



THE REPUBLIC OF SIERRA LEONE

**MINISTRY OF AGRICULTURE, FORESTRY AND
FOOD SECURITY (MAFFS)**

RICE SEED DEVELOPMENT STRATEGY OF SIERRA LEONE

**PREPARED FOR THE COALITION FOR
AFRICAN RICE DEVELOPMENT (CARD)**

2017 – 2026

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Executive Summary

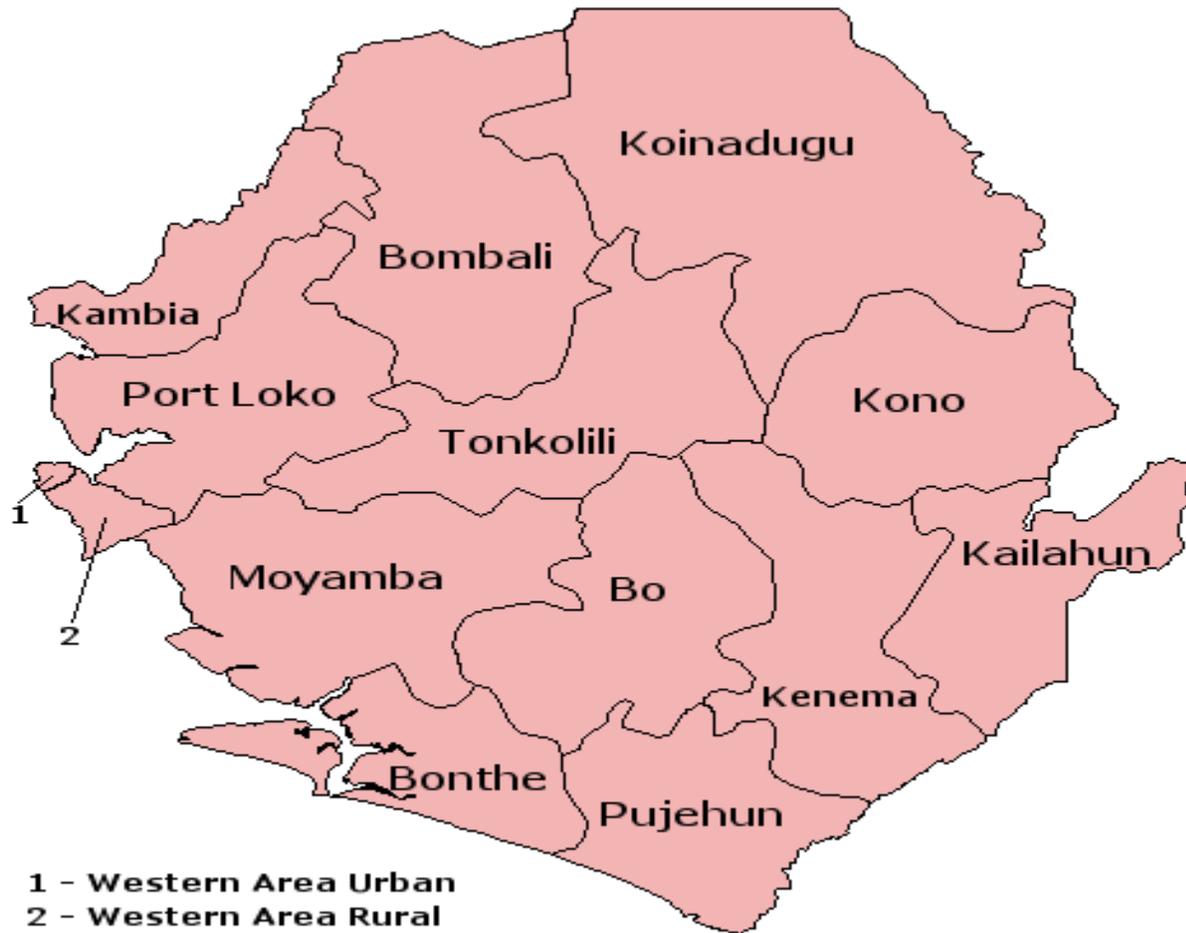
Agriculture could be an effective driver of economic growth, generating jobs and reducing poverty. Rice is largely produced by peasant farmers under five rainfed agroecologies such as uplands, inland valley swamps, mangrove swamps, bolilands and riverine grasslands. Due to rapid growth in consumption demand, the country requires about 530,000 mt of milled rice to meet the consumption needs of the population annually. The National Rice Development Strategy (NRDS) aims to increase rice production in order to contribute to the improvement of food security and economic development. Quality seed is the primary input that can significantly increase production and productivity. Its production and supply constitutes a major strategic intervention identified in the NRDS. The objective of this rice strategy is to assess the challenges and issues across the rice seed value chain and outline a roadmap for developing the rice seed sub-sector to double the supply of quality seed rice.

Sierra Leone produced its first ever Seed Bill (2012); reviewed it in (2016) and categorized rice as one of the prescribed crops for which seed certification is compulsory. Rice seed is typically produced through four stages of sequential multiplication. The Rokupr Agricultural Research Centre (RARC) develops a rice variety and produce small amount of initial source of seed (breeder seed); using which foundation and certified seed of the same variety are produced. Under the seed regulations (2014), certified seed can be further multiplied for up to two cycles. The Sierra Leone Seed Certification Agency (SLeSCA) is the national regulatory authority for assuring the quality of seed in the country. The national policies made provisions for active participation of the private sector in production and supply of certified seeds. Currently, certified seed rice is produced by public institutions (such as RARC, SMP) and few private seed entities and seed producers' groups.

Trends in seed production suggest strong growth in demand although the exact quantification of demand for certified rice seed is unknown. Non-enactment of the seed bill, inadequate human and material capacity, low budgetary allocation for seed production, varietal development and maintenance, seed certification, stakeholders' coordination, extension services and no seed production plan curbs the potential of the rice seed value chain. In this roadmap, inventory on existing seed production and certification facilities was conducted. Linkages between seed operators will be strengthened by establishing a forum for stakeholders. The dynamics of seed demand, supply and price will be established. Production of the different seed classes will be accordingly coordinated so that a critical mass of source seeds is constantly available. Recruitment and training on seed production and certification shall be organized through short and long term courses. Awareness on good agricultural practices, benefits of using certified rice seeds will be disseminated to farmers.

The roadmap will be implemented through the existing organizational structure of the NRDS. Funds for the implementation will be sourced from government and development partners through development of project concept notes on the various proposed interventions.

Figure 1: Map of Sierra Leone showing the twelve Districts and the Western Area



Acronyms and Abbreviations

AAG	Agricultural Advisory Group
ABCs	Agric Business Centres
AGRA	Alliance for Green Revolution for Africa
AFP	Agenda for Prosperity
AfDB	Africa Development Bank
BRAC	Bangladesh Rural Advancement Committee
BSc	Bachelor of Science
CAAD	Comprehensive Africa Agricultural Development
CARD	Consultative Agricultural Rice Development
°C	Degree Celsius
CIMMYT	International Centre for Maze and Wheat Improvement
DFPP	Diversified Food and Production Programme
FAs	Farmers Associations
FAO	Food and Agricultural Organization
FBOs	Farmer Business Organizations
GAFSP	Global Agricultural and Food Security Programme
GDP	Gross Domestic Products
GoSL	Government of Sierra Leone
Ha	Hectare
IRRI	International Rice Release Institute
IYR	International Year of Rice
JICA	Japanese International Cooperative Agency
Kg	Kilogram
Km	Kilometres
Le	Leones
LOD	Law Officer's Department
M	Million
MAFFS	Ministry of Agriculture Forestry and Food Security
M&E	Measurement and Evaluation
Mm	Millimetres
MSc	Masters of Science
MT	Metric tons
NaFFSL	National Federation of Farmers of Sierra Leone
NERICA	New Rice for Africa
NGOs	Non-Governmental Organization
NRDS	National Rice Development Strategy
PEMSD	Planning, Evaluation, Monitoring and Statistics Division
QDS	Quality Declares Standards
R ₁ and R ₂	First and Second Generation of Certified Seed

RARC	Rokupr Agricultural Research Centre
ROK	Rokupr
SCP	Small Holder Commercialization Programme
SLARI	Sierra Leone Agricultural Research Institute
SLeSCA	Sierra Leone Seed Certification Agency
SMP	Seed Multiplication Project
USD	United States Dollar
WAAPP	West Africa Agricultural Productivity Programme
Yrs	Years
%	Percentage

1.0 INTRODUCTION

Sierra Leone is located on the West coast of Africa, north of the equator. It covers an area of 71,740 km². It borders Guinea on the north and northeast and Liberia on the east and southeast. The Atlantic coastline is about 340 kilometers. The country has a tropical climate, and four main type of vegetation: forest, savannah, grassland and swamp. The country has eight main river systems which typically flow from north-east to south-west and empty into the Atlantic Ocean.

Sierra Leone is a rapidly growing country with a population of 7,075,641 million (Population Census, 2015). However, 70% of the population lives below the poverty line of US \$2 per day. The country has two main seasons: the rainy season which lasts about 7 months from May to November with a peak in July and August and the dry season from December to May. Rainfall is relatively abundant throughout the country. The Peninsula mountains in the West Area receive more than 5,000 mm (200 inches) annually, while the northeast receives about 2,000 mm (80 inches) a year. The dry season in the north is characterized by hot dry harmattan winds that blow from the Sahel. The south tends to be protected from these winds by the hills and mountains of the interior hills and plateaux region. This favours the production of tree crops in the south of the country. The most common natural hazard in Sierra Leone is flooding, and it occurs mainly from June to September. The practice of shifting cultivation means that there is little primary forest left. Most of the country is now covered by secondary forest or farm bush. The country is rich in minerals such as rutile, diamonds, gold, iron ore and bauxite. The country relies on mining as its economic base. But two-third of the population lives from subsistence agriculture which represents more than half of the national income.

Sierra Leone was subject to a devastating civil war from 1991 to 2002. Since then, significant progress has been made towards peace-building, the resettlement of displaced populations, reconstruction of war-affected communities, and rehabilitation of productive household and community assets. The war caused the displacement of 30% of the population. Farms were abandoned during the war, as the population fled into towns. Production of food and export of crops has however to some extent recovered remarkably since the end of the war. But despite of this, Sierra Leone remains highly dependent on food imports, and has been heavily affected by the 2008 food price crisis. The 2009 global financial crisis also greatly impacted the country, with remittances and revenues from minerals (iron ore and bauxite) dropping by 30% and the current high levels of commodity prices pose a great risk to the country's food security status.

Sierra Leone was an exporter of rice in the early 1950's. Since 1955 the agricultural sector has not been able to meet domestic needs. The need to import rice has continued in spite of government's efforts to increase domestic production through price support programmes, fertilizer subsidization, and subsidized mechanical cultivation scheme. Self-sufficiency has become the central focus for national agricultural policy.

The country is one of the largest consumers of rice in sub-Saharan Africa with a per capita consumption of 104kg. Rice is an economic crop hence an increase in its domestic production will not only promote food security, but also boost the income levels of the farming population and promote rice importation reduction.

The FAO of the United Nations estimates (IYR 2004) that 530,000 metric tons of rice is consumed annually in Sierra Leone and that annual local rice production equals 200 metric tons thus Sierra Leone rely heavily on imported rice to satisfy demand. Although the production of the major food crops, which contribute to 75% of the agricultural GDP, has shown an increasing trend in recent years, Sierra Leone has still not met the Comprehensive Africa Agriculture Development Programme (CAADP) agricultural growth rate of 6%. However, a steady increase in production and productivity was recorded.

Table 1: Rice Production Trend from 2001 to 2013

Year	Area (Ha)	Yield (MT/Ha)	Production (Mt)	Milled Equivalent (Mt)	Population	National Requirement (Mt Milled)	Self-sufficiency (%)
2001	258,850	1.20	310,620	186,372	4,725,033	498,403	37.93
2002	343,142	1.23	422,065	253,234	4,814,808	500,740	50.57
2003	356,506	1.25	445,633	267,380	4,906,290	510,254	52.40
2004	426,772	1.27	542,000	325,200	4,999,509	519,949	62.54
2005	427,907	1.29	552,000	331,200	5,094,500	529,828	62.51
2006	422,556	1.33	562,000	337,200	5,216,890	542,557	62.15
2007	432,356	1.36	588,004	352,802	5,343,200	555,693	63.49
2008	475,592	1.43	680,097	408,058	5,473,530	569,247	71.68
2009	499,111	1.78	888,417	533,050	5,607,930	583,225	91.40
2010	549,022	1.87	1,026,671	616,003	5,746,800	597,667	103.07
2011**	603,924	1.87	1,129,338	677,603	5,855,989	609,023	111.35
2012**	717,872	1.59	1,141,417	684,850	5,967,253	620,595	110.35
2013**	671,422	1.87	1,255,559	753,335	6,080,631	632,385	119.13

Source: Planning, Evaluation, Monitoring and Statistics Division (PEMSD)/MAFFS

- Note: Milled recovery = 60%
- Population growth rate at 1.9% using 2004 population as baseline
- Per capita consumption = 104Kg per person per annual
- **Please note that 2010 to 2013 figures are projected figures

Rice is cultivated in both the upland and diverse lowland ecologies in Sierra Leone. While climatic conditions are generally favourable for rice production, biotic and abiotic factors such as diseases, pests, use of low yielding local varieties, low soil fertility, poor extension services and several socio-economic factors are considered to be limiting farmers' productivity. In addition, most smallholder farmer's yield is greatly reduced by post-harvest losses due to poor crop

management, inappropriate storage and marketing facilities. The form of agriculture practice by the vast majority of Sierra Leonean farmers is very rudimentary. Less than 5% of the households have access to fertilizers, insecticides, herbicides and basic machinery which are resources that could help enhance rice production. Swamp development is proving very difficult due to prolonged abandonment during the civil war and now requiring robust labour beyond the capacity of individual households.

The National Rice Development Strategy (NRDS) was developed in 2009 with support from CARD to lay out a framework for significant increases in rice production in order to contribute to the improvement of food security and economic development in Sierra Leone. The specific objectives are: ensure an increase in the sustainable production and productivity of rice; promote appropriate post-harvest handling, processing and marketing of rice; develop appropriate infrastructure for rice production and marketing; improve the capacity of stakeholders and institutions involved in the rice sector.

The government and its development partners designed a number of agricultural development projects to contribute to the achievement of NRDS objectives since its formulation. Significant strides towards achieving the NRDS have been made through the country's flagship programme -Smallholder Commercialization Programme (SCP) which was also aligned with the Agenda for Change (2008-2012) now referred to as the Agenda for Prosperity (AfP) for the period 2013–2018. Some of the projects under the SCP included the Diversified Food Production Project (DFPP) and West Africa Agricultural Productivity Programme (WAAPP), Rural and Private Sector Development Project (RPSDP), Agricultural Sector Rehabilitation Project (ASREP), Rural Finance and Community Improvement Programme. These projects were financed by the World Bank (WB), Africa Development Bank (AfDB) and International Fund for Agricultural Development (IFAD). These projects to a larger extent have contributed to the country's agricultural environment. Attempts have been made to improve the rice seed sector through WAAPP support to SLARI. Notable progress includes support to lowland rice production and promotion of double cropping through development and rehabilitation of inland valley swamps, release of twelve rice varieties for both lowland and upland ecologies, dissemination and adoption of improved rice technologies and capacity building of SLARI research personnel among others. The support also includes expedition of the formulation of the seed bill, facilitating functionality of SLeSCA and reactivation of Varietal Release and Registration Committee (VRC) as well as the National Seed Board (NSB).

However, major impediments such as climate change and soil fertility are threats for Sierra Leone to meet its NRDS targets. Despite this notable progress, the above factors continue to pose significant shortcomings for the country's agricultural development. In responding to these critical challenges, the rice seed development strategy proposes to ensure effective ways to improve on the rice seed sub-sector along the value chain.

2.0 REVIEW OF NATIONAL RICE SEED SUB-SECTOR

2.1 Legislation, Policy, Institutions and Planning

2.1.1 Legislation

Sierra Leone recognized the importance of quality seeds by adopting a National Seed Policy in 2006 and reviewed in 2009, followed by the Seed Bill 2012 and Seed Regulations 2014. The Seed Bill brought the establishment of the Sierra Leone Seed Certification Agency (SLeSCA) that spearheads the development and regulation of the seed industry. It has been approved by Cabinet in 2014, reviewed by the Law Officers Department (LOD) in 2016 and currently awaits submission to Parliament for enactment. The Bill though not yet enacted has provided the whole regulatory legal framework for the control of varietal release, seed production, marketing, import, and export as well as quality assurance of agricultural seeds.

The reviewed Seed Bill 2016 has further reinforced SLeSCA as the national designated authority for implementation of regulations related to seeds. The Bill endorses the roles of private sector in multiplying and distributing seed to farmers. Farmers shall save and re-use seeds of varieties only on their own holdings. Under the Seed Bill, rice is described as one of the prescribed crops for which certification of seeds is compulsory. It prescribes government institutions to assist the development and market promotion of all the prescribed crops. The Bill also empowers SLeSCA to provide licenses for seed operators, monitor and facilitate the enabling environment for the sustainable development of national seed production and supply systems.

2.1.2 Policy

The GoSL has accorded high priority to the attainment of food security. The Agricultural Policy Framework issued in 2002 clearly states that the use of improved seed is considered a major pathway for the achievement of the national food security goals. The policy should create an environment, which will foster support from both government and development partners for all activities which relate to seeds. Sierra Leone's seed regulations (2014) emphasize the significance of certified seed system and advocate its implementation by the stakeholders. The national seed policy (2009) outlines strategies that aim at contributing to agricultural productivity through improvisation of seed production and supply systems. These strategies are to (i) ensure that adequate stocks of high-quality seeds of improved varieties are made available to farmers, (ii) encourage and support the private sector to produce, to the maximum extent possible, the seeds that are required for farmers' use, (iii) place equal attention on both true seeds and vegetative planting materials such as seedlings, tubers, cuttings and plantlets, (iv) ensure that all public sector seed infrastructural components are established and operated in the manner most beneficial to national agricultural and economic development.

The public sector shall withdraw from the commercial production of seeds as the private sector develops their capacity to produce and supply such seeds. All activities of a commercial, market-responsive nature, and in which the private sector is willing to invest in such a manner as to efficiently serve all or part of the national needs, shall be the responsibility of the private sector, as appropriate. Government has initiated provision of the enabling environment to attract private

sector investment in seed business through registration and licensing of seed operators along the seed value chain (including producers and suppliers/merchants). Acknowledging the importance of creation of demand for certified seed, the policy calls for strengthening of farmer extension and advisory services with a view to make farmers appreciate the benefits of using good quality seed. The policies emphasize a larger role for private sector. Projects promoting rice seed value chain developmental activities are presently supported by World Bank (West Africa Agricultural Productivity Program) and Islamic Development Bank (Linking Farmers to the Markets).

2.1.3 Institutions

Rice seed is produced and distributed by the formal and informal sectors. In the formal sector, Rokupr Agricultural Research Centre (RARC) is the public institution mandated to carry rice seed and seed related research including breeding programs. It is solely in charge for breeder seed production and to some extent foundation seed production. The Seed Multiplication Programme (SMP) which is also a public institution is responsible for foundation and certified seed (R1) production. SLeSCA is responsible for seed certification and quality control aspects in the form of field inspections and laboratory seed testing. However, the Seed Bill stipulates that new varieties must be registered for any commercial activity related to production and distribution of seeds. The value chain actors involved in rice seed production, supply and inspection are shown in Table 2.

The formal rice seed sector supply about 8% of rice seeds used in the country whilst the informal sector accounts for the remaining 92%. Because of the rudimentary nature of the whole rice seed sector, there are no established seed distribution channels in the country. Additionally, there are no specialized rice seed dealers operating in the country. Rice seed distribution in the form of assistance to rice producing farmers by the Ministry of Agriculture, Forestry and Food Security, Agricultural projects (such as WAAPP, LFM, etc) and NGOs is seasonal and it is one of the main supply channels in which rice seed is circulated in farming communities nationwide. There are massive potentials in the country to be tapped both in the informal and formal sectors if their capacities are strengthened. Nevertheless, the establishment of SLeSCA for quality assurances has gone long way in sanitizing the entire seed sector in the country.

Table 2: Institutions Responsible for Rice Seed Production, Inspection and Supply

Seed class	Activity	Name of Institution	Responsibility	Legislations/policies determining responsibility
Overall	Production	MAFFS, RARC, SMP (Public), Seed entities (private)	Planning, production and supervision	-National Seed Policy (2006) and reviewed in 2009; -SLARI Act (2007); -Seed Bill (2012) and reviewed in 2016
	Inspection	SLeSCA	Seed inspection and certification	
	Supply/distribution	MAFFS (Donor supported projects), RARC, SMP and NGOs	Seed supply and distribution	
Breeder Seed	Production	RARC	Seed production, storage, maintenance of varieties and parental lines	
	Inspection	SLeSCA	Seed inspection and certification	
	Supply/distribution	RARC	Supply of breeder seed to the Farm Management Unit of RARC and SMP, which produce foundation seed	
Foundation seed	Production	RARC and SMP	Production and maintenance of foundation seeds	
	Inspection	SLeSCA	Seed inspection and certification	
	Supply/distribution	RARC and SMP	Supply of foundation seed to seed entities producing certified seed	
Certified R1	Production	SMP	-Production, maintenance and storage of certified seeds	
		Seed Entities	-Production of certified seeds	
	Inspection	SLeSCA	Seed inspection and certification	
Certified Seed R2	Supply/distribution	SMP and Seed Entities	Supply of certified seed R1 to certified seed R2 producers	
	Production	MAFFS/SMP, ABCs, FBOs, NGOs, FAs, Seed growers	Production and maintenance of certified seed R2	
	Inspection	SLeSCA	Seed inspection and certification	
Certified Seed R2	Supply/distribution	-MAFFS/SMP, ABCs, FBOs, FAs, Seed growers	-Collect produced seeds from seed growers and distribute to farmers -Sell seeds to farmers -Return a part of seed produce to MAFFS, and distribute to other farmers	

2.1.4 Planning

The government allocates limited funds to MAFFS for seed procurement annually; however the demand far outstrips the supply at national level. This is as a result of lack of national projection on demand and supply of certified seeds. RARC activities in breeder and foundation seeds production program is also inadequate which has negatively impacted on the overall planning of seed production and supply. In the past, there were no fora where public and private sectors can dialogue on issues in rice seed production. As part of the strategies to address these challenges, the National Seed Board (NSB) was reconstituted and officially inaugurated in 2013. The NSB is envisaged to strongly enhance the public-private partnership in the country's rice seed sector, which will help to achieve proper planning for rice seed production and supply. It is also envisaged that the establishment of SLeSCA will make great strides in national projections on demand and supply of breeder, foundation and certified seed classes with proper planning.

2.2 Seed Production

Recent efforts to restore rice production in Sierra Leone include the Ebola Seed Production Project funded by the World Bank and the release and dissemination of seven and five upland and lowland rice varieties respectively, by SLARI. SLARI is responsible for the production of breeder seed through its rice breeding programme at RARC. RARC breeders produce breeder seed once the variety has been released. The breeder seed is then multiplied and maintained into classes of foundation and certified seeds (R1 and R2). The breeder seed produced is passed on to the Farm Management Unit of RARC for production of foundation seed. However, the Seed Multiplication Programme (SMP) in the Ministry of Agriculture is mandated to produce foundation and certified seed. The programme plays a vital role in varietal maintenance and production of foundation seed, marketing and promotion of certified seed in ensuring rice self-sufficiency. Certified seed (R1) production is also undertaken by seed entities in addition to the existing community based rice seed producer groups. The community based rice seed producer groups are located all over the country. Finally certified seed (R2) recovered from seed growers are distributed to farmers. Excess seed produced is purchased by SMP and sold to other farmers or NGOs supporting seed production (Table 3).

Nonetheless, there are no reliable data on amount of seed produced in the country as a whole. However, what is accounted for are data obtained from RARC, SMP and few seed entities registered and supervised by SLeSCA (Table 4). At farmers' level, no clear distinction exists between varieties for subsistence and commercial purposes. This situation calls for further support for the full operationalization of an effective and efficient seed certification and quality assurance system.

Table 3: Flow of seed production and how seed is supplied to seed producers

Activity	Players in production/procurement			
	Market varieties	Roles played	Subsistence varieties	Roles played
Breeder seed (BS) Production	RARC Breeding Unit	Receive from AfricaRice Center, IRRI, etc	RARC Breeding Unit	Maintenance and Production
How BS is supplied to foundation seed producers	RARC Farm Management Unit	Receive from Breeding Unit of RARC	RARC Farm Management Unit	Receive from Breeding Unit of RARC
Foundation seed (FS) production	RARC Farm Management Unit and SMP Maintenance Farm	-SMP purchases from RARC farm management unit. -Production and maintenance of seed	-RARC Farm Management Unit and SMP maintenance farm	-SMP purchases from RARC farm management unit. -Production and maintenance of seed
How FS is supplied to certified seed R1 producers	RARC Farm Management Unit and SMP Maintenance Farm	-Seed is supplied to contract seed growers for seed production, recovered and sold to NGOs. -Excess seed after recovery is purchased by SMP/RARC	RARC Farm Management Unit and SMP Maintenance Farm	-Seed is supplied to contract seed growers for seed production, recovered and sold to NGOs. -Excess seed after recovery is purchased by SMP/RARC
Certified seed production R1	Contract seed growers and seed entities	Production	Contract seed growers and seed entities	Production
How R1 is supplied to certified seed R2 producers	Contract seed growers and seed entities	Seed is sold to NGOs & other seed growing farmers in the community.	Contract seed growers and seed entities	Seed is sold to NGOs & other seed growing farmers in the community.
Certified seed production R2	Seed growers and other farmers in the community	Production	Seed growers and other farmers in the community	Production

Table 4: Production of Rice Seed (for 2015, 2014 and 2013), Production Station and Cultivated Area

Year 2015	Total production/ procurement amount	Name of production station	Production amount per station	Cultivated area per station (ha)
Breeder seed (G2)	14.492 kg	RARC	14.492kg	0.02
Foundation seed (G3)	-	RARC	-	-
		SMP	-	-
Certified seed (R1 & R2)	127.91 mt	SMP Makeni	65.08mt	1,041.2
		SMP Kobia	62.83mt	1,005.2
Year 2014				
Breeder seed	286 kg	RARC	286 Kg	0.38
Foundation seed	123.55 mt	RARC	23.55 mt	376.8
		SMP	100.0 mt	1,600
Certified seed (R1 & R2)	100.0 mt	SMP Makeni	45.0 mt	720
		SMP Kobia	55.0 mt	880
Year 2013				
Breeder seed	54.7	RARC	54.7	0.09
Foundation seed	22.44 mt	RARC	22.44 mt	359.04
Certified R1&R2	52.5 mt	RARC	52.5 mt	840.0

The 2016 Seed Bill emphasized the strengthening of the National Seed Board to oversee the monitoring of the seed sector in the country. The Bill also mandated the Variety Release and Registration Committee to register all released varieties in the country. Presently there are 27 rice varieties registered in the National Catalog of Plant Species and Varieties and recommended for commercialization. The varieties officially inspected and certified by SLeSCA are shown in Table 5. Majority of these varieties are used for commercialization as well as consumption by farm families (subsistence). Farmers keep aside a portion of their production as seed for the following year although a substantial amount of the grains produced are sold in the markets.

Table 5: Officially Certified Rice Varieties in Sierra Leone

Agro-Ecological Zones	Name of Varieties
Rain-fed Lowland	ROK 5, ROK 10, ROK 14, ROK 25, ROK 34 NERICA- L-19 and NERICA- L-20,
Rain-fed Upland	ROK 3, ROK 34 NERICA 3, NERICA 4, NERICA 6, NERICA 15, NERICA 16 and NERICA 18

Registered and licensed seed producing institutions both in public (RARC and SMP) and private seed entities (YEAVA, BRAC etc.) are engaged in the production of seeds of varieties recommended and promoted by Government (Table 6). Presently RARC and SMP are almost

exclusively engaged in own production and supply of seeds of ROK 10, ROK 24, ROK 34 and NERICA- L-19.

Table 6: Rice Varieties Recommended and Promoted by the Government of Sierra Leone

Agro-Ecological Zones	Name of Varieties
Inland Valley Swamp	ROK 14, ROK 24, NERICA-L-19 and NERICA-L-20
Boliland	ROK 3, ROK 10, ROK 24 and ROK 34
Mangrove Swamp	ROK 5, ROK 10, ROK 21 and ROK 23
Riverine Grassland	ROK 3, ROK 10 and ROK 34
Rain-fed Upland	NERICA 3, NERICA 4, ROK 3, ROK 16 and ROK 34

2.3 Quality Control

SLeSCA, a Government Agency, is responsible for assuring the quality of rice seeds produced and supplied in Sierra Leone. It is engaged in developing and implementing standards for both domestically produced and imported rice seeds for purposes such as research, multiplication, marketing and distribution. It undertakes inspection, laboratory testing, and variety release. In the field, inspections are up to four times maximum including land preparation, vegetative and flowering stages and prior to harvest. These are carried out to inspect for off-types, recommended isolation distances, field sanitation, pests and diseases etc. and seed sampling. The laboratory activities are testing for moisture content, germination, physical purity as well as varietal purity.

2.3.1 Methods

In principle, SLeSCA adheres to the standard operating procedures laid out by the Organization for Economic Co-operation and Development (OECD) and International Seed Testing Association (ISTA). SLeSCA performs the following specific sets of procedures in performing inspection and testing of rice seeds:

(1) Document verification: The seed producers (or merchants) must have registered and provide proof of origin of the variety of a crop that they intend to grow or market. Only registered and licensed seed growers/marketers can grow/sell seed for certification.

(2) Field inspection involves an examination of rice crop in seed fields for conformity to pre-laid standards (Table 7) as part of seed certification program. The following are checked in the field;

(a) Origin and identity of parent seed: It is essential that a seed crop is produced from a known parent seed source. A seed label is used as proof of the origin of the parent seed.

- (b) Hectarage: The hectarage planted must be established by the field inspector. This should comply with the registered hectarage.
- (c) Cropping history of the seed field: Crop rotation in seed production is a common practice to avoid cultivar contamination and disease incidents.
- (d) Isolation distance: Proper distance of 3 m for certified seed, 5 m foundation seed and 10 m for breeder seed from other crops is necessary to prevent pollination and mechanical admixtures (Table 8).
- (e) Off-types, weeds and other crop plants: Off-types are plants of the same species which do not exhibit the acceptable characteristics of the seed crop being grown must be rogued
- (f) Diseases: A seed is one of the major ways of disease propagation; control of seed-borne disease can prevent crop disasters. While the inspector walks in the field, the general crop condition is noted including the applied crop husbandry practices.

Table 7: Procedures and methods of on-plot seed inspection

Seed Class	Institution in charge of inspection	Frequency & timing of inspections	Items for inspection	Inspection methods	Quality standard for inspection
Breeder Seed	SLeSCA	4 Inspections			
		Land preparation	Weed/volunteer crops conditions, uniform land preparation	Visual assessment	0% weed/volunteer crops (all should be removed); even leveling of land
		Vegetative stage, Flowering stage and At/prior to harvest	Isolation distance, planting spacing, off-types, pest/disease condition, true-to-type	Measurement, visual assessment	10 m spacing, 0.05% max. off-types, 0.01% max. diseased plants
Foundation Seed	SLeSCA	4 times			
		Land preparation	Weed/volunteer crops conditions, uniform land preparation,	Visual assessment	0% weed/volunteer crops free, even land leveling
		Vegetative stage, Flowering stage and At/prior to harvest	Weeds condition, isolation distance, planting spacing, off-types, pest/disease condition, true-to-type	Measurement, visual assessment	5 m spacing, 0.05% max. off-types, 0.01% max. diseased plants
Certified Seed (R1)	SLeSCA	4 times			
		Land preparation	Weed/volunteer crops conditions, uniform land preparation,	Visual assessment	0% weed/volunteer crops free, even leveling of land
		Vegetative stage, Flowering stage and At/prior to harvest	Weeds condition, isolation distance, planting spacing, off-types, pest/disease condition, true-to-type	Measurement, visual assessment	3 m spacing, 0.03% max. off-types, 0.5% max. diseased plants
Certified Seed (R2)	SLeSCA	4 times			
		Land preparation	Weed/volunteer crops conditions, uniform land preparation,	Visual assessment	0% weed/volunteer crops free, even leveling of land
		Vegetative stage, Flowering stage and At/prior to harvest	Weeds condition, isolation distance, planting spacing, off-types, pest/disease condition, true-to-type	Measurement, visual assessment	3 m spacing, 0.03% max. off-types, 0.5% max. diseased plants

Table 8: Criteria and Standards used for field Inspections of Rice Seed

Criteria	Standards for Field Inspections			
	Breeder	Foundation	Certified R1	Certified R2
Minimum Isolation (metres)	10	5	3	3
Minimum Isolation of a variety susceptible to disease with regards to other varieties (metres)	100	100	100	100
Maximum off- type plants (%)	0.05	0.05	0.3	0.3
Maximum diseased plants (%)	0.01	0.01	0.5	0.5
Maximum number of other cultivars difficult to separate (%)	0.01	0.01	0.02	0.02
Maximum number of harmful foreign plants (%)	0.01	0.01	0.02	0.02

(3) Seed sampling: Seed sampling is an important aspect of post seed harvest inspection. Established procedures for seed sampling by ISTA are strictly adhered to. Ignoring sampling procedures during the process of sampling will most likely lead to unreliable laboratory test results.

(4) Pre and Post control plot testing

(a) Pre-control is the term applied to variety verification of early generation seed, i.e. breeder and foundation seed.

(b) Post-control is a term normally applied to variety verification of certified seed.

The pre and post-control testing are laboratory standard measures used to conduct both physical and varietal purity, whose minimum standards are indicated in the Tables 9 and 10 below.

Table 9: Procedures and methods of inspecting harvested seed

Seed Class	Institutions in charge	Items for Inspection	Inspection Methods	Quality Standard (%)
Breeder Seed	SLeSCA	Moisture content	Testing	13
		Germination	Germination Testing	80
		Physical purity	Purity Analysis.	98
		Other crop seeds	Purity Analysis	2
		Inert matter	Purity Analysis	2
		Variety purity	Variety Analysis	99.9
Foundation Seed	SLeSCA	Moisture content	Testing	13
		Germination rate	Germination Testing	80
		Physical purity	Purity Analysis.	98
		Other crop seeds	Purity Analysis	2
		Inert matter	Purity Analysis	2
		Variety purity	Variety Analysis	99.9
Certified Seed R1	SLeSCA	Moisture content	Testing	13
		Germination rate	Germination Testing	80
		Physical purity	Purity Analysis.	98
		Other crop seeds	Purity Analysis	2
		Inert matter	Purity Analysis	2
		Variety purity	Variety Analysis	99.7
Certified Seed R2	SLeSCA	Moisture content	Testing	13
		Germination rate	Germination Testing	80
		Physical purity	Purity Analysis.	98
		Other crop seeds	Purity Analysis	2
		Inert matter	Purity Analysis	2
		Variety purity	Variety Analysis	99.0

(5) Routine seed testing and issuance of certificates: The sampled seed will be tested for quality attributes such as moisture content, germination, analytical purity and varietal purity (Table 10).

Table 10: Types and standards for laboratory analysis for rice seed

Types of Analysis	Standards for Laboratory Analysis			
	Breeder	Foundation	Certified R1	Certified R2
Min. Variety Purity (% by weight)	99.9	99.9	99.7	99.0
Min. Physical Purity (% by weight)	98.0	98.0	98.0	98.0
Min. Germination capacity (%)	80	80	80	80
Max. Moisture Content (%)	13	13	13	13
Max. Inert Material	10 grains/kg	10 grains/kg	0.10	0.10
Max. number of seeds of foreign cultivars	10 grains/kg	10 grains/kg	0.10	0.10
Max. number of weed seeds (%) .	10 grains/kg	10 grains/kg	0.10	0.10
Max. number of red rice (%)	0	0	2 grains/500kg	2 grains/500kg

(6) Cultivar assessment for new variety: In order to release and promote new rice varieties that are better in certain respects than the existing ones, SLeSCA supposed to independently test the characteristics of the varieties before release and that they have sufficient merit to be released. Presently, due to lack of technical expertise, SLeSCA collaborates with SLARI to conduct two assessments for new varieties:

(a) Distinctness, Uniformity and Stability (DUS) tests: A new rice variety has to be distinct, in one way or another, from other rice varieties to be released. The distinction may be in morphological (e.g. grain shape, presence or absence of awns) or agronomic characteristics (maturity, lodging, and days to 50% heading)

(b) Value for Cultivation and Use (VCU) tests conducted in the National Performance Trials. These tests are the most important assessments and they include yield, maturity, regional adaptation, tolerance to abiotic and abiotic stresses.

2.3.2 Human Resource

Adequate human and infrastructural capacities for seed production and inspection are crucial in improving the efficiency and effectiveness of delivery of services related to seed production and quality control. The rice seed sub-sector has inadequate number of qualified, trained and skilled human resources for all classes of seed (breeder, foundation and certified) production. This is also the same for seed quality assurance operations (field inspection and laboratory seed testing). RARC through its rice breeding unit as well as the farm management unit produce breeder and foundation seeds respectively. As a result of the inadequate human and financial resources, it seems impossible to supply the required quantities of breeder and foundation seeds (Table 11). Foundation and certified seed production is also done by SMP. Few seed entities and seed producer groups are also engaged in certified seed production. SMP and seed entities also lack

human and financial capacities. The human resource for certified seed production in terms of numbers does exist for seed producer groups but the required technical know-how is a huge challenge. It is therefore, a limiting factor that needs to be addressed if any meaningful results are to be achieved. However, seed producer groups around the RARC have been trained in quality seed production incorporating soil fertility management, integrated pest management, seed purity and viability testing, storage materials and conditions. These trainings involved both male and female farmers, the outcome of which has increased rice productivity, reduced food insecurity and improved livelihoods in RARC environs.

Table 11: Technical Personnel Currently Involved in Breeder and Foundation Seed Production at the Rokupr Agricultural Research Centre (RARC)

	Number of Technical personnel	Capacity of Technical personnel		Size of land covered per Technical personnel (ha)	Geographical areas covered per Technical personnel	Means of transport (with Remarks)	Budget per Technical personnel (with Remarks)
		Knowledge (with Remarks)	Experience (with Remarks)				
Researchers	25	M.Sc B.Sc	18-27 yrs 20 – 25 yr	0.5 – 1.0	The whole country	Vehicles not always available	-
Technicians	24	Diploma – 10 Certificate – 14	yrs 10 – 20 yrs	2.0 – 2.5	1 seed producing station	Motorcycle and Bicycle (Insufficient)	-
Workers/ Labors	50	Basic education (need proper instruction)	15 – 25 yrs	0.5 – 2.5	1 seed producing station	Vehicles not always available	-
Total	99						

At SLeSCA, presently there are five (5) personnel engaged in field inspection and testing of seeds of all crops (Table 12). These personnel cover all the operational areas across the country especially for RARC and SMP. Although rice is grown in these areas, inspectors are not exclusively assigned for rice seed. Due to the low number of personnel, inspections are restricted to breeder and foundation seed production levels. These interventions at higher seed classes can make bigger impacts on seed quality. However, limited inspections are also done for certified seed (R1 and R2). SLeSCA needs to recruit and train more inspectors. The training program should cover various aspects of crop management, field inspection of seed crops, inspection of processed seeds, seed sampling, seed testing and varietal testing. Through a trainer of trainee module, the inspectors trained at these programs will provide training to other inspectors.

Table 12: Technical personnel currently involved in seed inspection and testing at the Sierra Leone Seed Certification Agency (SLeSCA)

	Number of inspectors	Capacity of inspectors		Size of land covered per inspector	Geographic areas covered per inspector	Means of transport (with Remarks)	Budget per inspector (with Remarks)
		Knowledge (with Remarks)	Experience (with Remarks)				
Breeder Seed	1	Ph.D MSc B.Sc Diploma	13 years 5 years 22 years 13-22 years		Whole country	1 vehicle (always available)	Not sufficient for mobility such as fuel
Foundation Seed				10 ha	Whole country		
Certified R1 Seed				25 ha	Whole country		
Certified R2 Seed				30-50 ha	Whole country		
Total				5			

2.4 Supply

Due to the absence of seed companies and trained seed dealers, rice seed supply chain is not well developed especially in the area of certified seed. The supply of foundation seed is well defined in theory but not practically. RARC supplies both breeder and foundation seeds. The breeder seeds produced at RARC are passed on to the farm management unit for foundation seed production. Some quantity of breeder seed is also purchased by SMP for foundation seed production. Seed entities and farmer producer groups' access foundation seed from RARC and SMP for certified seed production. The foundation seed in some instances is procured by NGOs or agricultural projects for distribution to farmers for certified seed production. It could also be distributed directly to rice growers for grain production.

Certified seed supply is also done by out growers' schemes under the auspices of SMP, RARC and some seed entities. They provide seed and other production inputs such as fertilizer on loan to contract seed growers. At harvest, the inputs providers recover seed based on the terms of the contract and buy any excess seed from the producers. The Ministry of Agriculture also provides seeds and other inputs to farmers nationwide for production of certified seed. At the end of the season, seed rice is recovered for onward distribution to other farmers. Certified seed producers also sell seed in their communities at farmer to farmer level.

Marketing and sales of certified seeds are done through agro-dealer network systems in rice growing areas. The network of outlets usually comprises unregistered agents, sub-agents and

stockists. Seeds supplied in response to emergencies (e.g. Ebola or flood) are through registered projects of governmental and non-governmental organizations. Table 13 shows the various stakeholders and their roles along the rice seed value chain.

Table 13: Stakeholders and their roles in the rice seed value chain

Activity	Stakeholders			
	Market varieties	Roles played	Subsistence varieties	Roles played
Breeder seed development/ Production/supply	RARC	Development and Production	RARC	Development and Production
Foundation seed production/ Supply	RARC /SMP	Production and maintenance of seed. Supply to foundation -seed producers	RARC /SMP	Production and maintenance of seed. Supply to foundation - seed producers
Certified R1 Seed production/ Supply	SMP	Production and maintenance of seed	SMP	Production and maintenance of seed
	Seed Entities such as BRAC, YEAVA etc.	Production and maintenance of seed	Seed Entities such as BRAC, YEAVA etc.	Production and multiplication of seed
Certified seed R2 production/ Supply	Seed Entities	Production and multiplication of seed	Seed Entities	Production and multiplication of seed
	Agricultural Cooperatives	Multiplication of seed and recovery by MAFFS	Agricultural Cooperatives	Multiplication of seed and share/sell among producers/community
Distribution of seeds	1. MAFFS → Agricultural Business Centres (ABCs) → FBOs → Farmers → Projects → FBOs Farmers 2. NGO → FBOs → Farmers 3. Development Partners → their projects → FBOs → Farmers	Sales to cooperative members Procurement, sales of certified seeds	1. MAFFS → Agricultural Business Centres (ABCs) → FBOs → Farmers → Projects → FBOs Farmers 2. NGO → FBOs → Farmers 3. Development Partners → their projects → FBOs → Farmers	Share/sell among producers

Seed prices are determined by the market forces and are based on the costs incurred in production, processing, storage, transportation and profit margins of the seed merchants. The current prices of certified seeds for the ROK and NERICA varieties are shown in Table 14.

Table 14: Market price (sales and purchase) of certified seed

Currency: Le (approximate exchange rate: Le = USD)			
	Name of Varieties	Sales Price (Le Million/mt)	Purchase Price (Le Million/mt)
Rain-fed Lowland and Rain-fed Upland	ROK series	2011 – 2.8	2011 – 2.0
		2012 – 3.2	2012 – 2.4
		2013 – 3.6	2013 – 2.8
		2014 – 3.6	2014 – 2.8
		2015 – 4.8	2015 – 3.2
	Nerica series	2011 – 4.4	2011 – 3.2
		2012 – 4.4	2012 – 2.4
		2013 – 5.2	2013 – 2.8
		2014 – 6.6	2014 – 4.4
		2015 – 6.6	2015 – 4.4

3.0 CHALLENGES IN NATIONAL RICE SEED SECTOR

3.1 Legislation, Policy, Institutions and Planning

3.1.1 Legislation

The challenges of the National Rice Seed Sector are multifaceted. The lack of seed law to regulate the operations of the seed industry and ensure its development is a critical challenge that is undermining the development of the seed sector. The seed bill has been reviewed by the Law Officers Department, signed by the Minister of Agriculture and awaits gazetting and enactment by Parliament. This is expected to be done in the first quarter of 2017. This will, to a great extent, address issues of seed production and marketing to ensure that varieties released at the national level are available at regional level. This creates an enabling environment for countries to benefit fully from the potentials of regional cooperation.

3.1.2 Policy

The present seed bill also calls for the continued support of public institutions such as RARC and SMP to maintain varieties and produce foundation seed. These places the rice seed sub-sector in a rather delicate position wherein the private sector is not fully in-charge of foundation seed production.

3.2.3 Institutions

Lack of effective platforms to articulate issues and challenges amongst the different stakeholders of rice seed value chain is affecting appropriate policy revisions. The existing platforms of the different rice growing areas are weakly integrated with each other. Although public facilities and utilities for producing, processing and storing of seeds at SMP are available in Makeni and Kobia, they remain under-utilized. Institutional challenges at SMP, RARC and SLeSCA include inadequate infrastructural and human resource capacities in seed production and certification. There is need to improve on staffing and provision of appropriate infrastructure in the various seed institutions.

3.1.4 Planning

There is no information on national seed demand for the various rice varieties in terms of who needs what, quantity needed, location and when. Lack of seed production plan presents challenge in making informed decision in terms of seed production requirement to effect positive impact. Sierra Leone lacks seed production plan for all categories of seeds (breeder, foundation and certified seed) which also affects proper budget allocation for seed production.

3.2 Seed Production

An estimation of seed demand for the different classes of certified seeds for the different rice varieties in the different agro-ecologies is not yet available. Lack of projections on seed demand restrains seed merchants from firming up a business investment plan for production and acquisition of certified seed for the required varieties. In the absence of regular planning and

budgeting mechanisms, seed institutions are not able to produce adequate fresh stocks of seeds that can meet the actual demand. Lack of irrigation facilities affects routine maintenance and production of certified seeds.

Since most of the certified seeds (R1 and R2) are produced in smallholder farmers' fields, the quality of production is intricately linked to the experience and knowledge of the producer. Since seed production requires specialized skills and management practices, the inadequate and incomprehensive training programs and extension services for the out-growers affects the quality of seeds produced. The heightened vulnerability to climate change induced erratic weather patterns and incidences of pests and diseases also affect on-farm productivity levels. Absence or low levels of mechanization by smallholders during production, processing and handling reduce the productivity and quality of seeds. Manuals outlining standard seed production practices and descriptors illustrating characteristics of the approved varieties are generally not available to the producers.

3.3 Seed Quality Control

Due to the limited human resources and limited number of vehicles and motor bikes for field inspections and seed sampling at SLeSCA, the inspectors find it difficult to physically verify every out-grower and check their fields and seed lots. However, when inspectors cannot arrive at the field in time, critical harvesting and processing time is lost.

Although SLeSCA is mandated to penalize offenders, its monitoring roles are challenged by the limited human capacities, lack of training of the concerned personnel and non-enactment of the seed bill. Owing to limited infrastructures, SLeSCA centralized location of the seed testing laboratory in Freetown and human resources makes testing of seed lots longer affecting the release of test results and availability of seed in time, especially during the peak growing season. SLeSCA main seed testing laboratory is not accredited to the International Seed Testing Association (ISTA). This makes seed test results from Sierra Leone may not be recognized by International bodies. Non-accreditation to ISTA is therefore a huge challenge for the entire seed sector in the country. Similarly, Sierra Leone should make effort to be accredited to the Organization of Economic Cooperation and Development (OECD) for seed field certification.

3.4 Seed supply

The demand for the most popular seeds of rice varieties (ROK 10, ROK 24, ROK 34 and NERICA L-19) cut across all the regions in the country. The lack of regular fora of rice seed value chain actors denies formal exchanges of inputs from the stakeholders. In the absence of a survey on seed demand, the timeliness of the supply of breeder and foundation seeds often does not meet the expectations. Long distances and fragile rural road networks between the rice seed producing areas and markets or sales points delay the movement of certified seed.

Summary of solutions to challenges in breeder, foundation and certified seed production, inspection and supply are indicated in Tables 15, 16 and 17.

Table 15: Solutions to challenges in production and supply of Breeder Seed

Seed Type	Issues / Challenges	Effects	Suggestions/ possible solutions	Responsible agency
Breeder seed development/ production/supply	<ul style="list-style-type: none"> -Insufficient and untimely budget allocation from Government of Sierra Leone - Insufficient number of researchers and technicians -Insufficient production infrastructure & equipment (irrigation and drainage facilities, dilapidated drying troughs, cold rooms, seed stores and fridges for gene bank). - Insufficient processing/post harvesting equipment, electronic seed counters, panicle threshers, simple hand held seed dehusker sensitive weight balance, magnifying hand lenses, moisture meter etc., -Insufficient capacity of technicians in: crop management, water management, identification of the off-types, post-harvest handling of the seed, etc 	<ul style="list-style-type: none"> -Inadequate and untimely seed production /supply -Low quality and quantity of seed produced -Affect quality/quantity of seeds produced in terms of varietal admixture, quality deterioration in germination and moisture, and seed health -Affect the work efficiency and increase workload of the few workers. -Inaccurate weighing causes variation between the expected and actual result, deterioration of the seed quality, high risk of losing the seed, etc Affect quality/quantity of seed, risk of pest and disease infection, varietal admixture, increase workload affect quality and quantity of seed 	<ul style="list-style-type: none"> -Adequate and timely provision of budget to undertake seed breeding that are demand driven -Recruitment of additional researchers and technicians -Procurement of equipment and construction of the infrastructure - Allocation /mobilization of funds - Identification of required production and infrastructure equipment - Procurement of equipment or construction of the infrastructure. -Provide training for technicians 	<ul style="list-style-type: none"> -Government of Sierra Leone (GoSL) GoSL and DPs GoSL/MAFFS and DPs -GoSL and DPs

Table 16: Solutions to challenges in production and supply of Foundation Seed

Seed Type	Issues / Challenges	Effects	Suggestions/ Possible solutions	Responsible Agency
Foundation seed production/ Supply	<ul style="list-style-type: none"> - Insufficient and untimely budget allocation (to hire labor, procurement of agro-inputs eg fertilizers, pesticides and herbicides) 	<ul style="list-style-type: none"> -Inadequate and untimely seed production /supply 	<ul style="list-style-type: none"> - Adequate and Timely provision of required budget to undertake seed multiplication activities that are demand driven 	<ul style="list-style-type: none"> GoSL, NGOs and DPs
	<ul style="list-style-type: none"> - Insufficient production, harvesting and post-harvest infrastructure & equipment (production fields, drying floors, seed stores, machinery/tractors, such as power tillers, transplanters, combined harvesters, pallets, threshers, winnowers, processing plant, etc) 	<ul style="list-style-type: none"> -Affect quality/quantity of seed produced, varietal admixture, quality deterioration in terms of germination rate, increase cost for production operation, risk of post-harvest losses, etc 	<ul style="list-style-type: none"> - Allocation /mobilization of funds - Identification of required production and infrastructure equipment - Procurement of equipment or construction of the infrastructure 	<ul style="list-style-type: none"> -GoSL, NGOs and DPs
	<ul style="list-style-type: none"> - Insufficient capacity of technicians and seed growers in crop management, water management, identification of off-types, quality control, post-harvest handling of the seed 	<ul style="list-style-type: none"> -Increased workload affect quality and quantity Increased workload affect quality and quantity 	<ul style="list-style-type: none"> - Provide training for technicians - Increase budget allocation 	<ul style="list-style-type: none"> -GoSL, NGOs and DPs
	<ul style="list-style-type: none"> - Insufficient number of technicians 		<ul style="list-style-type: none"> - Recruit additional technicians 	<ul style="list-style-type: none"> -GoSL
	<ul style="list-style-type: none"> - Insufficient transportation capacity (vehicles, motor bikes, fuel) 		<ul style="list-style-type: none"> - Procure vehicles, motor bikes, fuel, hire vehicles during peak periods 	<ul style="list-style-type: none"> -GoSL, NGOs and DPs

Table17: Solutions to challenges in production and supply of Certified (R1 & R2) Seed

Seed Type	Issues/Challenges	Effect	Suggestions/Possible solutions	Responsible Agency
<p>Certified Seed (R1 & R2) Production/Supply</p>	<p>- Insufficient supply of foundation seed</p>	<p>-Inadequate and untimely seed production /supply</p>	<p>-Improve production planning and communication between producers of different classes of seeds</p>	<p>-RARC, MAFFS, SMP</p>
	<p>-Insufficient and untimely budget allocation to hire labor, procurement of agro-inputs eg fertilizers, pesticides and herbicides.</p>	<p>-Affect quality/quantity of seeds produced, varietal admixture, quality deterioration.</p>	<p>-Adequate and timely provision of required budget to undertake seed multiplication activities that are demand driven</p>	<p>-GoSL, DPs</p>
	<p>-Insufficient production, harvesting and post-harvest infrastructure & equipment (production fields, drying floors, seed stores, machinery/tractors, such as power tillers, transplanters, combined harvesters, pallets, threshers, winnowers, processing plant, etc)</p>	<p>-Affect quality/quantity of seed produced, varietal admixture, quality deterioration in terms of germination rate, increase cost for production operation, risk of post-harvest losses, etc</p>	<p>-Allocation/mobilization of funds, identification of required production, infrastructure equipment), procurement of equipment or construction of the infrastructure</p>	<p>-GoSL, DPs</p>
	<p>-Insufficient capacity of seed growers in crop management, water management, identification of the off-types, quality control, post-harvest handling of the seed, etc</p>	<p>-Increased cost for production operation, risk of post-harvest losses, increase workload affect quality and quantity.</p>	<p>-Provide training for seed growers, preparation and provision of quality variety catalogue.</p>	<p>MAFFS, Seed Entities, etc</p>

Table 17 continues: Solutions to challenges in production and supply of Certified (R1 & R2) Seed

Seed Type	Issues / Challenges	Effects	Suggestions/ Possible solutions	Responsible agency
Certified Seed (R1 & R2) Production/Supply	-Unavailability of seed companies	-Inadequate availability of quality/quantity of seed	-Favourable government policies to encourage private seed companies (land, loans, tax exemption, subsidies), Consistency of policies and interventions	GoSL/MAFFS, Financial Institutions, DPs, NGOs etc
	<p>Inspections</p> <p>-Insufficient number of seed inspectors in field observation techniques</p> <p>-Lack of proficiency in the use of field equipment (GPS, tape, quadrant etc)</p> <p>-Insufficient seed analysts</p> <p>-Insufficient logistics (motor vehicles, motor bikes,</p>	<p>-Increased workload</p> <p>-Inability to carry out thorough inspection</p> <p>-Few visits to the field</p> <p>-Low seed quality</p> <p>-Delay in delivering results</p> <p>Affect planning of field operations</p> <p>-Low seed quality</p> <p>-Delay in delivering results</p> <p>-Affect planning of field operations</p> <p>-High risk of compromise leading to unreliable result</p> <p>-Ineffective coverage of the fields, untimeliness of inspection activities, etc</p>	<p>-Recruit additional personnel</p> <p>-Train of personnel</p> <p>-Recruit and train seed analysts</p> <p>-Provide vehicles (field pick-ups, motor bikes, etc)</p>	<p>-MoFED/ MAFFS/SLeSCA</p> <p>MoFED/MAFFS/SLeSCA, DPs</p> <p>MoFED/MAFFS/SLeSCA, /DPs</p> <p>MoFED/MAFFS/SLeSCA, /DPs</p>

4.0 VISION AND SCOPE

4.1 Position of Rice Seed Development Strategy

The rice seed development strategy is aligned with the existing broader strategic frameworks of the government that aim at economic development through agriculture transformation. The approaches proposed in this document are in consistence with the guidelines elaborated in the National Rice Development Strategy (NRDS). This will serve as the operational manual that will guide the execution of the set policies and strategies that will govern the creation of a functional and sustainable seed production and supply system. This will in turn serve the interest of rice farmers, hence accelerates the attainment of the set goals in the NRDS.

4.2 Vision and Scope

This document outlines a roadmap for developing the rice seed value chain which would augment the productivity enhancement envisaged under the NRDS. Hence, the vision of the roadmap is to transform the rice seed value chain into a vibrant sub-sector contributing to food security and economic development in the country. The scope of the actions proposed under this roadmap encompasses research for development, production, inspection and distribution of the various rice seed classes.

4.3 Goal and Objectives

The overall goal of the roadmap is to increase the supply and use of certified rice seeds for farmers. To achieve this, the roadmap sets out the following specific objectives:

- i. Promotion of the use of certified rice seeds of improved varieties by smallholder farmers
- ii. Improvement of the timeliness, availability, affordability and accessibility of certified rice seeds by rice growers
- iii. Enhancement of the quality of certified rice seeds by strengthening seed regulatory frameworks and institutions enforcing and implementing seed laws and policies so as to provide enabling environment for private sector involvement in seed business.
- iv. Building of human, physical and technical capacities of all the relevant stakeholders and improve the technologies along the rice seed value chain.

4.4 Implementation Structure

The alignment of rice seed development strategy directly under the NRDS allows the implementation of the strategy through the organizational structures of the NRDS. The Rice Unit (RU) of Ministry of Agriculture, Forestry and Food Security will be reactivated and lead the implementation of the strategy. The Unit will play a pivotal role in interacting with relevant public and private stakeholders, information collection and sharing, conducting gap analysis and developing concept notes and/or project proposals towards the implementation of the activities

proposed in the strategy. The National Seed Board (NSB) currently chaired by the Minister of Agriculture, will provide guidance on implementation by setting overall directions and priorities under this strategy. The rice seed taskforce that is set up for the purpose of elaboration of this strategy will provide technical backstopping to both the RU and NSB in assessing the issues and opportunities along the rice value chain. The implementation of the strategy shall be funded by Sierra Leone Government, development partners, Agricultural projects, regional and international research and development institutions through concept notes and/or projects.

5.0 STRATEGIES AND PRIORITIES

5.1. Strategic Principles and Approaches

In the implementation of the National Rice Seed Development Strategy, strategic approaches will be centered on the following priority areas:

1. Gazetting and enactment of the 2016 Seed Bill
2. Private sector involvement in foundation seed production
3. Varietal focus according to region with comparative advantage (variety with high productivity (eg ROK 10, ROK 24, ROK 34 and NERICA L-19)
4. Geographical focus for both certified seeds and quality declared seeds (QDS) - Based on agricultural production/potential and market access.
 - Four rice bowls: Mambolo (Kambia District), Rumbe (Port Loko District), Tormabum and Gbondapi (Bonthe District), Komrabai Mamilla (Tonkolili District). However the strategy will also consider other rice producing areas.
5. SLeSCA should be strengthened to carry out its mandate of seed certification and quality control so as to establish an effective and efficient seed certification system. More emphasis will be laid to certification and quality control of higher seed classes (breeder and foundation) at the beginning and then transcend to lower classes (certified, R1 and R2).
6. An enabling environment will be created to encourage private seed companies to become interested in seed production and marketing so as to speed up the transformation to the formal seed system.
7. The informal system will be strengthened through capacity building of CBOs, ABCs, FAs, etc. to fill the gap obtained
8. Efforts will be made to encourage agro-dealers to be engaged in seed marketing

5.2 Legislation, Policy and Institutions

The reviewing of the 2012 seed bill to the Sierra Leone Seed Certification Agency Act, 2016 and its subsequent signing by the Minister of Agriculture, Forestry and Food Security are recent progress to move the seed sector forward which will be equally promoted by this rice seed development strategy. Already established policies such as seed policy will be promoted to enable further participation of the private sector in seed production and marketing especially certified seeds. The foundation seed production will be relinquished by the public institution (RARC, SMP) in the long run. The establishment and operationalization of SLeSCA and the inauguration of the National Seed Board (NSB) as well as Variety Release and Registration Committee (VRC) is a strategic approach to accelerate the movement from the informal to the formal seed system. This is in addition to the already established SLARI and SMP. Further capacity building to strengthen personnel of these institutions need to be vigorously pursued.

5.3 Production and Inspection

Addressing the capacity needs of breeder, foundation and certified seed production highlighted earlier in this document is part of this strategy. All the three classes of seed will be given due attention. Breeder seed will be produced solely by RARC, foundation seed by RARC and SMP. However, foundation seed will be taken over by the private sector over time, unlike certified seed is fully a private sector mandate. The capacity gaps in quality control will be addressed. Only varieties registered in the National Variety Catalogue will be eligible for certification. The strategic approach will be to provide the required personnel, infrastructure and funds to support the establishment of a functional and sustainable rice seed production and supply system.

5.4 Supply and Market

Strategic measures will be taken to create the enabling environment for the private sector to take the lead in seed supply and marketing. Registration and licensing of seed entities and individual private seed dealers and subsequent monitoring of their seed businesses will be highly encourage.

5.5 Target Setting and Gap Identification

5.5.1 Legislation, Policy and Institutions

The Seed Bill has been reviewed by the Law Officers Department, signed by the Minister of Agriculture on the 1st November 2016. It has been submitted back to the LOD for publication to the Gazette and eventual enactment by Parliament. Parliamentary enactment is targeted to the first quarter of 2017.

5.5.2 Production and Inspection

The NRDS aims to produce 2,400 mt of paddy per year by 2025. Given the current national average on farm productivity of 1.8 t/ha for certified seed, 3.75t/ha for foundation seed and 4.0 t/ha for breeder seed. A seed: grain ratio of 1:30, 1:40 and 1:50 for certified seed, foundation seed and breeder seed respectively is observed. It is estimated that only about 8% of farmers are replacing their source of seed (formal seed system; estimated to be every 5 years). About 92% of the farmers are currently using their own saved grains as seeds (informal seed system). The proposed rice seed development strategy aims to increase the proportion of farmers using certified seed to 25% while also strengthening and increasing the usage of the quality declared seeds (QDS - informal system) to 40%. These key assumptions imply that 10,125 metric tons of certified seeds, 389 metric tons of foundation seeds and 0.06 metric tons of breeder seeds will need to be produced by 2025. In 2014 0.038 tons of breeder seeds, 100 tons of foundation seeds and 128 tons of certified seeds were produced. The gaps between the current production and the targeted production under the strategy and the area of land required for the production are shown in Table 18.

Table 18: Annual Gap between Production and target production

Seed Class	Target amount (mt/year)	Current Production/ Supply (mt/year)	Gap (mt/year)	Area of land required for production (ha)
Breeder Seed	0.06	0.038 (38kg)	0.022 (22kg)	
Foundation Seed G1	4.5			1.2
Foundation seed /Registered seed G2	47 (through the effort of the public sector) 337.5 (through the involvement of the private sector)	100	(4.5+47+337.5)-100 = 189	12.5 90 1.2+12.5 +90 103.7
Certified (R1& R2) Seed	10,125 (600)	128	10,025 (472)	5,414 (320)
QDS	960			640

Given the emphasis laid under this roadmap on the quality and timely production of seed classes at RARC (breeder seed) and SMP (foundation seed), human resources and their skills are paramount. The estimated human capacities for seed production at RARC and SMP and the gaps between these estimations and the currently available human resources are shown in Table 19.

Table 19: Gap between required and available human resource for seed production

Name of Seed Producing Stations	Researcher		Gap	Technician		Gap	Workers/ Laborers		Gap
	Required	Available		Required	Available		Required	Available	
RARC	35	25	10	40	24	16	150	50	100
SMP	0	0		25	11	14	40	10	30
Total	35	25	10	65	35	30	190	60	130

Areas of Training:

Researchers: (i) Short term (2-4 weeks) courses on rice seed production, (ii) Special 3-5 week courses (IRRI/AfricaRice/JICA) on seed technology, breeding, pathology, entomology, etc.

Technicians: (i) Short term (4-6 weeks) courses on rice seed production, seed quality, (ii) Long term courses on rice seed production, seed quality, weed science, pest and disease management, etc

Workers/Laborers: One (1) week field workshops on field procedures and protocols, crop and management, post-harvest handling, etc

Farmers (Registered seed producers): One week training program on crop husbandry

Human capacities that are involved in seed inspection and quality control are equally important to effectively and efficiently authorize the production into marketable products. The number of inspectors required by SLeSCA and the difference between the available and the required number of inspectors for certification process are shown in Table 20.

Table 20: Gap between required and available human resources in seed inspection

Geographical area	Number of Inspectors		Gap in number	Gap in Capacity
	Required	Available		
Freetown	2	2	0	Training on seed production, practices, field inspection and seed testing, variety testing for release (DUS VCU tests), phytosanitary inspection, etc
Rokupr/Kobia	6	2	2	
Njala	2		2	
Tormabum	6		6	
Makeni	6		6	
Kenema	2		2	
Total	24	5	16	

5.5.3 Seed Supply

The target of seed supply under this road map is to address factors limiting supply of rice seed from production, quality assurance, distribution and marketing. The target under this aspect is to accomplish the below:

- Provision of seed budget in the national budget.
- Creation of links between input dealers and seed producers.
- Recruiting and Training of more seed inspectors and extension workers.
- Creating the enabling environment for private seed companies and dealers to operate smoothly.
- Linking seed producers to financial institutions.
- Establish well defined channels for the movement of seed.

5.6 Intervention Options and Priority Areas

Achieving the targets set under this rice seed strategy needs addressing the challenges along the rice seed value chain. The following interventions are envisaged to improve the policy environments, institutional functions, planning, quality seed production and supply of rice seeds.

5.6.1 Legislation, Policy, Institutions and Planning

- The Sierra Leone Seed Certification Agency Act 2016 which has been reviewed by the Law Officers Department should be gazetted and pass into law by Parliament so that it could be enforce in the country. This will bring sanity not only to the rice seed sub-sector but to the entire seed industry.
- Sensitization on the existence of the seed policy 2009 and the Sierra Leone Seed Certification Agency Act 2016 (when enacted).
- Liberalization of foundation seed production to encourage private seed companies. This could be done by establishing a transparent policy framework that allows seed companies to sub-contract farmers to produce seed on behalf of seed companies.
- Develop financial schemes that could expand operations of seed companies into major rice production areas/environments.
- Recovery of public lands belonging to government institutions intended for seed production, seed testing and quarantine.
- Allocate parcels of lands exclusively for seed production in major rice producing areas through lease with area management committees.
- Provide loans to private sector for establishing seed production and processing facilities through Agriculture Finance Corporation.
- Review registration and licensing fees of seed operators (seed growers, sellers, importers, exporters, distributors, processors, etc.) by consulting stakeholders.
- Develop annual national seed production plan and include an annual seed production budget into the National budget.
- Setting up of stakeholders' fora for rice seed operators and organizing regular meetings to discuss issues (costs of production, processing, seed prices, etc) and feed backs.

5.6.2 Production and Inspection

- Capacity building of existing staffs engaged in seed production, inspection and quality control through short and long term training activities.
- Recruitment and training of new staffs for production and inspection of rice seed and improve their retention through attractive career advancement programs.
- Increase infrastructural facilities and transportation capacities for seed production, inspections and quality control.
- Refurbish the main seed tesing laboratory in Freetown and rehabilitate satellite seed testing laboratories at Rokupr and Njala under the auspices of SLeSCA.
- Aspire for membership as well as accreditation of SLeSCA to the International Seed Testing Association (ISTA).
- Aspire for accreditation of Sierra Leone to the Organization for Economic Cooperation and Development (OECD)
- Training of seed out-growers including potential smallholder farmers who prefer to grow rice seed.

- Introduction of appropriate machinery/tools (including transplanters, hand held motorized weeders, harvesters and threshers) in smallholder rice seed production systems.
- Develop and disseminate good agricultural practice manuals that will improve the quality and quantity of seed produced.
- Create awareness on the advantages of using certified rice seed amongst farmers through demonstration trials.
- Strategic positioning of seed processing facilities in rice seed producing areas through public-private partnerships.
- Upgrading of existing drying, processing and storage facilities under the administration of different rice growing areas.
- Promote internal quality control mechanisms of seed producing entities and merchants.
- Two indigenous seed entities assisted to establish their own seed processing/storage facilities.

5.6.3 Supply and Marketing

- Conduct seed demand surveys of certified seeds of different rice varieties and farmers' preferences
- Enhance coordination of production of the different seed classes so that critical masses of source seeds (breeder and foundation) are constantly available.
- Promote linkages between seed producers, agro-dealers, farmers and grain buyers/processors so as to synergize their mutual interests and benefits.
- Promote of certified rice seeds by improving extension services on seed production and seed usage. Improve coordination amongst the different rice growing areas on seed requirements (plans), current availability and sources.
- Consolidation and coordination of existing seed producing facilities, infrastructures, institutional capacities in different rice growing institutions e.g. RARC, SMP etc, for effective utilization of their facilities
- Capacity building of seed merchants/traders on rice seed business and financial management practices.
- Construction of warehouses and provision of seed processing machines.
- Construction of inter village road network; creation of links between input dealers and seed producers; and encourage involvement of private sector participation.
- Address the key issues hindering effective seed marketing and assist in the development of a nationwide seed marketing network, including a network of rural seed retail outlets that will ensure the regular availability of quality seed for farmers.

6.0 Resource Mobilization and Monitoring & Evaluation

6.1 Resource Mobilization

The Government of Sierra Leone is required to serve as the main and sustainable funding source. In all respects, judicious provisions should be made from the national coffers to meet Government's responsibilities in this rice seed roadmap. However, due to challenges facing budgetary allocations in the face of competing demands from other development needs, Government will request assistance from its Development Partners (DPs). Considering that there is multiple DPs initiatives that benefit the seed sector, opportunity should be taken to ensure incorporation of the key portions of this plan into DPs intervention activities. At the stage of initiating concept notes/project proposals, DPs should be involved to precisely determine their interest areas in the seed roadmap.

6.2 Monitoring and Evaluation

Concept notes/projects developed will have strong M & E components to ensure that, on a case by case basis, objective and timely monitoring and evaluation of all activities are conducted. In this regard, a sub-unit with responsibility for M&E will be incorporated into the Rice Unit that will coordinate all activities of the roadmap

Annex 1: Taskforce for the Preparation of the Rice Seed Development Strategy

1. Momoh Yusif Turay, SLeSCA – Focal Point
2. Idris Baggi, RARC – Member
3. Alpha B. Jalloh, RARC – Member
4. Aiah S. Ngaujah, RARC – Member
5. Dennis P.Y. Yankson, MAFFS – Member
6. Edward O. Dixon, SLeSCA – Member

With Support and Contributions from:

1. Raymonda Johnson, MAFFS
2. Dennis R. Taylor, RARC