identify agronomists and lead farmers (LFs) from the rice schemes (cooperatives, unions, NGOs, FBOs) to participate on the training of trainers (ToT) sessions</b>					
On-farm Technology Dissemination (Extension)	Human Resource/Capacity Development	Farmers' Field School	Planning for FFS: Identification of lead farmers and agronomists for the conduct of FFS in marshlands	Identification of 1555 sites [(0.2*26000)/(30*0.15)] and lead farmers for FFS (1 coordinator, 4 provincial heads, 20 staffs); 2-months	76000
				Logistics	7600
				Total_1.1.2	83600
<b>Objective 1: Output 1: PA (3,4&amp;6) 3. Train them on the latest and appropriate technologies in rice development (production through to harvesting and post-harvest), 4. Furnish them with the requisite training facilities and necessary supports to enable them disseminate the technologies learnt, and 6. Strengthen programs of mass extension messages within rice development schemes, including newspapers, brochures, films &amp; video shows, local/national radio broadcasts, TV shows, etc.</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost

On-farm Technology Dissemination	Human Resource/Capacity Development	Farmers' Field School	Training for FFS facilitators and trainers of trainees (ToT), and Promotion		
			Training for Facilitators, 1-month (accommodation, food, pocket money (3000Frw/day) per season, 2 seasons per year		1502222
			Tools for Training (Knap sack sprayers (50), implements (plough tools (20), rotary weeders (100), small pumps (20)), Sickles (100), Pedal threshers (50))		75000
				Logistics for Procurements	7500
				Dissemination tools (prints, audio, video, multi-media tools)	30000
			Total_1.1.3/4/6	1614722	
<b>Objective 1: Output 1: PA (5) Develop and implement a program of certifying farmers, including women farmers, as trainers and facilitators after they have been involved in participatory research and extension activities and receive specified types of additional training afterwards</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Human Resource/Capacity Development	Farmers' Field School	Awarding Farmers, trainers and facilitators		
			Selection of awardees (Once a year; 4 National Consultants (1-month/year); 5 years (from 2013))		100000
				Logistics (Certification, communication, and ceremony)	50000
				Total_1.1.5	150000
			<b>Total_Objective1_Output_1</b>	5150544	
<b>Objective 1: Output 2: PA (1) Identify interested and capable private sector companies and/or individuals</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Policy	Public-Private partnerships	Identification of potential candidates from private sector		
			Appraisal of interest, capabilities (1 Expert, 2 National Consultants; 30-days)		34500
				Logistics	3450
			Total_1.2.1	37950	
<b>Objective 1: Output 2: PA (2) Systematically provide capacity support in terms of finance and human resource development</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Policy	Public-Private partnerships	Facilitation of capacity support (finance and human resources)		
			Assessment of financial and HR needs (1 expert, 1 National consultant; 30 days)		27000
				Logistics	2700
		Infrastructure	Recruitment of human resources (Expected: 5 agronomes per rice growing province; 5 years from 2014-2018)		1200000
			Infrastructure support (Cost of sharing of maintenance/renovation of existing public office/Storage space; 10,000 USD per rice growing province; 5 years)		200000
			Total_1.2.2	1429700	
			<b>Total_Objective1_Output_2</b>	1467650	

<b>Objective 1: Output 3: PA (1) Identify main rice schemes to establish at least one farmers training center per province (except Northern province)</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Policy/Institutional Support	Farmers training center	Identification of suitable rice schemes	Potential/Need assessment (2 National Consultants; 45-days)	22500
				Logistics	2250
				<b>Total_1.3.1</b>	<b>24750</b>
<b>Objective 1: Output 3: PA (2) Develop the required capacities (human and infrastructure)</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Infrastructure	Capacity Building	Build farmers' training centers (Expected 1 per rice growing province)	Cost of construction (2000 sq. ft; \$500 per sq. ft)	4000000
				Interiors (training facilities; 100,000 per center)	400000
				<i>Human resources ..covered under 7.9 (Policy tools)..</i>	
				<b>Total_1.3.2</b>	<b>4400000</b>
				<b>Total_Objective1_Output_3</b>	<b>4424750</b>
<b>7.4.2.2. Objective 2: To scale-up identification and characterization of major pests and diseases of rice in all rice schemes in Rwanda</b>					
<b>Objective 2: Output 1: PA (1) Identify and characterize major pests and diseases across all rice schemes of Rwanda</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Information/Knowledge	Plant Protection	Diagnosis of major pests and diseases	Characterization of pests and diseases (2 Experts; 4 National consultants; 2-months; every 3 years; twice until 2018)	200000
				Logistics	20000
				<b>Total_2.1.1</b>	<b>220000</b>
<b>Objective 2: Output 1: PA (2) Improve the awareness and preparedness of rice growers against outbreaks of pests and diseases in rice schemes</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
On-farm Technology Dissemination	Information/Knowledge	Plant Protection	Create awareness and preparedness	Monitoring and Forecasting Committee (5 Lead farmers per province (5 days per season); 4 National consultants (7 days per season)); 2011-2018	118667
				Logistics	11867
				<b>Total_2.1.2</b>	<b>130533</b>
				<b>Total_Objective2_Output_1</b>	<b>350533</b>
<b>7.4.2.3. Objective 3: To design and implement pests and diseases control measures</b>					
<b>Objective 3: Output 1: PA (1) Recommend and demonstrate identified pests and diseases mitigation measures such as the use of diseases resistant varieties</b>					

Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
On-farm Technology Dissemination	Information/Knowledge	Plant Protection	Dissemination of plant protection Measures			
				Recommendation of remedial measures (2 Experts, 4 National Consultants; 30-days; every 3 years)	34500	
					Logistics	3450
				Validation/Demonstration of Protection measures (Field cost; 4 provinces; 40 lead farmers per province; field appraisal through 4visits per season)	34000	
				Organization of demonstrations (4 National Consultants; 6-months)	240000	
				Logistics	27400	
				Total_3.1.1	301400	
<b>Objective 3: Output 1: PA (2) Create awareness, and provide training and extension services on pests and diseases identification and control measures including integrated pest management (IPM), safe handling and utilization of pesticides to field extension agents and farmers</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
On-farm Technology Dissemination	Provision/Support	Plant Protection	Training for Farmers on plant protection aspects			
				Staff (44 schemes; 4-days per session; 3 sessions per scheme (2011-2018); 4 National consultants, 4 Agronomes, 4 support staff (1 each per province))	528320	
				Training Costs (Farmer participation (20 farmers/scheme/session); Field costs (75% of production costs; 0.5 Ha per training session))	455125	
				Logistics	98345	
				Total_3.1.2	1081790	
<b>Objective 3: Output 1: PA (3) Facilitate research &amp; development (R&amp;D) efforts in the field of pesticide production, safe handling and utilization, with the aim of diversifying pesticide use</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
On-farm Technology Dissemination	Provision/Support	Validation	Test and validate the agronomic and cost efficiency of pesticides/alternates			
				Validation trials for existing and potential pesticides (Field costs (100% production costs); 2 trials/province; 1 Ha each; once a year till 2018)	133333	
				Consultation on methods and results (1 Expert (30-days; once a year)	156000	
				Logistics (Importation of pesticides/tools)	28933	
				Total_3.1.3	318267	
<b>Objective 3: Output 1: PA (4) Facilitate procurement and distribution of the recommended pesticides to farmers through agro-dealers and SPs</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
On-farm Technology Dissemination	Policy/Institutional Support	Facilitation	Enable agro-dealer network on procurement and distribution			
				Assessment of needs and options for procurement and distribution (1 Expert, 4 National Consultants, 1 support staff; 60-days)	100500	
				Logistics	10050	

				Total_3.1.4	110550	
<b>Objective 3: Output 1: PA (5) Provision/support to farmers on small tool requirements for sustainable management of pests and diseases through IPM</b>						
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>	
On-farm Technology Dissemination	Provision/Support	Integrated Pest Management	Increase access to small tools for sustainable control of pests and diseases			
			Identification of appropriate tools for IPM (1 Expert, 2 National Consultants; 30-days)			49500
			Purchase of small tools (Estimated 250 tools per scheme; 44 schemes)			1100000
			Logistics			114950
				Total_3.1.5	1264450	
				<b>Total_Objective3_Output_1</b>	<b>3076456</b>	
<b>7.5.2.1. Objective 1: To increase rice productivity through efficient land use</b>						
<b>Objective 1: Output 1: PA (1) Determine appropriate mechanization options for all rice schemes</b>						
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>	
Mechanization	Information/Knowledge	Mechanization Options	Assessment of agronomic and economic feasibilities of mechanization modes			
			Appraisal of mechanization options (2 Experts (Engineer, Agronomist); 1 National Consultant; 60-days)			93000
			Validation of options (44 schemes; field testing of implements/machineries)			110000
			Logistics			20300
				Total_1.1.1	223300	
<b>Objective 1: Output 1: PA (2) Sensitize and demonstrate benefits of mechanization and land consolidation on mechanized rice production within the marshlands</b>						
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>	
Mechanization	Capacity Development	Dissemination	Training on the use and awareness on the agronomic and cost efficiencies of mechanization Improve the capacity of technical staff in private and public sector			
			Demonstration on the use and benefits of machineries/implements (44 schemes; 2-days; once a year; 2011-2018)			1408000
			Organization/participation (4 National consultants (1/province) and 8 support staffs (2/province); 20 farmers/session)			154133
			Logistics			156213
				Total_1.1.2	1718347	
				<b>Total_Objective1_Output_1</b>	<b>1941647</b>	
<b>7.5.2.2. Objective 2: To reduce human labor cost in rice production and post-harvest handling activities</b>						
<b>Objective 2: Output 1: PA (1) Facilitate capacity building for both private and public personnel, through focused/tailor-made short and medium term training activities within and outside Rwanda</b>						
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>	
Mechanization	Human	Skill Development	Improve the capacity of technical staff in private and public sector			

	Resource/Capacity Development			In-country training modules (2 Experts (21-days)	27300
				In-country training (5-days)for service providers (15) and RAB staff on farm mechanization (5); once a year; 2011-2018)	4167
				In-country training Materials (Machineries/Implements; Operational costs)	60000
				Logistics	9147
				On the Job training Modules (1 short-term course a year (21-days); 6 staffs (3+3) public and private sectors	27150
				Total_2.1.1	127763
<b>Objective 2: Output 1: PA (2) Sensitize the stakeholders on the benefits associated with increased adoption of farm machinery and equipments in the marshlands</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Mechanization	Human Resource/Capacity Development	Skill Development	Train the farmers on the use and benefits of mechanization		
			Provision of training (1 Coordinator/Expert; 4 National Consultants and 4 support staffs (11 schemes each); 3-days/session; 2011-2018)		1003200
			Training Modules (44 schemes; 1 session per scheme per year; 25 farmers/session; 3-days; 2011-2018)		660000
				Logistics	166320
				Total_2.1.2	1829520
				<b>Total_Objective2_Output_1</b>	<b>1957283</b>
<b>7.5.2.3. Objective 3: To improve access and availability of farm machineries and implements for rice production</b>					
<b>Objective 3: Output 1: PA (1,2&amp;3) 1. Identify the limitations in farm machineries and equipments that are recommended for rice schemes, 2. Facilitate procurement of the recommended farm machineries and implements through private sector participation and 3. Encourage provision of mechanization services in marshlands by directly promoting private service providers</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Mechanization	Policy/Institutional support	Public/Private investments	Assess the needs and facilitate procurement of machineries/implements and provision of mechanization services		
			Appraisal of gaps and requirements in machineries, implements and services (1 Expert, 4 National Consultants, 60-days)		99000
			Policy environments for private investments in procurement and service provision (1 Expert; 30-days)		19500
			Lobbying for investments by public (banks/MFI) and private sectors (1 Expert, 1 National consultant; 30-days)		27000
				Logistics (Assessment)	14550
				Total_3.1.1/2/3	160050
<b>Objective 3: Output 1: PA (4&amp;6) 4. Support establishment of workshops for fabricating prototypes across the rice schemes, 6. Establish farm machinery workshop posts close to all rice schemes</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Mechanization	Infrastructure	Mechanical workshops/places	Establishment of workshops for R&D on designs and prototypes		
			Construction of workshops (4 (1/province); 3000 sq ft; 500 USD/sq ft)		6000000

			Operationalization of workshops (Interiors and basic machineries & tools (\$250,000/workshop)	1000000
			Total_3.1.4/6	7000000
<b>Objective 3: Output 1: PA (5) Train engineers, technicians and rural artisans in fabrication/maintenance of prototypes and other operations</b>				
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>
Mechanization	Human Resources/Capacity Development	Training	Improve the skills of grass-root level workers on operations and designing of machineries and implements	
			Training requirements (\$5000 each; 4 provinces; 1 session per year; 2011-2018)	160000
			Training participation (25 participants per session; 5-days/session; 4 provinces; Each year; 2011-2018)	166667
			Logistics	32667
			Total_3.1.5	359333
			<b>Total_Objective3_Output_1</b>	<b>7519383</b>
<b>7.6.2.1. Objective 1: To increase the milling quality of Rwandan rice</b>				
<b>Objective 1: Output 1: PA (1&amp;3) 1. Sensitize and train rice producers and millers on the benefits associated with producing high quality rice, 3. Encourage routine/regular servicing and maintenance of machinery and equipments for increased efficiency</b>				
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>
Quality Improvement	Human Resource/Capacity Development	Training	Sensitize and create awareness on the linkage between production and processing of rice grains	
			Training requirements for rice growers (1 Expert; 2 National consultants; 44 schemes; 3 (2+1 overlap with farmers and millers) days each; once in 2 years; 2011-2018)	151800
			Participating rice growers (44 schemes; 50 farmers/session; 2-days; once in 2 years; 2011-2018)	440000
			Participating millers (2-days; 1-day overlapping with farmers' training 44 schemes; 3 millers/session; 2-days; once in 2 years; 2011-2018)	17600
			Logistics	60940
			Total_1.1.1/3	670340
<b>Objective 1: Output 1: PA (2) Enforce quality standards/norms for rice through RBS and related stakeholders, through banning of inefficient hullers/mills</b>				
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>
Quality Improvement	Policy/Institutional support	Regulations	Evaluate the efficiency of mills in rice schemes	
			Comprehension of RBS assessment of samples from mills (2 National consultants (1 per province); 30-days; Every year; 2011-2018)	120000
			Logistics	12000
			Total_1.1.2	132000
<b>Objective 1: Output 1: PA (4) Provide concessions and financial support for entrepreneurs on residue management and value addition</b>				



Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Quality Improvement	Policy/Institutional support	Financial incentives/support	Assess the needs and means of providing financial support			
			Appraisal of requirements and policies (1 Expert, 1 National consultant; 30-days; once in 2 years; 2011-2018)		108000	
					Logistics	10800
					Total_1.1.4	118800
					<b>Total_Objective1_Output_1</b>	<b>921140</b>
<b>7.6.2.2. Objective 2: To minimize the harvest and post-harvest losses of rice</b>						
<b>Objective 2: Output 1: PA (1) Identify and recommend appropriate threshing, drying, winnowing machines and other equipment that could be used by smallholder farmers</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Quality Improvement	Policy/Institutional support	Need assessment	Identify the gaps in post harvest facilities and/or equipments			
			Appraisal of post harvest requirements (2 Experts (Agronomy/Mechanization), 2 National Consultants; 60-days)		108000	
					Logistics	10800
					Total_2.1.1	118800
<b>Objective 2: Output 1: PA (2) Scale up availability and usage of intermediate machineries and equipments in post harvest handling operations such as drying and storage</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Quality Improvement	Infrastructure	Provision/support	Construction and/or provision of post harvest facilities/machineries			
			Construction of drying yards (Expected 5 new yards/scheme; 44 schemes; 1000 sq.ft each; \$50/sq. ft)		11000000	
			Post harvest machineries (50% cost sharing with cooperatives; 100 threshers and 100 winnowing/other machines per scheme; \$100 each; 44 schemes)		440000	
					Logistics	44000
						Total_2.1.2
<b>Objective 2: Output 1: PA (3) Facilitate scaling up and promotion of Warehouse Receipt System in all rice schemes</b>						
Sub Sector	Element	Sub Component	Activity	Particulars	Cost	
Quality Improvement	Policy/Institutional support	Access to traders	Enable scaling up and promote warehouse receipt system			
			Facilitation of scaling up (2 National Consultants; 30-days)		15000	
			Promotion of warehouse receipt system(2 National Consultants; 1 supporting staff; 2 x 30-days)		33000	
			Workshop on Warehouse receipt system(2-days/session; 4 provinces; 25 participants/session; Every year; 2011-2015)		16667	
					Logistics	6467
			Total_2.1.3	71133		

<b>Objective 2: Output 1: PA (4) Increase number of milling facilities capable of producing grades 1 and 2</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Quality Improvement	Policy/Institutional support	Milling quality	Raise the number of efficient mills through training and policy interventions		
		Facilitate enabling environments for efficient milling in all marshlands (1 Consultant; 21-days)			
	Training Requirements (1 Expert, 1 National consultant; 1 supporting staff; 2-days/province; 4 provinces; Every year; 2011-2018)				64000
	Training Modules (10 millers; 2-days/province; 4 provinces; Every year; 2011-2018)				26667
				Logistics	10432
				Total_2.1.4	114748
				<b>Total_Objective2_Output_1</b>	<b>11788682</b>
<b>7.7.2.1. Objective 1: To improve physical access to national/regional markets</b>					
<b>Objective 1: Output 1: PA (1) Rehabilitate and construct feeder roads within existing and newly reclaimed marshlands</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Market	Infrastructure	Feeder roads	Establishment of transport routes to marshlands		
		Prioritization, Categorization of roads, Feasibility (4 Experts (Economist(s), Engineer(s), Rural Development); 2 x 25-days)			
				Logistics	13000
		Construction of feeder roads (Expected; 50 Km/scheme; 44 schemes; Estimated cost*=19,311/Km)			42484200
				Total_1.1.1	42627200
* <a href="http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_policy/@invest/documents/publication/wcms_asist_10178.pdf">http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_policy/@invest/documents/publication/wcms_asist_10178.pdf</a>					
<b>Objective 1: Output 1: PA (2) Encourage private millers and traders to reach out to rice producers in remote and inaccessible areas through incentives</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Market	Policy/Institutional support	Access for traders	Encourage trading in remote areas		
		Assessment of policy instruments/options (1 Expert, 4 National Consultants (1 per province); 30-days)			
				Logistics	4950
	Workshop meetings with post harvest value chain players (40 participants; 3-days/session; 4 provinces; once a year; 2011-2018)				160000
				Total_1.1.2	214450
				<b>Total_Objective1_Output_1</b>	<b>42841650</b>
<b>Objective 1: Output 2: PA (1) Facilitate transparency in trading, pricing and price incentives for quality products through networking of farmer cooperatives, and communication and extension services</b>					
Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Market	Policy/Institutional support	Market Information	Establish communication network on trading, pricing and incentives		
		Ascertain the mechanism of networking (2 Experts (Economist, IT), 2 National consultants; 30-days)			
				Logistics	5400

			Setting up of communication network (network tools, nodes, web systems)	100000	
			Total_1.2.1	159400	
<b>Objective 1: Output 2: PA (2) Improve linkages between input and output markets by integrating players in the value chain with millers and traders</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Access to Market	Policy/Institutional support	Market Information	..Same as Objective 1; Output 1; PA (2)..		
<b>Objective 1: Output 2: PA (3) Conduct surveys on household consumption, consumer preference, demand trends and price sensitiveness of traders and consumers</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Access to Market	Policy/Institutional support	Consumer Demands	Survey rice consumer demand details in the country		
			Survey and Analyses (1 Economist, 4 National consultants, 8 supporting staff; 45-days; once in 4 years (2011-2018))		92250
			Logistics		9225
			Total_1.2.3		101475
			<b>Total_Objective1_Output_2</b>		<b>475325</b>
<b>7.8.2.1. Objective 1: To increase access to agriculture finance by rice farmers and other players in the rice value chain</b>					
<b>Objective 1: Output 1: PA (1,2&amp;4) 1. Sensitize rice farmers on benefits associated with the use of agriculture finance and available financing products (credit and savings products), 2. Link farmers to available credit and other financing facilities and, 4. Train and/or facilitate farmers in acquiring basic farm management skills that enable them operate efficiently and fulfill credit servicing requirements</b>					
<b>Sub Sector</b>	<b>Element</b>	<b>Sub Component</b>	<b>Activity</b>	<b>Particulars</b>	<b>Cost</b>
Access to Finance	Human Resource/Capacity Development	Skill Development	Link farmers and farmer cooperatives with agriculture finance schemes, and provide financial skills and management through training		
			Training requirements (2 National consultants, 2 supporting staff; (2+2+1) days; 4 provinces; Every year; 2011-2018)		33600
			Training participation (4 provinces; 2-days; 50 farmers/cooperatives; Every year; 2011-2018)		106667
			Training workshop requirements (1 Expert (Economics), 2 National Consultants, 2 supporting staff; (5+2) days/session; 2 sessions; Every year; 2011-2018)		151200
			Training workshop for cooperatives (50 representatives from 22 schemes each; 2 sessions (44 schemes); 5-days; Every year; 2011-2018)		166667
			Preparation of multi-media materials (prints, audio and video messages; 1 Expert, 2 National consultants, 2 supporting staff; 14-days; Every 2 years; 2011-2018)		75600
			Multimedia Preparation (Prints, Audio, Video materials)		125000
			Logistics		65873
			Total_1.1.1/2/4		724607

**Objective 1: Output 1: PA (3,5&6) 3. Train and/or facilitate farmers, cooperatives and service providers in preparation of bankable projects and acceptable business plans, 5. Assist cooperatives keep proper inventory of the assets that are used as collateral, and 6. Facilitate commercial banks and MFIs prepare and present attractive credit and savings products**

Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Finance	Human Resource/Capacity Development	Skill Development	Link farmers and farmer cooperatives with agriculture finance schemes, and provide financial skills and management through training		
		Training Requirements (1 Socioeconomics, 2 National consultants, 2 supporting staff; (5+5) days; Every year; 2011-2018)			92000
		Training Farmer cooperatives/Farmers/Entrepreneurs (30 participants; 5-days/session; Every year; 2011-2018)			50000
		Stakeholders' workshop requirements (2 National consultants, 2 supporting staff; (2+2+1) days; 4 provinces; Every 2 years; 2011-2018)			16800
		Workshop with stakeholders (Banks/MFI/Ministries/Institutions; 25 per session; 2-days; Once in 2 years; 2011-2018)			10000
				Logistics	16880
				Total_1.1.3/5/6	185680
				<b>Total_Objective1_Output_1</b>	<b>910287</b>

**Objective 1: Output 2: PA (1) Categorize authorized rice traders, millers and other service providers including rice cooperatives based on their financial performance**

Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Finance	Policy/Institutional Support	Inventory of commodity chain stakeholders	Census on authorized players in rice commodity chain		
				Survey team (1 National Consultant (Economics), 1 supporting staff; (40+20)-days); Every 4 years	42000
				Logistics	4200
				Total_1.2.1	46200

**Objective 1: Output 2: PA (2) Provide linkage amongst rice traders, millers, service providers and financial institutions (commercial banks, MFIs etc.)**

Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Finance	Human Resource/Capacity Development	Linkage with stakeholders in finance sub sector	Regular workshop meetings with stakeholders		
				Workshop requirements (1 National consultant (Economics), 2 supporting staff; (3+3) days/session; Every year; 2011-2018)	21600
			Workshop meeting (40 participants; 3-days/session; Every year; 2011-2018)		40000
				Logistics	6160
				Total_1.2.2	67760

**Objective 1: Output 2: PA (3) Facilitate financing institutions to provide working capital credits to rice traders including cooperatives and unions that buy paddy during the harvesting period**

Sub Sector	Element	Sub Component	Activity	Particulars	Cost
Access to Finance	Policy/Institutional Support	Financial instruments	Create favorable environments for increased access to finance in rice sector		

Finance	Support	Issues and Policy options (1 Expert, 1 National consultant, 1 supporting staff; 21-days, Every 2 years; 2011-2018)				168000
					Logistics	16800
					Total_1.2.3	184800
					<b>Total_Objective1_Output_2</b>	<b>298760</b>
<b>7.9.1. Human Resource Development</b>						
Requirement by 2018: Gaps in Human Resources in rice sector						
Researchers		Research Technicians		Extension Workers		
Full-time	Part-time*	Full-time	Part-time*	Full-time	Part-time*	
16	4	48	12	48	12	
3	0	9	0	10	0	
13	4	39	12	38	12	
234000	72000	702000	216000	273600	86400	
*Engaged in other institutional mandates					Sub-total_1	1584000
<b>8. NRDS secretariat</b>						
	Unit	Recurring Cost				
Technical Coordinator	1	192000				
M&E Specialist	1	144000				
Secretary	1	57600				
					Sub-total_2	393600
					<b>Total_Objective_Output7.9.1/8</b>	<b>1977600</b>
					<b>Grand Total</b>	<b>156,521,000</b>

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