

Road Map for Rice Seed Value Chain Development in Uganda

2014-2018

**MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES
GOVERNMENT OF UGANDA**

Executive Summary

Rice is a priority crop in Uganda. Rice is cultivated largely by smallholder farmers in lowland and upland production environments. The rice production has increased from 117,000 tons of milled rice in 2008 to 153,000 tons in 2012. However, the demand for rice consumption has also increased from 157,000 tons of milled rice to 186,000 tons during the same period; thus forcing the country to import rice from other rice producing countries.

Uganda has developed its National Rice Development Strategies (NRDS) outlining key approaches by which the country can raise its paddy (un-milled) production by 3.9 fold from 177,000 tons in 2008 to 680,000 tons by 2018. NRDS represents the framework for rice development in Uganda. Improving the accessibility of rice farmers to quality rice seeds is one of the key strategies outlined for achieving the goal of NRDS.

Presently the rice seeds are produced and distributed through both formal- and informal systems. Under formal systems, the nucleus seeds of rice cultivars are either sourced from international organizations such as Africa Rice and/or from National Agriculture Research Organization. Breeder- and foundation seeds are produced from the nucleus seeds at National Crops Resources Research Institute and supplied to private seed companies who then produce certified seeds on a commercial scale and sell to farmers.

Informal seed systems, through which rice seeds are predominantly produced in Uganda, are carried out by either saving a portion of their harvest by individual farmers themselves or by progressive/entrepreneurial farmers for a given community. Community based seed production is often organized by development projects and non-governmental organizations. Such seeds however are often not certified; but declared as quality seeds on a mutual basis.

Given the capacity constraints of the public system in inspection and certification of seeds, the road map for development of rice seed value chain presented here envisages improving both the formal- and informal seed systems, and yet steadily guiding rice farmers to fully embrace a more formal seed production system. Therefore, strengthening (i) private seed company based production and marketing, (ii) community based seed production and distribution, and (iii) farmer saved seed practices represent the three strategic elements for rice seed development in Uganda.

To achieve the tripling of paddy production targeted under NRDS, it is estimated that Uganda would need to produce annually 13,656 t (5,462 Ha) of certified seeds from 273 t (109.2 Ha) of foundation seeds and 5.46 t (2.18 Ha) of breeder seeds. Production and supply of quality rice seeds would require fresh recruitment of 9 researchers and 6 technicians, 24 inspection staffs. The technical capacity of the existing staffs needs to be enriched through on-job training courses and through upgrading infrastructures for screening, testing and storage.

Adequate and routine annual budget allocations for production and inspection shall improve the volumes and supply of rice seeds through formal system. Facilitating access to more lands,

broadening of licensing of varieties, public-private partnerships in varietal development, allowing natural market forces to determine the value of seeds, and improving transparency in seed procurement and distribution processes would enable competitive and sustainable private sector participation in rice seed value chain development.

Shifting farmers towards adoption of formal seed system will require coordinated extension services on creating awareness, incentivizing seed producers and seed users, and training on community based and farmer saved seed production. Scaling out of the production of breeder- and foundation seeds to different sub-zones where rice is cultivated shall increase the accessibility and facilitate timely supply.

Marketing of seeds requires promotion and expansion of agro-dealer networks in rice producing areas through financial and technical assistance. Besides ensuring the quality of seeds, it also becomes important to assert quality in marketing practices by ensuring that the seeds are packed with tamper proof materials and labeled with appropriate technical details.

It shall be expected that implementation of the strategic principles and approaches outlined in this document will enable increased productivity and thereby contribute to realization of the goals of NRDS, food security, poverty alleviation and economic development in Uganda.

Map



Acronyms and abbreviations

AGRA: Alliance for the Green Revolution in Africa
ASARECA: Association for Strengthening Agricultural Research in Eastern and Central Africa
AU: African Union
CAADP: Comprehensive Africa Agriculture Development Programme
COMESA: Common Market for East and Southern Africa
DSIP: Development Strategy and Investment Plan
EAC: East African Community
IPPC: International Plant Protection Convention
ISSD: Integrated Seed Sector Development Program
ITPGRFA: International Treaty on Plant Genetic Resources for Food and Agriculture
JICA: Japan International Cooperation Agency
MAAIF: Ministry of Agriculture, Animal Industries and Fisheries
NAADS: National Agricultural Advisory Services
NaCRRI: National Crops Resources Research Institute
NARO: National Agriculture Research Organization
NERICA: New Rice for Africa
NRDS: National Rice Development Strategy
NSCS: National Seed Certification Services
OECD: Organization for Economic Cooperation and Development
PASS: Program for African Seed Systems
PEAP: Poverty Eradication Action Plan
PIQS: Phytosanitary Inspection and Quarantine Services
RIS: Rice Industry Secretariat
RTC: Rice Technical Committee
RSC: Rice Steering Committee
TWG: Technical Working Group
USTA: Uganda Seed Trade Association
UPOV: International Union for the Protection of New Varieties of Plants

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1. Introduction

Rice has become one of the major staple food crops in Uganda. Owing to rapid urbanization, high population growth and changing consumption patterns, the demand for rice in Uganda is fast rising¹. The per capita consumption of milled rice is higher amongst urban population (15 Kg) than amongst rural population (8 Kg). Presently about 350,000 tons of milled rice is consumed annually in Uganda¹. Rice has thus displaced traditional food crops such as sorghum and millets to become the second most consumed food (after maize) in Uganda.

Rice was introduced into Uganda in 1940s by Indian traders; but gained more recognition when the government of Uganda established irrigation schemes with assistance from China². Initially the rice production in Uganda was concentrated mainly in a few irrigation schemes in Eastern region. Rice is now cultivated as both food- and cash crop, largely by small holder farmers in rural areas where the population density is high. The consumption demand for rice over other crops pushes farmers to rice cultivation in the uplands~~Error! Bookmark not defined.~~. In wetlands, a relatively better market access and a secure tenure system encourages lowland rice production in Uganda⁵. Evidences suggest that the recent introduction of NERICAs in Uganda has contributed to increased household incomes and on-farm job creation in rural areas³. The recent increases in domestic rice production have also contributed to national economy by also reducing the volume of imports. Rice imports had dropped significantly since 2004, which helped save the country an average of US\$30 million per year in foreign exchange earnings⁴. Rice production in Uganda has thus opened new vistas for ensuring food security, poverty reduction and economic development.

Today, rice is increasingly recognized as one of the key strategic enterprises that could augment Uganda's national agriculture sector Development Strategy and Investment Plan (DSIP; 2010/11-2014/15). Uganda has recently formulated National Rice Development Strategy (NRDS; 2008-2018) and has set directions and guidelines for rice sub sector. It seeks to render Uganda self sufficient in rice production by increasing paddy production by more than 3-fold; from about 177,000 tons in 2008 to 680,000 tons by 2018. The NRDS is being implemented under DSIP which represents the national framework for Comprehensive African Agriculture Development Program (CAADP). Development of rice sub-sector through NRDS has hence been captured as one of the 18 sub-sector plans under DSIP. Implementation of NRDS is coordinated through a 3-tier structure.

A Rice Steering Committee (RSC), which represents key stakeholders of rice sub-sector, oversees and guides the developmental activities and projects within rice sub-sector. A Rice Technical Committee (RTC) provides technical advices to RSC and Rice Industry Secretariat (RIS).

¹ Prosper, A (2013) Low local production driving up rice prices, Daily Monitor

² Monitoring of African Food and Agricultural Policies (2012) Analysis of incentives and disincentives for rice in Uganda

³ Bergman LJ et al (2012) New seeds, gender norms and labor dynamics in Hoima District, Uganda. Journal of Eastern African Studies; 6(3)

⁴ Mohapatra S (2012) Uganda blazing a trail to rice success, Rice Today 12(2) 16-17

The RIS, represented as rice desk under the Department of crop production at MAAIF, plays an important role by coordinating with various stakeholders and development initiatives such as the Coalition for African Rice Development (CARD) and gathering information on rice sub-sector.

Data from Food and Agriculture Organization (FAO), Uganda’s Bureau of Statistics (UBOS) and United States Department of Agriculture (USDA) on paddy (un-milled) production reveal that rice production has increased to 212,000 tons in 2012 (an increment of 19.1% since 2008).

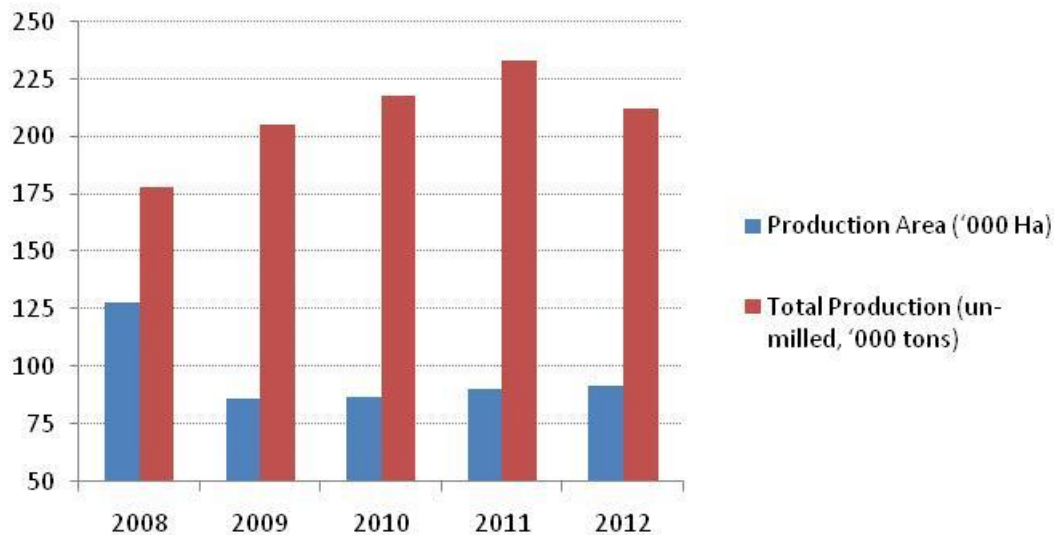


Fig. 1: Trends in rice cultivation and production in Uganda since 2008 (Source: FAO)

Although the available data on area under rice cultivation from these sources are not consistent, the recent introduction of upland NERICA varieties has contributed to expansion of area under rice cultivation into rain fed upland and rain fed lowland ecosystems across the country⁵. Concurrently however, the demand for rice (milled) consumption has also risen from 157,000 tons of milled rice in 2008 to 186,000 tons in 2012⁶. Thus the demand for rice in the country has outstripped the local production. Presently the deficit in rice production is filled by importing rice from other rice producing countries such as Tanzania, Pakistan, Thailand and India.

Several reports^{2,7,8} suggest that average on-farm rice yields in Uganda have become stagnant and are typically less than the 5 t/Ha obtained in on-farm technical demonstration plots^{9,10}.

⁵ Hyuha TS et al (2007) Analysis of profit inefficiency in rice production in Eastern and Northern Uganda, African Crop Science Journal 15(4) 243-253

⁶ USDA review of policy constraints on competitive EAC rice production dated 9 July 2012

⁷ Fungo B et al (2013) Narrowing yield-gap of rice through soil fertility management in the Lake Victoria Crescent agroecological zone, Uganda; AJAR: 8(23) 2988-2999

⁸ Bekunda M, Sanginga N, Woomer PL (2010). Restoring Soil Fertility in Sub-Sahara Africa; Advances in Agronomy 2113(10)08004-1

Among the several constraints that limit the on-farm productivity of rice crop is the use of quality seeds by farmers. Recent studies show that only about 27% of the farmers use improved seeds^{7,10,11}. Seeds of higher quality represent a single given variety and have high percentages of vigor and germination. High quality seeds are also free from seed borne diseases, pests and other physical impurities. Using seed of lower quality often introduce weeds and off-types which could affect productivity of the main rice crop. Production and distribution of high quality seeds represents an important strategic element for achieving the goal of more than tripling rice production set under Uganda's NRDS. This document analyzes the current situation, identifies gaps and outlines a road map for improving the production and supply of rice seeds in Uganda.

2. Review of National Rice Seed Sector

2.1. Legislation, Policy, Institutions and Planning Aspects

2.1.1. Legislations

Ugandan parliament had passed Agricultural Seeds and Plant Act in 2006. This act provides the overall legal framework for the regulation, promotion and control of varietal release, seed multiplication, seed import and export, marketing and quality assurance of seeds. These existing government regulations are highly supportive of private sector participation in seed production and marketing. Seed and Plant Regulations (2009) provide guidelines for the implementation of the Act. Under these regulations, MAAIF has established such statutory agencies as National Seed Certification Services (NSCS), Seed Board and Variety Release Committee.

Uganda's Plant Protection Act Cap 244 was legislated in 1962. This act makes provision for the prevention of the introduction and spread of diseases that are destructive to plants. The Plant Variety Protection Bill (2010) promotes development of new plant varieties and their protection as means of enhancing breeders' innovations and rewards through granting of plant breeders' rights. This bill also enables Uganda to comply with the International Union for the Protection of New Varieties of Plants (UPOV).

As a signee of the Convention on Biological Diversity (CBD), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), and the Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization, Uganda's regulations accede to trans-border movement of germplasm. National Agriculture

⁹ Africa Rice Center (2001) New Rice for Africa (NERICA) Offers Hope to Women Farmers and Millions

¹⁰ Oonyu (2011) Upland rice growing: A potential solution to declining crop yields and the degradation of the Doho wetlands, Butaleja district-Uganda; AJAR 6(12) 2774-2783

¹¹ Kijima Y (2012) Expansion of Lowland Rice Production and Constraints on a Rice Green Revolution: Evidence from Uganda; JICA-RI Working paper No: 49

Research Organization (NARO) is responsible for sustainable utilization and conservation of all rice genetic resources in the country.

2.1.2. Policy

Despite the statutory regulations setting the institutional and legal frameworks however, the policy guidelines for the seed sub-sector are not yet finalized. The policy, presently being drafted by a national seed sub-sector coordination group, aims to invigorate the roles of private sector in production and that of public sector in seed inspection and certification. It seeks to promote the use of high quality seeds and a vibrant seed industry. It puts an emphasis on capacity building, creating sustainable formal markets, establishing quality control mechanisms and harmonizing with regional and international conventions and protocols. The current legislative measures and national agriculture policies have motivated private-sector players such as FICA Seeds, NASECO Seed Company, Grow More Seeds, Victoria Seeds and Pearl Seeds in multiplication and distribution of rice seeds.

2.1.3. Institutional frameworks

Rice seeds are presently produced and distributed through both formal and informal systems. Under the formal system, NARO runs public breeding programs and is solely responsible for generating nucleus- and breeder seeds. The foundation- and certified seeds are produced and distributed through both public- and private institutions. At each stage of production, the seeds are subject to inspection and certification by NSCS. However, the low capacity of the public system in performing inspection services is a major bottleneck. This has led to proliferation of informal system of production and exchange of seeds outside the purview of public scrutiny. The informal systems include farmer (individual) and community (groups) based seed production and distribution on the basis of specific needs or demands from either the farmers and/or project/scheme based interventions.

In the recent times, such an informal system of rice seed supply is being embraced by local administration under the decentralized set up. Because of the low and scattered volumes of seed requirement and the inconsistency in the timing of seed demand, the parish or village procurement committees prefer local seed producer/entrepreneurs instead of private firm, for timely distribution of rice seeds to the beneficiaries. The local entrepreneurs contract local farmers in the same community for production of rice seeds.

It is also common that farmers save and share a portion of their production as seeds for the next round of rice cultivation. Selection of seeds shall sometimes start from ear marked areas/pockets of field, plants, panicles and grain features. Seeds distributed through such informal systems are however not necessarily certified and often declared as of sufficient quality by the seed producers, who are often from the same farming community as the target beneficiaries. Recent surveys show that farmers in Uganda predominantly use informal seed

system, and that the formal seed sector accounts for only about 10% of the overall quantities of seed used¹².

Several programs/initiatives by development partners have aimed at improving the seed value chain in Uganda. Japan International Cooperation Agency (JICA) and Africa Rice Center directly support the public sector by facilitating breeding, variety selection and community based seed production and distribution activities. Through an emergency rice project, the Government of Japan facilitated access to quality rice seed to vulnerable farmers in Uganda. By engaging various stakeholders, it established procedures to produce seeds of improved varieties; trained staffs in both the public and private programs; and improved the provided basic threshing and seed processing equipment to produce quality foundation seeds in the country.

International Seed Sector Development program (ISSD) financed by the Dutch Directorate General International Cooperation aims at increasing the efficiency and effectiveness of public sector organizations, and creating functional local seed businesses by building capacities of farmer groups. Initiatives such as Program for African Seed Systems (PASS) by the Alliance for the Green Revolution in Africa (AGRA) and Feed the future by USAID support the development of the private seed sector in Uganda through grants and investment funds for strengthening of the private seed companies and their agro-dealer network. Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) supports the harmonization of seed policies and regulations in the region.

Besides the international programs/projects, non-government organizations such as Catholic Relief Services (CRS), Self Help Africa (SHA) and Volunteer Efforts for Development Concerns (VEDCO), assist farming communities in the production and distribution of quality by strengthening the capacities of farmers' groups in quality assurance, management, and seed marketing. Table 1 shows the institutional framework for multiplication, inspection and distribution of rice seeds in Uganda.

Table 1: Institutions responsible for rice seed production, inspection and supply

		Name of institutions	Roles/ Responsibility	Legislations/Policies determining responsibility
Overall	Production	Private and public institutions	Production and marketing	Agricultural Seeds and Plant Act 2006
	Inspection	MAAIF	Regulation and certification	Agricultural Seeds and Plant Act 2006
	Supply/distribution	Private and public institutions	Marketing, promotion, demonstration, M&E, treatment, storage	Agricultural Seeds and Plant Act 2006
Nucleus Seed	Production	NARO	Procurement of germplasm	Agricultural Seeds and Plant Act 2006

¹² Alliance for a Green Revolution in Africa (2010) Mid-Term Review of the Program for Africa's Seed Systems

	Inspection	MAAIF		Quality control	Agricultural Seeds and Plant Act 2006
	Supply/distribution	NARO		Breeder seed multiplication	Agricultural Seeds and Plant Act 2006
Breeder Seed	Production	NARO		Multiplication of breeder seed	Agricultural Seeds and Plant Act 2006
	Inspection	MAAIF		quality control	Agricultural Seeds and Plant Act 2006
	Supply/distribution	NARO		breeder seed multiplication	Agricultural Seeds and Plant Act 2006
Foundation seed	Production	NARO, Private sector		Production & maintenance of foundation seed	Agricultural Seeds and Plant Act 2006
	Inspection	MAAIF		Quality control	Agricultural Seeds and Plant Act 2006
	Supply/distribution	NARO, Private sector		Sell to seed companies	Agricultural Seeds and Plant Act 2006
Certified Seed	Production	Private sector, projects and NGOs		Production and maintenance of seed plots	Agricultural Seeds and Plant Act 2006
	Inspection	MAAIF		Quality control	Agricultural Seeds and Plant Act 2006
	Supply/distribution	Private sector, NGOs and projects		Marketing, promotion, demonstration, M&E, treatment, storage	Agricultural Seeds and Plant Act 2006

2.1.4. Planning

In the absence of clear projections on demand and supply of certified seeds in rice producing areas, presently there is no routine allocation of annual budget for rice seed production. Presently there is no forum through which dialogue amongst public- and private stakeholders involved in rice seed production could take place. Nonetheless the private seed companies have established Uganda Seed Trade Association (USTA) which helps coordinate them with other developmental activities along the seed value chain. USTA is also engaged in lobbying for and promoting an enabling environment for seed producers.

2.2. Production

NARO is responsible for sourcing the nucleus seed (progenies of parental lines) of each variety either from international institutions such as Africa Rice or from its own breeding program. At NARO, the nucleus seeds are constantly renewed and breeder seeds are obtained from the progenies of nucleus seed. These steps are done exclusively by the breeders at National Crops Resources Research Institute (NaCRRI) in small plots (0.5 Ha) at Namulonge every year. Private companies and NaCRRI are involved in production of foundation seeds to reach the desired volumes of certified seed of each variety. The certified seeds are produced at various locations

by private seed companies, projects, NGOs and farmers throughout the country. Licenses for marketing of varieties are uniquely assigned to private seed companies. The volumes of production between 2010 and 2012 are shown in table 3.

Table 2: Production, location, and cultivated area of rice seed in the past 3 years:

<Year 2012>

	Total production/ procurement amount (MT)	Name of production stations	Production amount per station (MT)	Cultivated area per station (ha)
Nucleus Seed	0.1	NaCRRI, Namulonge	1.25	0.05
Breeder Seed	1.25	NaCRRI, Namulonge	1.25	0.5
Foundation Seed	24	<u>Public</u> :- NaCRRI, Namulonge	8	3.3
		<u>Private</u> :- FICA Seeds Co., NaSECO, Equator Seed, Pearl Seeds Co., and Victoria Seeds Co.	16	6.7
Certified Seed	504	FICA Seeds Co., NaSECO, Equator Seeds Co., Pearl Seeds Co., and Victoria Seeds Co.	-	202

<Year 2011>

	Total production/ procurement amount (MT)	Name of production stations	Production amount per station (MT)	Cultivated area per station (ha)
Nucleus Seed	0.1	NaCRRI, Namulonge	1.25	0.05
Breeder Seed	1.25	NaCRRI, Namulonge	1.25	0.5
Foundation Seed	18	<u>Public</u> :- NaCRRI, Namulonge	6	2.4
		<u>Private</u> :- FICA Seeds Co., NaSECO, Equator Seeds Co., Pearl Seeds Co., and Victoria Seeds Co.	12	5.0
Certified Seed	392	FICA Seeds Co., NaSECO, Equator Seeds Co., Pearl Seeds Co., and Victoria Seeds Co.	-	156

<Year 2010>

	Total production/ procurement amount (MT)	Name of production stations	Production amount per station (MT)	Cultivated area per station (ha)
Nucleus	0.1	NaCRRI, Namulonge	1.25	0.05

Seed				
Breeder Seed	1.25	NaCRRI, Namulonge	1.25	0.5
Foundation Seed	12	<u>Public:-</u> NaCRRI, Namulonge	4	1.6
		<u>Private:-</u> FICA Seeds Co., NaSECO, Equator Seeds Co., Pearl Seeds Co., and Victoria Seeds Co.	8	3.4
Certified Seed	350	FICA Seeds Co., NaSECO, Equator Seeds Co., Pearl Seeds Co., and Victoria Seeds Co.	-	140

Since most of the rice varieties available in Uganda were bred by international institutions such as Africa Rice, the nucleus seeds (germplasm) are sourced from the originating institutions. Production of initial round of seeds from these germplasm (nucleus seeds) and breeder seeds of all released public varieties is done in experimental farms at NaCRRI in Namulonge. The production of foundation seeds from breeder seed of such public goods is also carried out by NaCRRI. Of late, private companies are also engaged in on-farm production of foundation seeds of both public- and privately bred/brought varieties. Certified seeds from foundation seeds that have met standards set by NSCS are produced by private companies, projects, NGOs and farmers. Besides producing seeds in their own farms, the private companies also engage local farmers in producing certified seeds through contracts. The certified rice seeds of private firms are sold through a network of registered agro-dealers in rice producing areas.

Government programs/agencies/enterprises are thus not engaged in producing certified seeds. When deemed necessary under public distribution programs, the seeds are purchased by the government from the private seed companies through standard procurement procedures. Although community based system of rice seed production is generally not common in Uganda, donor funded projects and NGOs engage local progressive or lead farmers in producing rice seeds under their own supervision. Such seeds are distributed to target beneficiaries/communities within the scope of the project on a mutual understanding on the quality of seeds.

A range of rice varieties are presently available for cultivation under rain fed upland ecosystems. These include NERICA 1, NERICA 4, NERICA 10, Africa 1, Africa 2, NARIC 1, NARIC 2, NP2, NP 3, UK2, NAMCHE 1, NAMCHE 2, NAMCHE 3 and NAMCHE 4. Among these cultivars, the government of Uganda promotes cultivation of NERICA 1, NERICA 4, NERICA 10, NAMCHE 1, NAMCHE 2, NAMCHE 3 and NAMCHE 4 under rain fed upland environments. Although no official variety is made available for irrigated rice environments, the above mentioned varieties are cultivated in lowland rice farms. The public- and private institutions involved in rice seed production are engaged in production of these popular varieties (table 4). Rice farmers in Uganda set aside a major portion of paddy produced in their farms for household consumption,

and yet save a significant amount for markets. Hence all the currently available rice varieties shall be considered of both ‘market and subsistence’ significance.

Table 3: Agro-Ecological based cultivated areas and amount of rice seed production:

Year 2012	Name of Varieties	Cultivated Areas (ha)	Amount produced (MT)
Irrigated Lowland	None		
Rain-fed Lowland	None		
Rain-fed Upland	NERICA 1	**	**
	NERICA 4	**	**
	NERICA 10	**	**
	NAMCHE 1	**	**
	NAMCHE 2	**	**
	NAMCHE 3	**	**
	NAMCHE 4	**	**

2.3. Quality Control

2.3.1. Methods

The National Seed Certification Services (NSCS) is the designated authority for ensuring the quality of rice seeds in Uganda. Operating under the department of crop protection of MAAIF, the National Seed Certification Services is responsible for inspection and certification of seeds. NSCS conducts on-farm evaluation of seed production plots and laboratory testing of seed samples before certifying that the seeds conform to the breeders’ specification and description. Field visits are generally aimed at verification of varietal characteristics, isolation distance, roguing, distinctiveness, uniformity and stability of plant population. NSCS also conducts sampling of seeds produced or procured and stocked within the country, by subjecting them to laboratory tests. The standards prescribed by NSCS on purity of the various types of rice seeds are shown in table 5.

Table 4: Purity Standard of Seeds

	Purity Standard
Breeder Seed	99.9%
Foundation Seed	99.9%
Certified Seed	99%

NSCS is also responsible for establishing and maintaining a database wherein information on the prescribed seed standards for all the approved rice varieties are available. Seeds imported

from other countries are subject to Phytosanitary Inspection and Quarantine Services (PIQS). Through quarantine services, PIQS conducts pest risk analysis to establish compliance with international and regional standards of rice seeds by International Plant Protection Convention (IPPC). Upon recommendations from PIQS, the NSCS inspects the purity standards of the seeds before issuing certificate for clearance at customs.

In order to ensure quality of seed production, NARO and NSCS have set forth specific set of practices and conditions. These procedures and methods are in conformation with protocols prescribed by Organization for Economic Cooperation and Development (OECD). Fields where rice seeds are produced must have had at least two seasons of rice cultivation. The isolation distance for breeder seed production is set as 10 m and that for foundation and certified seed production as 5 m. The Source seeds are generally subject to disinfection using fungicides. About 30 Kg/Ha of Nitrogen in the form of DAP is applied during land preparation. Both transplanting and direct seeding by dibbling 2-3 grains per hill in lines are practiced. A wider spacing of 30 cm between hills is recommended. While the missing hills are filled within one week of transplanting, the number of plants per hill is generally kept to 1 by roguing at tillering stage. Until panicle initiation stage, removal of off types should be done weekly. After panicle initiation, off types are removed once in every 2 days. At panicle initiation stage, second dose of Nitrogen is applied using Urea at the rate of 30 Kg N/Ha.

Weeding is carried out during at least 3 stages viz., 3 weeks after germination, 6 weeks after germination and panicle initiation. Harvesting is done at 80% panicle ripening stage. While harvesting, a minimum of 3 rows from the border are excluded from other seed, thus harvested earlier than other hills. After harvesting, seeds are spread on clean Tarpaulin over a cemented floor with a shaded roof, packed and stored.

Field inspections involve examination of the seed crop as a whole to ensure it is consistent with the characteristics of the variety (Table 6). This is usually done by walking into the seed crop and randomly examining plants. The inspectors also look for uniformity of the variety, presence of pests, diseases, weeds and frequency of off types. After examining the field as a whole, the inspections around the perimeter are made. Observations include signs which would indicate that part of the field might have been sown with different variety or might have become contaminated, for instance, in field gateways or on headlands.

Table 5: Procedure and methods of on-plot seed inspection

	Organizations/ institutions in charge of inspection	Frequency and timing of Inspections	Items for Inspection	Inspection Methods	Quality Standard for Inspection
Breeder Seed	NARO	As frequently as possible at vegetative stage,	Isolation distance	Sampling and visual observations	10 meters
			Off types		No. of off types
			Pests and		Incidence of

		flowering stage, harvesting and storage	diseases Weeds Time isolation		diseases Incidence of weeds
Foundation Seed	MAAIF	3 – 4 times: at vegetative stage, flowering stage, harvesting and storage	Isolation distance	Sampling and visual observations	5 meters
			Off types		No. of off types
			Pests and diseases		Incidence of diseases
			Weeds		Incidence of weeds
			Time isolation		
Certified Seed	MAAIF	3 – 4 times: at vegetative stage, flowering stage, harvesting and storage	Isolation distance	Sampling and visual observations	5 meters
			Off types		No. of off types
			Pests and diseases		Incidence of diseases
			Weeds		Incidence of weeds
			Time isolation		

Inspections on quality of harvested rice seeds in Uganda involve assessment of physical features, germination, purity and chaffiness of seeds. Physical assessment is done manually by verifying the color and ratio of length/breadth. Germination test is carried out using petri-plate in which a sample of 100 grains. Purity tests involve examination of a sample of 500 grams for uniformity in color and presence of debris and impurities. Chaffiness is tested by soaking the sample seeds in water for 5 minutes.

Table 6: Procedure and methods of harvested seed inspection

	Organizations/ institutions in charge of inspection	Items Inspection for	Inspection Methods	Quality Standard for Inspection
Nucleus seed	NaCRRI – Seed Laboratory	Germination	Germination test (petri-plate; sample of 100 grains)	Germination percentage (>85%)
		Purity	Sample of 500 grams – determine percentage of off types – uniformity in color, length/breadth	Percentage (99.9%)
		Chaffiness	Soaking in water for 5 mins – assess chaffy grains	Percentage of empty/partially filled grains (<2%)
Breeder	NaCRRI – Seed	Germination	Germination test (petri-plate;	Germination

Seed	Laboratory		sample of 100 grains)	percentage (>85%)
		Purity	Sample of 500 grams – determine percentage of off types – uniformity in color, length/breadth	Percentage (99.9%)
		Chaffiness	Soaking in water for 5 min – assess chaffy grains	Percentage of empty/partially filled grains (<1%)
Foundation Seed	NaCRRI – Seed Laboratory	Germination	Germination test (petri-plate; sample of 100 grains)	Germination percentage (>80%)
		Purity	Sample of 500 grams – determine percentage of off types – uniformity in color, length/breadth	Percentage (97%)
		Chaffiness	Soaking in water for 5 min – assess chaffy grains	Percentage of empty/partially filled grains (<3%)
Certified Seed	Private Companies and Farmers' fields	Germination	Germination test (petri-plate; sample of 100 grains)	Germination percentage (>80%)
		Purity	Sample of 500 grams – determine percentage of off types – uniformity in color, length/breadth	Percentage (99%)
		Chaffiness	Soaking in water for 5 min – assess chaffy grains	Percentage of empty/partially filled grains (<3%)

2.3.2. Human Resources

Presently there are seven researchers and four technicians are involved in production of breeder and foundation seeds at NARO. The staffs are responsible for multiplication of seeds and propagate materials of all crops. While four of the researchers have Ph D qualification, 3 of the researchers have M Sc qualification. The work experience of the researchers ranges from 1 to 10 years. Two of the technicians hold B Sc with 1-5 years of experience and the other 2 hold diploma degree qualifications with 10 years of experience. The researchers and technicians are supported by about 40 workers at their work station. Collectively these staffs are involved in multiplication of breeder- and foundation seeds of rice over 2.15 Ha of land at NaCRRI in Namulonge. For inspection and certification services, about 4 inspection staffs are available under NSCS. While one of the inspection staffs hold Ph D, 2 of them hold M Sc and the other hold B Sc degree qualification. The experience of inspection staffs range between 1 and 5 years. Together, they perform field and laboratory inspection of seeds and other propagate materials of all the crops.

The current training programs are broadly focused on two sets of players involved in rice seed production viz., seed technicians and farmers. The technicians engaged in production in private seed companies are given one-day training by JICA. The training program covers the various standard agronomic methods of rice seed production. Emphasis is laid on removal of off-types from seed production plots. Under the public system, rice farmers who are engaged in seed production are trained by district extension workers. Through a half-day program, the farmers are trained on improving their on-farm seed production practices. The major components of such training modules include selection of panicles, roguing off-types and integrated crop management practices.

2.4. Supply

Several stakeholders play significant roles along the supply chain of rice seeds in Uganda. NARO is a key stakeholder in determining the availability and supply of rice seeds in the country. NARO sources the nucleus seeds either from originating institutions or from its own research services; and sets off the supply chain. In collaboration with the local government’s extension network, the Zonal Agricultural Research and Development Institutes play a critical role in evaluating the needs and conducting adaptive research on seeds. However, since the public institutions are not involved in certified seed production, the private companies play a major role in supplying the seeds to farmers through agro-dealer networks in rice producing areas. There presently are 23 private seed companies active in Uganda. USTA, representing these private companies, plays an important role in creating awareness campaigns, capacity building, advocating for policies that promote the production and supply of quality seeds. NSCS is the statutory body under MAAIF that ensures quality of seed supplied through the formal system in the country. The key roles played by the various stakeholders in the rice value chain are shown in table 8.

Table 7: Stakeholders in seed supply chain

	Stakeholders			
	Market varieties	Roles played	Subsistence varieties	Roles played
Nucleus seed development/ Production/ supply	NARO	Importation, testing and evaluation, multiplication and storage	NARO	Importation, testing and evaluation, multiplication and storage
Breeder seed production/ Supply	NARO	Multiplication and storage	NARO	Multiplication and storage
Foundation seed production/ Supply	NARO, Private Seed Companies	Multiplication and storage	NARO	Multiplication and storage
Certified seed	Private Seed	Multiplication, marketing	Private	Multiplication, marketing

production	Companies	and storage	Companies	and storage
Distribution of seeds	Private Seed Companies	Transportation, marketing, branding, packaging	Private Companies	Transportation, marketing, branding, packaging
Financing	Donors, NGOs and Local- and central governments	Technical support, salaries, logistics and capacity building (training and recruitment)	Donors, NGOs and Local- and central governments	Technical support, salaries, logistics and capacity building (training and recruitment)

Public sector programs on supply of certified rice seeds to farmers are presently administered by National Agricultural Advisory Services (NAADS). In the absence of a regular annual budget however, NAADS sponsor production and distribution of rice seeds on an *ad hoc* basis. In such instances, it is often the farmer groups that request extension agents under local district administration and/or sub-county NAADS coordinator. In consultation with district agriculture production officer and zonal agriculture research and development institute of NARO, the district NAADS coordinator then forwards the appropriateness of the request for rice seeds to NAADS Secretariat through zonal NAADS coordinator. Based on the availability of budget, tenders are announced for purchase of certified rice seeds from private companies who often sub-contract the local farmers for producing the seeds.

Development partners such as JICA and USAID, and NGOs such as CRS, SHA and VEDCO assist rice growers directly by either helping them produce seeds and/or supplying quality seeds. Such community based seed supply activities are however limited to the corresponding project sites and target beneficiaries. ASARECA, Integrated Seed Sector Development (ISSD) program by Dutch government, and PASS (AGRA) are engaged in strengthening the supply chain of seeds by integrating private sector and entrepreneurship and policy advocacies for efficient distribution and marketing systems of seeds.

Although there is no national forum through which public and private stakeholders could engage in discussions on issues, challenges and policies related to production and supply of rice seeds in the country. However rice multi stakeholder innovation platforms are being formed in such rice growing regions as Mukono. Such platforms also serve as innovation forum for zonal agriculture research and development institutes of NARO.

The price of commercially sold certified seeds of rice is determined by markets in Uganda. The government agencies are not directly involved in fixing the price for commercially sold seeds. Although the commercial seed segment presently accounts for only about 10% of the total quantities of seed used by farmers, the market penetration of the formal seed segment is expanding fast in Uganda¹². Rice farmers generally renew their seeds once in every 5 years. Presently about 95 % of farmers in lowland rice environments use grains saved from the previous season as seeds. In the uplands, about 60% of the farmers use saved seeds.

Table 8: Purchase price from seed multipliers and sales price of certified seed

Currency: (Approximate exchange rate: 1 = USD)			
	Name of Varieties	Purchase price	Sales price
Irrigated Lowland	**	**	**
	**	**	**
Rain-fed Lowland	**	**	**
	**	**	**
Rain-fed Upland	**	**	**
	**	**	**
	**	**	**
	**	**	**

(Information from the year of 20**)

3. Challenges in National Rice Seed Sector

3.1. Legislation, Policy, Institutions and Planning

Although the Agricultural Seeds and Plant Act were legislated in 2006 and the Seed and Plant Regulations were ratified in 2009, strategic directions explaining what can be achieved (targets) and how they can be achieved (policy guidelines) are not yet drawn for the seed sub sector. The policy guidelines that are now being drafted need to clearly outline the principles that the government (public) and other stakeholders including the private seed companies will use to achieve its directive.

Under the existing seed legislations, the responsibility for inspection and certification has been assigned to NSCS which remains inadequately resourced. The inadequate human capacity and insufficient operational funds limit the NSCS from being able to fulfill its mandate. Hence the quality of rice seeds being distributed and sold in the markets is not efficiently regulated.

Given the structural and functional integration of Uganda's trade, harmonization of seed policies with regional economies is an important facet of value chain development. Although the recent liberalization of seed sub sector has increased the presence of private seed companies in the country, streamlining of procedures of seed production, quality standards and prices remain to be harmonized with that in the region. Hence Uganda's national seed testing labs still remains to be accredited by international seed agencies.

Presently there are 23 private registered seed companies in Uganda. Although commercial production of cross pollinated crops such as maize and sunflower are more lucrative, private seed companies acknowledge that production of rice seeds is a profitable venture for them. However, exclusive licensing of rice varieties to private seed companies result in poor penetration of markets for some cultivars.

Since the production of breeder- and foundation seeds is done centrally at NARO, planning gains importance. However, lack of clear and reliable projections on the demand for certified seeds of different rice varieties in various rice producing regions within the country inhibits the planning process. The lack of routine funding mechanisms for rice seed production further aggravates the uncertainty over the flow of rice seeds through the public systems and hence the seed markets. Such vagueness in demand and supply dynamics of rice seed value chain remains as one of the major challenges for the stakeholders.

Being an often self pollinated crop, rice varieties generally retain most of the phenotypic traits even if farmers use a portion of their saved grains as seeds in the following seasons. Hence it is tempting for rice farmers to circumvent the formal seed system. However several studies had shown that despite of the self pollinating nature of rice, rice varieties tend to use their viability (and hence crop productivity) if the seeds are not refreshed. Thus creation of awareness on the importance of renewing the seed source amongst rice growers assumes importance.

Under the current legislations, a national seed board has been formed to oversee the seed value chain development in Uganda. However, the board members could not meet on a routine basis due to limitations in operational budget. The absence of a national platform for the various stakeholders involved in rice seed production prevents the chance for the stakeholders to comprehend the various challenges confronted during production, marketing and distribution of rice seeds, and discuss possible solutions to the problems faced. The platforms shall also serve as a medium for policy dialogues between public and private sectors along the rice seed value chain.

3.2. Production

Despite a substantial increase in area under rice cultivation in the recent years (Fig. 1), the area under breeder- and foundation seed production has not significantly increased (Table 3). Although sufficient lands are available at the NARO research stations, the inadequacy in technical personnel, operational funds and infrastructure impede maintenance breeding of existing varieties and constant replenishment of seed stocks. The centralized seed production restrains NARO in meeting the specific demands of seeds of different varieties in the rice production areas.

Recently, there is a growing recognition on the importance of hybrid rice varieties and lowland irrigated rice varieties in raising productivity and achieving self sufficiency in rice production in Uganda. Research collaborations between NARO and advanced research institutions other than Africa Rice remain to be widened in order to expand the varietal options. However, the low levels of funding on rice improvement through breeding and selection limits the scopes of commercial expansion of rice seed production. Private sector has not yet been actively engaged in varietal introduction, testing and evaluation of improved rice varieties.

3.3. Quality Control

The increasing number of complaints on the quality of rice seeds marketed by the private seed companies is eroding the farmers' trust on the formal certified seed production system. Owing to limitations in access to land however, the private seed companies often contract farmers in the rice producing areas to produce seeds on a seasonal basis. Lack of formal contracting between producers and private companies/entrepreneurs/traders has resulted in failure of honoring the contracts. The price spread between the paddy grains and seeds is presently minimal and hence affects the adherence to contractual obligations on seed production practices and ensuring quality of rice seeds in the market. Furthermore, seeds of a given variety produced by various farmers in different rice growing areas are pooled and then packed by seed companies, making it difficult to track the sources of certified seed production lots and creating information asymmetry between producers and traders.

Given the limited capacities of the human and transportation resources for seed inspection and certification, the NSCS is struggling to fulfill the responsibilities of ensuring the quality of rice seeds supplied in the markets. Appropriate technical procedures such as isolation distance, roguing and pest and disease control measures are hence not fully adhered by seed producers. In a vicious cycle, the under staffing of NSCS also restricts the total seed production as the registered producers could not be sure of field inspection and certification of the seeds. Avoiding physical admixtures and physical damage to seeds during harvesting and post production stages remain a critical challenge in ensuring quality of rice seeds. Usage of appropriate methods and tools for harvesting, threshing, winnowing, drying and storage shall also minimize the losses.

3.4. Supply

NARO largely depends on Africa Rice Center and other international organizations for the nucleus and breeder seeds of Uganda's most popular varieties such as NERICAs 1, 4 and 10. The low technical capacities of research institutions in generating adequate quantities of breeder- and foundation seeds of popular rice varieties remains as a bottle neck in the supply chain. Lack of training for researchers and technicians and the inadequacy in infrastructures such as cold rooms, glass house facilities and equipments for testing and evaluation of parental lines limits the ability of existing researchers in supplying in-house nucleus seeds and breeder seeds, and scaling up of foundation seed distribution. Furthermore, the physical distance between Namulonge, where almost all the breeder- and foundation seeds of rice varieties are produced, and the various locations of certified seed production affects the timeliness in supply of seeds in the different zones.

Given the difficulties faced by NSCS in regulating the supply of quality seeds, the supply of community or farmer based seeds becoming extremely vulnerable to compromises on quality. Lack of storage facilities for bulking the certified seeds at individual farmer, community, sub-county and district levels also affect the spatial and temporal patterns of seed supply in rice

producing areas. Accessibility to upland rice production areas in the uplands is another major bottleneck affecting the timely supply of rice seeds.

Marketing of certified seeds by private seed companies are done through licensed agro-dealers. Promotion of rice seed marketing is constrained by the fragmented and weak distribution system. The sales turnover of certified rice seeds is generally lower than that for other commercial crops such as maize, sunflower and vegetables¹². Hence rice seed distribution requires greater depth in marketing and higher transaction costs. The source of certified seed production could not be verified in most of the packs. Pressed for meeting the obligation of supply of seeds to public distribution systems within the time frame committed under the tenders, some private seed companies and local entrepreneurs source rice seeds from unauthentic sources of seed (sometimes grain) production.

Broad based licensing mechanisms that will allow all the private seed companies to produce the desired varieties and allowing the market forces to compete for quality seeds are not yet adapted. Besides the government approved varieties, there are several varieties that are grown in upland and lowland environments (section 2.2) the characteristics of which are not clearly established. This is due to lack of clarity on procedures on release of varieties. Presently there is no registry of farmers who are engaged in certified rice seed production. This makes it difficult for ensuring quality of seeds distributed through informal systems. The decentralized procurement process engages local entrepreneurs who are also responsible for distribution of the seeds. There is a need for improving the transparency of procurement process and the criteria of selecting target beneficiaries. The absence of guidelines for pricing of certified seeds affects the demand and marketing of seeds.

The limited access to finance for agro dealers and potential seed producing entrepreneurs restricts the distribution of certified seeds. Most of the existing agro dealers in rice producing areas are small rural investors and hence find difficulty in accessing credit. Although some seed companies supply seeds on credit and collect the money after the sales, such financing system works more efficiently for commercial cross pollinating crops the seeds of which must be replaced more often than in self pollinating crops such as rice. There is a growing number of complaints on the poor quality and adulteration of rice seeds. Given the wider mandate of NSCS covering all the crops, the inadequate operational budget for inspection and certification services is a major constraint in testing and evaluating the quality of seeds supplied in the system.

4. Vision and Scope

4.1. Position of Rice Seed Development Strategy

Quality seeds play an essential role in improving crop productivity. Hence multiplication and distribution of rice seeds is included as one of the major strategic elements in achieving the goal set forth under Uganda's NRDS. Since availability of quality seeds shall also influence the marketability of grains, strategic interventions in rice seed value chain become paramount for competitiveness of locally produced rice. The road map for development of rice seed value chain is in very much line with Uganda's own formal visions for national development as stated in both the old master development framework for Uganda, the Poverty Eradication Action Plan (PEAP), and the Agriculture Sector Development Strategy Investment Plan (DSIP). The DSIP is the investment framework under Comprehensive African Agriculture Development Program (CAADP).

Uganda's Vision 2025 calls for a significant role of private sector in diversifying production patterns and in raising the competitiveness in the face of globalization. It emphasizes the role of private sector in steering the country's agriculture towards sustainable path. The National Agricultural Policy¹³ states that the biggest gains in productivity shall be obtained only by improving the value of seeds. The macroeconomic framework and general government policies in Uganda are accommodative of private sector companies for seed production and marketing. The private seed sector in Uganda has hence been growing and becoming competitive in the region. Thus the rice seed development strategies presented in this document is well positioned within the overarching agricultural development agenda of Uganda.

4.2. Vision for rice seed sector

The vision for the strategic road map for the development of rice seed value chain is to ensure a 'self-sustaining supply of quality rice seed in Uganda'.

4.3. Goal and Scope

The goal of the road map described in this document is to enable access quality rice seeds to farmers by 2018. This road map therefore aspires to put in place stable frameworks for production and distribution of rice seeds. Hence the scope of this strategic road map encompasses the entire supply chain of rice seed system in the country.

4.4. Objectives

To achieve the goal set forth in this road map, the following specific objectives are set:

¹³ Ministry of Agriculture, Animal Industry and Fisheries (2011) National Agricultural Policy

1. To improve the quality of rice seeds by building capacities and strengthening of inspection- and certification processes
2. To increase the volume of rice seed production by mobilizing and building capacities of farmers, private- and public sector stakeholders
3. To enhance accessibility of improved seeds through timely distribution and strengthening of supply chain
4. To promote implementation of policies and regulations related to rice seeds by providing advocacy, creating awareness, capacity building and strengthening/reorganization of rice seed industry

4.5. Implementation Structure

The rice seed development strategies will be implemented through the same set up through which NRDS is presently being implemented in Uganda. The Rice Steering Committee (RSC) under MAAIF shall direct Rice Technical Committee (RTC) and Rice Industry Secretariat (RIS) to prioritize the strategic elements that require attention from development partners and government through their budget cycle. Based on the priorities, concept notes will be developed by Technical Working Group (TWG) that will specifically address the various challenges along the rice seed value chain. After getting the endorsement of concept notes by the RSC, RIS in collaboration with TWG shall mobilize funds from appropriate sources. When the concept notes are accepted by the sponsor and transform into projects, the execution of projects will be done by the respective institutions. The rice desk at MAAIF will spearhead the overall implementation of the strategies and coordinate by streamlining the actions and by engaging the relevant stakeholders in the rice sector. Since the two units responsible for phyto sanitary protection, inspection and certification namely PIQS and NSCS, and the rice desk office are housed at MAAIF; the RIS shall perform monitoring and evaluation of the implementation of strategies.

5. Strategies and Priority

5.1. Strategic Principles and Approaches

A sustainable supply of quality rice seeds in Uganda would require multiple channels of production and supply. Given the dominance of informal system of rice seed production and supply in the country, the following strategic pillars are envisaged to achieve the vision. It is intended that these three elements will complement each other.

- i. Private Seed Company based production and marketing
- ii. Community based seed production and distribution
- iii. Farmer saved seed practices

The private seed companies have established a good penetration into the markets of seeds of cross-pollinated commercial crops. Such private seed companies could therefore use the marketing channels for supplying certified rice seeds. It shall be believed that the formal system of using certified seeds would steadily replace traditional methods of seed provision once farmers realized the benefits of improved seed. It is important therefore to create enabling environments that would allow private seed companies to persuade rice farmers shift towards a formal seed system.

Development partners and NGOs often embrace a rice seed system that is built into the community of target beneficiaries. Through a methodical process of identifying potential progressive or lead farmers, training and equipping them with seed production technologies, monitoring the production practices and putting in place a system for distributing the seeds. Although the quality of such community seeds are not always certified, without compromising basic standards of seed quality the seeds are mutually accepted by the users.

The value of farmer based traditional rice seed system shall not be overlooked; as 85% of the farmers in Uganda produce their seeds themselves¹⁴. Rice farmers save a portion of the harvested paddy grains as seed for the next planting season, and exchange seed among fellow farmers, neighbors and relatives. Such socio-cultural means of seed production and distribution are more common amongst subsistence rice farmers who could not afford to purchase certified seeds. Transition to more formal seed systems by subsistence farmers would therefore require coherent extension services elucidating the benefits.

5.1.1. Legislation, Policy and Institution

The national seed policy that is being currently drafted needs to be enacted at the earliest possible. It is important that the policies seek to support a vibrant market-led rice seed industry and outline methods and principles of how the seed industry shall be regulated and coordinated. Besides the policy, developing long term strategies on seed development defining

¹⁴ Mubangizi E et al (2012) Uganda seed sector assessment, ISSD briefing note

targets, directions, resource allocations, and action plans shall assist stakeholders set sights on their roles

There is a clear need to build human resource capacities in rice seed production, extension services for seed producers, inspection of seed production, certification and monitoring of marketing practices. Besides fresh recruitments, there is considerable need for training existing staffs. Since rice seed production through both formal- and informal systems is envisaged, periodical training courses for private seed producers and farmers are necessary to improve the quality of rice seeds in the country

Given the limitations of land for private seed companies and community seed services, raising the interests amongst farmers to produce seeds on a contract basis will require adequate incentives and price support for seed production. Besides increasing seed production, incentives could be used as a tool to enable transition of community based seed producers into formal systems, when such incentives are tied with conditional inspection and certification by NSCS. Incentives could also motivate entrepreneurial farmers to turn into formal seed producers and thus help improve the penetration of supply of quality rice seeds in to more rice producing areas. Creation of awareness amongst farmers and registration of farmer-seed producers could improve the linkages between private seed companies and contracted farmers.

5.1.2. Production and Inspection

Instilling technical knowledge on seed production procedures and protocols on the producers of breeder-, foundation and certified seeds is an important approach envisaged in the road map. This shall be supplemented by building capacities through fresh recruitment of staffs engaged in inspection and certification. Efforts must be made to increase operational budget for field inspection, seed testing and certification. Facilitating inspectors to access production sites and samples of seed stocks by rendering transportation means will also improve the coverage of production and inspection. Besides increasing the seeds of established varieties, farmer-seed producers will be encouraged to produce seeds of consumer preferred local varieties will improve the competitiveness of locally produced rice.

Establishing a registry of released varieties and procedures for release of new varieties will improve the efficiency of inspection and certification. Seed testing laboratories will have to be adequately equipped and accredited by meeting standards set by international agencies such as OECD and ISTA. Protocols in evaluating the seed samples will be streamlined with international procedures.

Capacity building by in-service training and upgrading the educational qualifications of existing staffs in breeder- and foundation seed production, inspection and extension services on seed production shall help scaling out of availability of rice seeds. Extension services need to focus on enabling the shift from informal seed system to formal systems by creating the awareness on the importance of renewal of seed sources, various on-farm technologies and the relationship between quality seeds and productivity and profitability.

5.1.3. Supply and Market

Capacity of supply chain of rice seeds needs to be strengthened through physical and technical competence of private- and public systems. Engaging private sector in introduction of improved inbred varieties and hybrids, testing and selection of breeder's materials through public-private partnership shall help broaden the seed sources and varietal options. Spreading, instead of centralizing, the production of breeder- and foundation seeds by NARO shall expand the production and supply of certified rice seeds to zonal and/or sub-zonal levels.

Given the capacity constraints and cost implications, the public system shall not engage in production and supply of certified seeds. Instead, the public system shall strive to support seed producers and facilitate strong linkages between farmers and private companies. Technical improvements in farmer saved seed production system shall be attained by creating awareness and providing training. Extension services should emphasize on the importance of seed quality on the profitability and marketability of production by smallholders and subsistent rice farmers.

Market prices for rice seeds shall be moderated by naturally existing market forces; however the quality of seeds needs to be ensured of strict adherence to standards. It is also important that the packaging and the technical details of the seeds should be appropriately displayed on the packets of rice seeds. Quality assurance along the marketing chains shall be regulated through Ugandan Bureau of Standards.

Under the public system, the procurement process of certified seeds shall be streamlined by pooling the requirements of different sub-counties at district or national level. Besides addressing the challenges in bidding for low volumes of seeds, integrated purchases shall also allow NSCS to ensure the quality of rice seeds supplied in the system. The distribution of procured rice seeds at the parish or village level shall be used as incentive for adoption of other productivity enhancing technologies in rice production.

5.2. Target Setting and Gap Identification

Uganda's NRDS aims to increase rice production to about 700,000 metric tons of paddy by 2018 from the current level of production of 313,000 tons. An average seed rate of 50 Kg/Ha is recommended in upland and lowland production environments. At the current productivity level of 2.5 t/ Ha therefore, a seed-grain ration of 1:50 is observed. Under the current awareness status, it is assumed that rice farmers would replace the seeds on an average of once in 5 years. Based on the current trends in rice seed production under public- and private systems, gaps and targets for production, supply, financial and human resources for the road map are set as shown below:

5.2.1. Production and Inspection

The target annual production for the different classes (breeder-, foundation- and certified seed) and the gaps that are required to achieve the targets of paddy production set under the NRDS by the year 2018 are shown in table 9.

Table 9: Gap between the current production and target amount of seed production

	Target amount (MT/year)	Current Production/ supply (MT/year)	Gap (MT/year)
Breeder Seed	1.092 t/year	0.0776 t	1.0144 t/year
Foundation Seed	54.6 t/year	3.88 t	50.72 t/year
Certified Seed	2731.2 t/year	~250 tons (20% of the requirement)	2481.2 t/year

Given the suitability of different varieties in the lowland and upland environments, there is a need to establish the required amount of seeds of different varieties and the area required to produce the targets set for these varieties. Based on the current area under seed production of different varieties, and the required land area for producing the seeds are shown in table 10.

Table 10: Target annual production and the land areas for the different rice varieties cultivated in Uganda

Name of Seed Producing Stations	Name of recommended varieties	Breeder seed (MT/year)	Areas required for production (ha)	Breeder's (Pre-basic) Seed (MT/year)	Areas required for production (ha)	Basic Seed (MT/year)	Areas required for production (ha)
NaCRRRI, Namulonge	NERICA 6			0.7628 t/year	0.3052 Ha/year	38.12 t/ year	15.248 Ha/year
	WITA 9						
	NERICA 1			0.32292 t/year	0.13 Ha/year	16.146 t/ year	6.46 Ha/year
	NERICA 4						
	NERICA 10						
	NAMCHE 1						
	NAMCHE 2						
	NAMCHE 3						
NAMCHE 4							

The required human resources for the production breeder- and foundation seeds of existing rice varieties; and the projected financial requirements for fresh recruitments and training of existing staffs are shown in table 11.

Table 11: Human Capacity needs for rice seed production

	Number of technical personnel to be newly employed	Required Budget For employment	Number of technical personnel to be trained	Areas for training	Required Budget for training
Researchers	9	108,000 USD per year	9	Seed production technologies, Maintenance breeding (overseas)	45,000 USD
Technicians	16	48,000 USD per year	16	Seed production technologies (in-country)	8,000 USD
Workers/Laborers	65	39,000 USD per year		-	-
Total	85		25		

The human resources that are required to cover the field- and laboratory inspections of rice seed production and certification of seeds in various rice producing areas in the country; and the recurring budget for recruitment are shown in table 12.

Table 12: Requirement of human resources for inspection of the targeted rice seed production in different rice producing areas

Geographical area	Required Number of Inspectors	Required Capacity of Inspectors		Means and Budget required to be allocated per Inspector (with Remarks)
		Knowledge(with Remarks)	Experience (with Remarks)	
Abi, West Nile	3	B Sc	>0	28,800 USD per Inspector per year
Ngetta, North	3	B Sc	>0	
Nabuin, NE	2	B Sc	>0	
Buginyanya, East	5	B Sc	>0	
Mukono, Central	2	B Sc	>0	
Rwebitaba, West	2	B Sc	>0	

Bulindi, West	3	B Sc	>0	
Mbarara, West	2	B Sc	>0	
Kachwekano, SW	2	B Sc	>0	
Total	24			691,200 USD per year

Presently there is no exclusive rice seed production team at NARO that could meet the expected volumes of rice seeds. The staffs who are engaged in breeder- and foundation seeds of rice varieties are also engaged in producing seeds and propagative materials of other crops. Besides the total capacity, the technical competence of existing staff needs to be enhanced through in-service training. There presently are only 4 inspection staffs covering all the crops and the entire country. The technical knowledge on verification of varietal traits, inspection of other crop & field features, laboratory testing and reporting is inadequate, and hence needs to be improved through on-job overseas and domestic training courses.

5.2.2. Supply

Storage warehouses for foundation and certified seeds in rice producing areas limit the timely supply of seeds. Infrastructures such as feeder roads and electricity also inhibit the supply flow of seeds in remote areas. Centralized breeder- and foundation seed production also restricts the flow of seeds to entrepreneurial rice farmers and rural entrepreneurs who has the potential to resort seed production on a commercial scale. Liberalization of foundation seed production to more private companies through broader licensing mechanisms could also widen the geographical penetration of the certified seed markets.

The procurement of seeds by the parish or village committees largely depends upon the availability of budget. However, the inconsistent and often inadequate budget allocations render the supply of seeds uncertain and unpredictable. The community based seed supply mechanisms are highly vulnerable to compromises on seed quality. Although the quality declared seeds are distributed on a mutual consensus, any lapses in quality through pest and disease outbreaks for example shall lead to loss of trust on formal seed systems by rice farmers.

The demand for rice seeds is generally low amongst rice farmers as most of them engage in a low-risk and low input rice farming. The supply of farmer saved seeds amongst farmers is difficult to quantify. Nonetheless since the method of selection employed by farmers are highly variable, it is conceivable that the quality of farmer saved seeds however is highly variable amongst farmers even within a given rice producing area. Although it is difficult to measure the magnitude of the gap in supply in such informal seed production system, since 85% of the farmers save seeds for themselves provide the scopes for marketing through formal seed system.

5.3. Possible Intervention Options and Priority Areas

The following interventions are envisaged to achieve the goal and targets set in this road map for rice seed value chain development by improving the environments of policy, institutions, planning, quality seed production and supply of rice seeds;

5.3.1. Legislation, Policy, Institutions and Planning (Recommendations)

- Expedite the process of drafting the national seed policy
- Harmonize national seed production standards and procedures through collaboration with regional blocks such as East African Community (EAC) and Common Market for East and Southern Africa (COMESA)
- Draw long-term strategies for the development of seed sub sector
- Streamline varietal release procedures with international procedures
- Establish a registry of community- and farmer-seed producers
- Raise interests of contract farmers in rice seed production for private companies through policy decisions;
 - by allowing only the registered seed producers in the contract
 - providing incentives
 - price support – margins/premium price for seed vs grains
 - Leasing of land to private companies
- Supplement the capacity and reach of NSCS by training and engaging local extension agents to perform inspection of fields where farmers produce seed for themselves
- Allocate exclusive annual budget for production of line for multiplication and inspection of breeder's, pre-basic and basic seed production of popular rice cultivars
- Install a 'self sustaining seed fund' that could reinvest the funds generated from the sales of foundation seeds back into the production of breeder- and foundation seeds
- Widen the licensing framework by issuing rights for multiplication of seeds of more than one variety per private seed company
- Set up rice multi stakeholder innovation platform at all rice producing regional and at national levels
- Establish clear and realistic projections on demand for rice seeds, varieties on a seasonal/annual basis by engaging local governments, private sector, NAADS and MAAIF

5.3.2. Production and Inspection

- Establish a database on all existing rice varieties and their characteristics
- Improve the technical know-how of researchers through training (overseas and in-country) and collaboration with advanced research institutions
- Capacity building for "certified" seed production & inspection:
 - Recruitment of staffs for inspection & certification of seeds

- train existing and to-be-recruited staffs on field inspection, and testing of seed quality
- conduct technical courses for private agencies (including farmers) involved in rice seed multiplication
- Increase the quantity and access of initial seeds (breeders' seeds) by;
 - allocating annual budget for seed multiplication;
 - recruitment of staffs (researchers & technicians)
 - expanding seed production activities in research centers (other than NaCRRI)
 - equipments & infrastructure
 - training of existing staffs
 - promoting private sector in varietal introduction, evaluation and multiplication of breeder's and foundation seeds
- Encourage participation of private sector in commercial rice seed production by;
 - granting exclusive rights for 'production' of certified seeds for as yet unauthorized rice varieties
 - registered network of 'seed producing farmers' who are authorized to produce for private companies
 - raising interests of 'contract farming' in rice seed production for private companies through policy decisions;
 - by allowing only the registered seed producers in the contract
 - providing incentives
 - price support – margins/premium price for seed vs grains
 - Leasing of land to private companies
 - Promotion of 'quality declared seeds'
 - create awareness (role of public- and private sectors) on the importance of
 - certified seeds
 - periodical renewal of seed sources by farmers
- Procurement of testing equipments and laboratory infrastructures (cold storage room, screen house, glass house)
- Increased operational budget for inspection and testing and transportation
- Accreditation of national seed testing labs by subscribing to OECD and ISTA (International Seed Testing Association) and through regular auditing and routine meetings (national and international)
- Harmonization of regional seed policies through collaboration with regional blocks such as EAC, COMESA, AU.
- Organizing training programs for farmers who save seeds for themselves and extension agents who shall monitor seed production and/or selection technologies

5.3.3. Supply and Marketing

- Actively promote agro-dealers
 - for selling certified rice seeds through incentives

- providing quality seeds as incentives for selling other productivity enhancing technologies and/or inputs
 - improving access to finance
- Scale out the functions of foundation seed production & supply through other NARO centers/stations
- Promote and strengthen agro-dealer networks in rice production areas
- Training of seed multipliers (farmers and other private producers) to broaden the sources of supply of certified seeds in more rice production areas
- Letting the natural market forces prevail over the seed supply chain (only the seed producer is supported under public distribution system)
- Improve transparency in selection of seed recipients by local administration
- Create awareness on financial products and schemes available for seed production
- Increase the budget outlay for supply of certified seeds under local administration
- Increase annual operational budget allocation for National Seed Certification Services Unit
- Improve the timeliness of availability/release of funds for seed supply to local administration
- Facilitate quality assurance through inspection of seeds sold in the market
- Reduce forgery by ensuring that the seeds are packed with tamper proof materials and the required technical details are shown
- Provide quality assurance through monitoring & evaluation of distribution practices & services