



National Rice Development Strategy of Liberia Doubling Rice Production by 2018



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EXECUTIVE SUMMARY

Rice is one of the staple food crops in Liberia. Rice is predominantly grown in upland environments by smallholder farmers, with a limited percentage devoted to lowland ecology. Presently, rice is largely cultivated once a year. The low input low risk production keeps the rice yields in uplands persistently low in Liberia. In 2010, about 296,090 t rice (before milling) was produced from 251,230 Ha with an average yield of 1.18 t/ Ha.

The demand for rice however, is in far excess of the local production. In 2010, the total demand for milled rice in Liberia was estimated at 465,276 t. Being a popular food choice in Liberia, the annual per capita consumption of rice (133 Kg per year) is the highest in Africa. The gap between the demand and local production is met through importation of rice from countries such as China and USA. The large importation of rice adds pressure on country's trade balance and the foreign exchange.

Given the social and political significance of rice in Liberia, there is a strong need for increasing domestic rice production. In response to the global food crisis in 2008, the Government of Liberia (GoL) has acknowledged the importance of increasing rice production and has helped markets increase the rice supply by subsidizing the importation of rice.

The Liberia's National Rice Development Strategies (LNRDS) described in this document aims to achieve self sufficiency by doubling the local rice production by the year 2018. The strategies proposed here aim to achieve this by increasing the rice productivity in both upland and lowland ecosystems and by expanding the land area under rice cultivation in the lowlands.

The intensive slash and burning of food crops has reduced the levels of soil nutrients in the uplands, thus affecting the sustainability of rice production in the uplands. Whereas in the lowlands, the vast uncultivated land area, the abundant water resources and the climatic suitability offer greater potential for increased rice yields and multiple rice cropping cycles. Thus the scopes for sustainable rice production and the profitability of growing rice are substantially higher in the lowlands than in the uplands.

The LNRDS aspires to improve productivity in smallholder rice farms through a value chain approach in which the needs and issues of various subsectors will be addressed through an integrated approach. The six main strategic components of LNRDS include (i) Land and water management, (ii) Increasing availability and accessibility of smallholder farmers to farm inputs, (iii) Enhancing post harvest quality improvement, (iv) Increasing access to market, (v) Institutional capacity building, and (vi) Mechanization.

The abundant land and water resources could play an important role in doubling rice production. The LNRDS aspires to rehabilitate existing irrigation infrastructures and construct new irrigation schemes with improved drainage and water storage facilities in the lowlands. Policy tools outlining the guidelines on maintenance, ownership and water sharing under these schemes will be developed and disseminated. The sustainability of rice production will be enhanced through improved land management practices and increased adoption of organic- and inorganic fertilizers in smallholder rice farms.

Availability and accessibility of inputs by smallholder farmers will be increased through adaptive research and development in germplasm, seed production, pest and disease management and labor saving technologies. Private sector participation in the input supply chain will be promoted through improved rural infrastructure, creation of awareness and

demand for inputs, incentives for input use access to finance, extension and advisory services, and public-private partnerships.

The competitiveness of locally produced rice will be increased through improved post harvest handling practices such as threshing, drying, cleaning, storage and milling. Through private sector participation, the capacity and standards of trading and milling will be increased in rice producing areas. Value addition process such as parboiling and management of by products such as straw, husk and bran will be increased. Grades and standards of rice grains will be established and streamlined with that of regional and international norms.

Access to market will be improved by increasing the capacities of rural infrastructure such as storage/ware houses, feeder roads and trading network. Information on prices and finance will be made available to smallholder farmers. By encouraging formation of farmer based organizations such as cooperatives, linkage between producers and traders will be facilitated.

Institutional capacities on technical and extension services in rice sector will be enriched through on-job training, recruitment, education, and information management. Knowledge and awareness of improved technologies amongst farmers and other stakeholders involved in the rice value chain will be improved through periodical workshops, training and communication.

Land- and labor productivity in smallholder rice farms in both uplands and lowlands will be increased by promoting appropriate mechanization options. Policy tools for creating an enabling environment for private sector's participation in this subsector will be developed. Institutional capacities on testing and standardization and human resources on grass root level operations, service, maintenance and extension services will be enhanced in rice producing areas.

The strategic components of LNRDS are drawn within the context of the Poverty Reduction Strategy (PRS). Under the framework of Comprehensive African Agriculture Development Program (CAADP), the LNRDS is fully aligned with Liberia Agriculture Investment Program (LASIP).

The increased domestic rice production under the proposed strategies will substantially improve the food security, environmental sustainability and livelihoods of both rural and urban communities. Furthermore, it shall reduce the rice trade balance and poverty, and thereby allow investing of financial resources in other economic developmental priorities.

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ACRONYMNS

LNRDS.....	Liberia National Rice Development Strategy
CARD.....	Collation of Africa Rive Development
CAADP.....	Comprehensive African Agriculture Development Program
LASIP.....	Liberia Agriculture Sector investment Program
RSTWG	Rice Sector Working Group
GOL.....	Government of Liberia
MDG	Millennium Development Goal
MOA.....	Ministry of Agriculture
PRS.....	Poverty Reduction Strategy
FAPS	Food and Agriculture Policy strategy
CARI.....	Central Agriculture Research Program
ASRP.....	Agriculture Sector investment Program
USAID.....	United States Agency for international Development
FAO	Food and Agriculture Organization
FARA	Forum for Africa Research association
IRRI.....	International Rice Research institute
WARDA.....	West African Rice Development Association
CFSNS	Comprehensive Food Security and. Nutrition Survey,
WB.....	World Bank
GDP.....	Gross National Product
LISGIS.....	Liberia institute for Statistics Geological Information Service
MCI.....	Ministry of Commerce
CAAS-Lib.....	Comprehensive African Agriculture strategy for Liberia
NGO.....	Non Governmental Organization
PMU.....	Project Management Unit

1. Introduction

Liberia is at peace after 14 years of civil war which ended in 2003. The Government is taking actions to rebuild the shattered economy, consolidate peace, ensure security and improve the livelihoods of the estimated 3.5 million inhabitants¹. A Poverty Reduction Strategy (PRS) has been developed and launched. The PRS sets out a framework for rapid, equitable, and inclusive growth, poverty reduction and progress towards achieving the United Nations Millennium Development Goals (MDGs).

The PRS recognizes the role and contributions to be made by the agriculture sector towards achieving the objectives of the PRS. Agriculture sector is strategically important for poverty reduction in Liberia. It accounts for employment of nearly 70% of the economically active population, and over 90% of total exports. Agriculture has contributed 76.9% of the national Gross Domestic Production (GDP) in 2011². The value chains of the sector's commodities possess tremendous potential for improved access to food, remunerative employment, and improved livelihoods of the rural people.

Liberia's agriculture sector is forest based. Dominated by traditional subsistence farming systems mainly in the uplands, the farming is characterized by labor intensity, shifting cultivation, low technologies and low productivity. Rice and vegetables occupy about 87% of the cultivated land. Small acreages of tree crops are maintained for generating cash income. Commercial agricultural activities are almost exclusively carried out on plantation estates of rubber, oil palm, coffee and cocoa, the latter two are produced exclusively for export, with little value addition done for rubber and oil palm. Besides the plantation estates, very little private sector investment has been made in the agriculture sector, except for limited commodities trading which has persisted over the years.

According to the 2008 World Development Report by the World Bank, agriculture is the main engine for overall economic growth, rural poverty reduction and food security in Africa. The report emphasized that growth originating in agriculture is four times as effective in reducing poverty as growth originating outside of the agricultural sector. In Liberia, land and water resources are abundant and offer potential for significant expansion of agriculture production. There is no shortage of water resources for agriculture development. Although an estimated 600,000 hectares of land with irrigation potential exist, only less than 1% of the land is under irrigation. Agriculture contributes 60% of the country's total export revenue. The sector employs up to 75% of the rural workforce, making it the main tool in employment creation and poverty reduction in the country.

Rice gains significance in all Government policies and strategies. Rice is the primary staple food of most of Liberia's 3.5 million people. It is produced by 71% of the estimated 404,000 farm families predominantly on the uplands where traditional technology of slash and burn shifting cultivation remains largely unchanged. Annual per capita consumption of rice in Liberia is estimated to be 133kg, one of the highest in Africa. In 2010, rice was cultivated over a land area of 251,230 Ha. With an average yield of 1.1 t/ Ha, the total domestic rice production was estimated to be about 296,090 metric tons. The demand for rice in Liberia is however far

¹ Census (2008) LISGIS; Liberia Institute of Statistics & Geo-Information Services;

http://www.tlcafrica.com/lisgis/lisgis_population.htm

² The World Fact book, Liberia – CIA (2012); <https://www.cia.gov/library/publications/the-world-factbook/geos/li.html>

higher than the domestic production. The import bill for rice has steadily grown from US\$25 million in 1990 to US\$58.4 million in 2006, US\$70.9 million in 2007 and approximately US\$200 million in 2008³. Interventions to increase rice production in Liberia therefore could have multiple socio-economic effects both within rural livelihood and between various livelihoods.

The Liberian National Rice Development Strategy (LNRDS) is a deliberate initiative by the GoL to develop appropriate interventions in the rice sub-sector to enhance rice production and productivity and thereby ensure food security. Two agro-ecologies of intervention are proposed in the LNRDS: lowland rain-fed and lowland irrigated.

Rice Production map



³ Rice trade statistics (2009) Ministry of Commerce and Industry

2. Review of the National Rice Sector

2.1. Status of Rice in National Policies

Agriculture continues to be the main source of growth and poverty reduction in Liberia during the next decade or more. Rice is the primary staple food of most of Liberia's 3.5 million people. The PRS clearly acknowledges this fact and articulates the country's aspiration for achieving the UN Millennium Development Goals (MDGs), especially Goal #1: Halving of hunger and extreme poverty by 2015. It recognizes the role of agriculture as the engine of overall economic recovery.

The GoL developed the Food and Agriculture Policy and Strategy (FAPS) in 2008 within the context of the framework of the PRS. It relied heavily on the recommendations of the CAAS-Lib). FAPS accentuates pro-poor policies and associated strategies that will harness and utilize the potentials of the large number of smallholders of the agriculture sector.

Building on the objectives embodied in Liberia's national vision and goal for the agriculture sector as stated in the PRS, as well as the food and agriculture vision contained in the FAPS, the Liberia Agriculture Sector Investment Program (LASIP) was developed and validated in 2010. LASIP seeks to transform Liberian agriculture within the context of Comprehensive Africa Agriculture Development Program (CAADP) for 2010-2015. It provides a framework for progressively increasing GoL's annual budgetary allocation to the agriculture sector to a minimum of 10% to ensure sustainable annual 6% growth in compliance with the Maputo Declaration in 2003 to ensure the sector's contribution to economic growth, employment and income generation, food and nutrition security and poverty reduction.

LASIP identifies priority programs from which investments projects aligning national projects and CAADP are to be developed. The LASIP has four main pillars: (1) Food and nutrition security, (2) Competitive value chains and market linkages, (3) Institutional Development, and (4) Land and water development. Rice gains significance in all the policies and strategies mentioned above, especially Pillar 1 of the LASIP.

2.2. Consumer Preferences and demand Projection Rice

2.2.1 Consumer Preferences

For the majority of Liberians, the term food is generally synonymous to rice in the Liberian context. Rice is eaten as breakfast, lunch and dinner in most Liberian households. No empirical study has been conducted to determine Liberian consumer preferences for rice. Many factors (generally subjective) determine consumers' preferences, including the cost of rice, quality of rice, etc. Consumer preference is generally based on price and cooking characteristics. Consumers prefer non-parboiled, 20 – 25% broken, medium to bold grain type that is non-sticky and swells when cooked. White colour rice grains are more preferred.

A wide range of parboiled rice is also available in the urban markets, but it is of second choice to consumers, and it is relatively more expensive. Based on the preference of rice qualities, the consumer markets in Liberia shall broadly be categorized into three segments;

I. A high-end urban segment for high-grade imported rice (parboiled, long grain): Rice in this segment is generally imported from the USA. The market for such rice is price insensitive. With a low volume, the markets for parboiled rice shall be found in urban and concession areas.

II. Butter rice: The medium sized, starchy and non-parboiled that are imported from China is generally referred to as 'butter rice'. The butter rice represents the mid- and low range urban consumer segment in Liberia. It is estimated that the Chinese "butter rice" accounts for approximately 85% of all rice imports in Liberia. This variety of imported rice is cheaper. The grain type is white, slightly broken and of medium length. When cooked, the grain swells significantly and remains non-sticky. The plain cooked rice has a pleasant taste and can be eaten with just butter, without soup or much gravy (and hence the name butter rice). The butter rice dominates mainstream market and is generally price sensitive. This market segment is characterized by high volumes and is mostly found in rural and urban dwellers.

III. Country rice: The locally produced rice is often referred to as country rice. The country rice is largely broken, mixed, poorly milled grains and become sticky when cooked. The locally produced rice is generally consumed by the smallholder farm families which often are the producers. The market supply of country rice is low, seasonal, and generally affordable. Often the consumers of country rice are price insensitive and can be found in both rural and urban areas of the country.

A large portion of the butter rice that is currently available in the markets is sourced through inter-governmental arrangements between GoL and Government of China at subsidized prices. It is possible that this market segment would revert to importation from other sources such as Thailand. On the long run however, it is important to substitute the supply of butter rice through modifications in the quality characteristics and quantity of locally produced rice. The LNRDS describe a range of approaches to achieve quality equivalence through such elements as varietal improvement and post harvest management.

2.2.2. Demand Projections

In Liberia, a majority of the locally produced rice is pounded and/or milled by farmers and consumed by the smallholder farm families⁴. The reliance of consumer markets on imported rice constantly strains the overall trade balance of the country. Table 1 shows the general trends in local production, consumption and importation in the country. As judged from the average yield levels, the crop productivity has become stagnant in Liberia (table 1). In contrast however, the demand for rice has increased by about 1.9 fold from 243,684 t in 2000 to 465,276 t in 2010. This clearly shows that if the demands ought to be met through local production both the productivity level and area under rice cultivation need to be raised significantly.

Table 1: Rice Production and Consumption in Liberia (1990-2008)⁵

	YEAR								
	2000	2002	2004	2005	2006	2007	2008	2009	2010
Area (Ha)	143,500	120,000	120,000	120,000	130,000	160,000	190,000	247,580	251,230
Yield (t/Ha)	1.28	0.92	0.92	1.29	1.26	1.45	1.55	1.18	1.18
Production (t)	183,400	110,000	110,000	154,800	164,000	231,800	295,150	293,000	296,090
Milled rice ⁶ (t)	97,200	98,820	59,400	59,400	54,000	77,760	91,800	150,660	158,220
Consumption (t)	243,684	270,609	241,534	287,017	383,710	397,069	422,000	445,500	465,276
Food Assistance (t)	n/a	n/a	100,000	74,000	22,000	n/a	20,000	n/a	n/a
Import (t)	121,340	153,092	162,266	230,714	324,208	222,732	140,000	101,359	82,973
Value (US\$ million)	37	20	22	140	170	116.79	200	65.7	47.3

2.3. Typology and Number of Rice Farmers, Processors and Traders

Agriculture employs directly or indirectly 1,673,960 people. It is estimated that 404,000 of the total 1,673,960 farm families are involved in rice cultivation. Rice is generally grown as a subsistence crop, mainly under slash and burn shifting cultivation systems in the uplands, with a limited percentage grown in the lowland ecology. Most of the locally produced rice is consumed at farm or village level. Donor-funded, project-based initiatives are virtually the only vehicles of facilitation along the value chain. These initiatives are involved in extension services, input supply (mainly seed) and distribution of small mills in rice producing areas. Although some small portable milling machines have been donated by NGOs, manual pounding is still the most common method of milling. Warehouses are in varying degrees of disrepair.

Rice seed and other inputs have been distributed for free as an emergency or recovery activity during the civil war and the post-conflict period. Private sector operators are very few and their

⁴ U SAID (August 2009) Global Food Security Response Liberia Rice Study, microREPORT #157

⁵ Source: Ministry of Agriculture Crop surveys, FAO crop surveys, MCI rice statistics (2000-2010)

⁶ The milled rice (white rice) production was calculated by first subtracting 10% of paddy production for seed/feed/losses, and then multiplying the remainder by a milling ratio of 0.60 (60%)

impact on domestic rice production is negligible. Vertical linkages in the value chain are extremely weak. The lack of feeder roads inhibits flows of rice and other commercial goods. The lack of information transmitted down the chain prevents input suppliers from being able to deliver seeds and other inputs at the right volumes and price, and farmers from getting the knowledge needed to make informed investment decisions.

The horizontal linkages are almost nonexistent. In the recent years, some rice farming communities, often with NGO-support, have revitalized traditional forms of cooperation, which could be strengthened and used as a basis for input supply, marketing and a nucleus for rice value chain development. Only informal petty traders are buying and selling small seasonal surpluses of locally produced rice.

2.4. Gender Dimension of Liberia's Agriculture Sector

As in most African countries, there is a clear division of labor between men and women in agriculture in Liberia. According to the Comprehensive Food Security and Nutrition Survey (CFSNS/MoA, 2008), it is estimated that almost 43% of the labor for food crops production is supplied by women. Whereas men represent 35% of general agriculture labor force. However, in rice and cassava production, women contribute 36% of the total labor in rice and cassava production. While women do most of the weeding and harvesting of rice crop, the men provide most of the labor for clearing and preparing the land.

Men and women also have clearly defined socio-economic roles. On an average, 33% of household income is jointly generated by men and women. About 33% and 16% of the household incomes are generated exclusively by men and women separately. An additional 5% is generated by women with the support of children, and 10% jointly by all household members. About 6% of food crops are produced only by men, whereas 8% of the food crops are produced only by women. About 57% of the food crops are produced jointly by women and men. In contrast however, about 22% of cash crops income is produced by men only, and only 5% by women only. Women and men jointly produce 49% of cash income.

Besides in production, women are the dominant actors in processing and marketing of farm produce. According to the CAAS-Lib Cross-Cutting Issues report (2007), 50% of rural women in Liberia are actively engaged in agro-processing, compared to only 25% of rural men. In addition to agro-processing, women are clearly the dominant actors in marketing and trading of agricultural produce in the country, comprising 80% of all actors in this area and accounting for the majority of micro creditors in rural and urban areas. Given the important role of women in agricultural and rural development in Liberia, it is not surprising that current policies on gender harmonization place emphasis on removing barriers to women's participation in development efforts.

Despite their significant role in the agricultural sector, women face numerous constraints in the agriculture value chain, especially their lack of access to land. This represents a key constraint in rural areas that undermines women's contribution to agricultural growth and rural development, making them more vulnerable to poverty⁷. Men have more access than women to cultivable lands (33% men versus 16% women) on an individual basis. In general, only about 56% of female headed households have access to land. Other constraints for women include less access to almost all forms of agricultural inputs and technologies, limited access to farm tools, limited access to agricultural extension services. Since extension workers generally tend to exclusively focus on male farmers for crop support services, women have limited access to

⁷ Comprehensive Food Security and. Nutrition Survey, CFSNS (2006)

new technologies. Extension services provided to women have focused mostly on nutrition and food security issues and, thereby, neglected the commercial aspect of agriculture.

Given the strategic importance of women in national development, especially agricultural development, the Government of Liberia places greater importance on equitable access to resources and opportunities. In light of this, mainstreaming gender into development is an important element of the country's Poverty Reduction Strategy. The Ministry of Gender and Development serves as the focal point for gender harmonization. The strategy focuses on creating the enabling environment to eliminate factors that restrict development opportunities for women, improving access of women to productive resources, and promoting the involvement of women in new economic areas of rural growth. In the agricultural sector, it is clearly articulated that women will be at the center of all agricultural development projects in the country.

2.5. Advantages of Domestic Rice Production

The current rice yields of 1.1 t/ Ha remain far below the potential. More could be done to close this yield gap. Providing key inputs such as improved (quality) seeds would deliver an immediate productivity boost. The country is endowed with about 600,000 hectares of irrigable land in which less than 10% has been used. The country has very good annual rainfall and favorable climatic conditions that could facilitate year round production of rice.

Domestic rice production has a huge advantage in Liberia. Since production of rice by smallholder farm families gives increased direct access to food in their livelihoods, rice gains importance in enabling food security and poverty reduction in Liberia. In Liberia, rice has hence become a socially and politically important food crop.

Although it has long been nearly impossible to obtain the real data on production costs and yield from rice farmers, it is presently obvious that increasing the production of rice is important for ensuring food security. There is very high demand for rice, especially in the highly populated urban centers. This implies that if cost-effective production and quality issues are stepped up there will be potential market for farmers' produce. However, cost-effective production alone may not solve the problems associated with the huge deficit of domestic rice unless issues of rice value chains and quality issues, including market improvement, are addressed.

The raising import bills on rice (table 1) constantly strains the foreign exchange and Liberian currency. Through increased domestic rice production, the country shall be able to divert such precious financial resources to other socioeconomic developmental activities of the country. Furthermore, the continued filling of gaps between local production and consumption of rice also threatens overall economy of Liberia by negatively influencing the balance of trade.

3. Strengths, Weaknesses, Opportunities and Threats Facing National Rice Sector

3.1. Strengths

Rice sector in Liberia has several advantages in the country that can provide the sustainability and offer food security to smallholder farmers.

Enabling resource environments: A wide range of environments such as irrigated lowland, rain-fed lowland and upland suitable for rice production exist across the country. Limited efforts in developing lowlands in the past did not produce expected results. This could be due to the absence of an integrated approach along the value chain. Establishing appropriate value chain in the lowlands will be critical in maximizing the benefits of lowland rice cultivation. The experience from the development of value chains of commercial and cash crops such as rubber in Liberia shall be used in developing input and output markets for lowland rice production.

Ministry of Agriculture is already working with African Development Bank in identifying and assessing the swamps with potential for rice production in South Eastern region. Under Agriculture Sector Rehabilitation Project (ASRP), feasibility studies are being conducted for expansion of rice cultivation over 7000 Ha in two major swamps in Grd. Bassa. Mapping work for an additional expansion of about 1,600 Ha is also currently in progress.

Support for rice production: Rice is a priority crop with social and political significance in Liberia. Having acknowledged the importance of increasing rice production, the Government and its development partners have laid emphasis on the development, production and dissemination of rice technologies to promote food security.

Position of rice in Liberia: Rice is a primary staple crop. Historically rice has important political significance in Liberia. Socially, rice is a crop upon which traditional social- and cropping calendars are based. A majority of rural livelihoods in Liberia adopt rice based farming and thus rice provides a viable avenue for poverty alleviation. Therefore investments in developing rice sector represent an integral component of the poverty reduction strategies and achieving millennium development goals in the country.

Under the framework of Comprehensive African Agriculture Development Program (CAADP), the GoL has drawn Liberia's Agriculture Sector Investment Program (LASIP). LASIP aims to maximize economic growth, employment and income generation, food and nutrition security, and poverty reduction by transforming agriculture sector. The transformation from subsistence farming to commercially vibrant agriculture sector shall be envisioned through efficient expansion of rice cultivation to lowland ecosystems where the yield potential is significantly higher than in the traditional upland environments. The alignment of the various rice development strategies proposed here with LASIP is shown in Appendix 1.

Domestic and regional demand for rice: The demand for rice is constantly rising in Liberia. Given the growing population and the consumer acceptance of rice, there is a strong market for rice across the country and in the region. This expands the scope for private sector participation along the value chain of rice sector. Public-private partnerships shall be envisioned in the markets for inputs such as seeds, fertilizers and irrigation. By increasing local production of rice, the government shall be able to save the much precious foreign exchange that is under pressure from the raising import bill for rice.

3.2. Weaknesses

To increase rice production however, a number of constraints need to be resolved:

Adaptive research capacities: CARI, the Central Agriculture Research Institute was destroyed during the 14-year war and has recently resumed performing rice adaptive trials. Staff with technical backgrounds or training in the areas of rice breeding, agronomy, crop protection and socioeconomics are lacking at CARI.

Lack of certified seed production system: After 14 years of war, there is no rice seed chain in Liberia. The MoA is restarting the seed chain as well as the seed certification system. A national seed service for seed certification and for ensuring seed quality standards does not exist in Liberia. Certified seed is a prerequisite for establishing a healthy crop. Liberia is doing its utmost to build up the seed production chain, based on the partnership between the public and private sectors.

Outdated information on socioeconomics of rice: Rice production costs and benefits analyses are outdated. There is a lack of socioeconomic information on rice and other staple foods. Other necessary information includes grade and standard, profitability and level of investment in production, market access (including regional market and trade) and so forth.

Lack of credit and micro-finance institutions: Liberia does not have functional credit and micro-finance systems. Thus, short-term credit for seasonal inputs is not available. Farmers are constrained by lack of credit. To overcome these constraints, the Central Bank of Liberia is preparing to launch a micro-finance system aiming at the rural sector.

Inadequate trained manpower: The available manpower along the rice value chain is inadequate. There is a lack of trained agriculturists, water management and irrigation specialists as well as researchers and extension officers. Inadequate human capacity to monitor and enforce government and non-government partners often impedes implementation of schemes and obtaining the demand-driven results.

Lack of an extension system in all rice growing areas: A strong extension system (private and public) is lacking in the main rice basket areas of Liberia that can support the development of a rice value chain.

Inadequate infrastructures: Inadequate feeder road network, farm machinery, transport systems, irrigation systems, stores and equipment are impediments to effective implementation of rice production.

Non-Governmental Organizations: NGOs are playing an important role in the provision of agriculture and other social services. The proliferation of NGOs in the agricultural sector is an emergency response to the lack of adequate personnel and coordination of extension system in

the rural sector during the post conflict period. Most international NGOs are fairly well staffed and well funded, but their services need to be more sustainable in the long run.

Private Sector: The private sector is weak and fragmented within the agricultural sector in Liberia. There are few small and medium private sector operators involved in marketing of farm inputs and outputs, and in agricultural processing (including rice). The private sector has been involved mainly in the marketing of imported rice.

3.3. Opportunities

There exists abundant opportunities for all actors in rice technology development, dissemination, processing and marketing. Some of the opportunities include the following:-

High demand for rice: The current national annual demand for rice in Liberia is approximately 465,000 metric tons while production is estimated at 296,000 metric tons. In 2008, Liberia imported rice at a cost of over \$200 million. This implies that if cost-effective production is stepped up there will be a ready market for farmers' produce.

Value addition: Based on economic principles, consumers indicate their preference by making informed choices about targeting best quality products among substitutes in the market. Value addition shall therefore render local rice production competitive in domestic and international markets.

Farmer's groups: Marketing is a factor often cited by farmers as a key constraint to rice production. The current extension efforts have given rise to Farmer's group with enhanced bargaining power, allowing them to negotiate better deals along the commodity value chain. This skill can be used as a means of accessing technology, leverage bulk purchases of farm inputs and marketing of farm produce at fair and profitable prices, thereby eliminating exploitative tendencies of the middlemen.

Contribution of rice to rural development: Domestic rice makes up a very small fraction of the total rice supply in urban markets. Production is mostly for household consumption and only about 20% of locally produced rice goes to the market. The key constraints here include the low volume of rice production, poor farm-to-market accessibility due to poor rural road conditions, and poor market organization. Thus, improving production by itself will not enhance the performance of the rice value chain without market improvement. There is great potential for rural development in the areas of increased food security, natural resource management, employment and wealth creation through rice production and distribution.

Availability of production factors (Land and Water): Liberia has a potential of about 60,000 Ha of irrigable land of which less than 10% has been used. With improved water schemes, storage, resource utilization and innovative management technologies the current irrigation potential can be increased from 60,000 ha to 120,000 ha. Opportunities for increased rice production exist as a result of these extensive land and water resources together with the high demand for rice in Liberia.

Potential interventions in rice sector: Regional and international collaborations on technical issues in rice production is flagged by several initiatives under AfricaRice, IRRI, CARD and South-South Cooperation (FARA, FAO). There is a need for various interventions at the policy/institutional, infrastructure, human resources, provision/support to farmers, and knowledge/information on the various subsectors. These needs are shown in Appendix 2.

3.4. Threats

Opportunities for enhanced rice production and marketing are threatened by major constraints to the Liberian rice sector. These constraints have been exacerbated by “emergency operations” and lack of investment in the agricultural public sector. They include the following:

- Climate change affecting rice yields in upland and lowland environments
- Shifts in urban consumer preferences
- Raise in global prices of fuel prices, farm inputs and imported rice
- Changes in intergovernmental policies on rice trade (with China for example)
- Inadequate or inappropriate selection of high yielding rice varieties
- No access to credit for inputs
- Poor physical infrastructure, mainly feeder road and transportation
- Weak institutional linkages between research and extension services
- Inadequate training opportunities for farmers and farmer organisations
- The lowland wetlands are infested with schistos which discourages farmers from cultivating these areas
- Pests and disease epidemics due to continuous rice cultivation
- Globalization and regional competition in domestic rice markets

4. Vision and Scope of the Liberia National Rice Development Strategy (LNRDS)

The LNRDS is a deliberate initiative by the GoL to rebuild and develop appropriate interventions in the rice sub-sector to ensure food security. The LNRDS is inspired by goals and objectives in Liberia’s Food and Agriculture Policy Statement and is consistent with the Comprehensive Africa Agriculture Development Program (CAADP). Liberia received support from the CARD to prepare its LNRDS. The strategy proposes a 10-year time frame (2009-2018) for implementation.

The LNRDS envisions self-sufficiency and building an export capacity for rice production in Liberia. The goal of LNRDS is to double current rice production by 2018. The LNRDS aspires to accomplish this goal by improving rice productivity through a value chain approach and thereby increasing Liberia’s global and regional competitiveness.

The LNRDS proposes to (i) enhance the productivity of rice in both the upland and lowland ecosystems, and (ii) expand the area under rice cultivation in lowland ecosystems to attain self sufficiency in rice production in Liberia.

Table 2: Production and Area under cultivation in 2009 and projection for 2018

Ecosystem	Area cultivated 2009 (Ha)	2018 projection (Ha)	Production output (MT)		
			2009	2018 1-crop/yr	2018 1.5 crop/yr
Upland	190,000	190,000	171,000	380,000	380,000
Lowland Rain-fed	20,000	64,500	24,000	225,750	338,625
Lowland Irrigated	2,000	45,500	4,000	273,000	409,500
Total	212,000	300,000	199,000	878,750	1,128,125

By increasing the area under cultivation in both rain-fed and irrigated lowlands by 88,000 Ha, Liberia will be able to double production before 2018. By cultivating a single crop per annum in the projected land area, Liberia shall become self-sufficient by 2016. If production is increased to 1.5 crops per annum (meaning 2 crops of rice every 3 years), Liberia will produce a surplus of 172,000 metric tons of milled rice by 2018.

5. Priority Areas and Approaches

5.1 Priorities

The LNRDS aspires to increase productivity of rice through a value chain approach whereby the needs of the various subsectors such as seed, fertilizer/chemicals, irrigation/water management, mechanization, quality improvement, access to finance, access to market, and overall policy tools are addressed through various interventions. The priority zones for cultivation are the lowland rain-fed and lowland irrigated ecosystems.

The following areas of intervention have been earmarked for both the lowland and upland rice ecosystems:

- Establishing a national seed program to backstop rice production
- Providing support to farmers in the form of improved farm tools and equipment including tractors, power-tillers and threshers
- Undertaking a rehabilitation program of rice fields destroyed or damaged during the conflict years
- Linking farmers to markets by providing timely price and market information and improving transport network
- Training farmers in improved production and post-harvest processing, storage, handling, parboiling, threshing, winnowing, drying, and milling methods to reduce field and storage losses of rice (pre- and post harvest)
- Instituting proper weed- and pest control measures and intensifying farmers education on the use of Integrated Pest Management (IPM)
- Strengthening human resource development
- Working in collaboration with the regional economic cooperation such as Mano River Union⁸ (MRU) and the Economic Community Of West African States (ECOWAS) in various strategic areas such as research and other crop protection interventions

5.2. Strategic Interventions Approaches

The value chain approach is based on strong linkages between the diverse stakeholders and processes that jointly influence the overall rice commodity and sub-sector performance. Within this context, the development of the rice value chain involves improvement of the performance of stakeholders along the ‘production – consumption continuum’.

The principal components of the rice value chain are inputs, equipments, markets, supply systems, production, agro-processing, value addition, output markets, and consumption. Because of the strong dependency along the chain, key opportunities and constraints at any point along the chain will have direct and indirect effects on overall performance.

⁸ Mano River Declaration; wits.worldbank.org/GPTAD/PDF/archive/MRU.pdf, Note: As of April 1 2008, Liberia, Ivory Coast, Guinea and Sierra Leone are the official members of this regional economic cooperation.

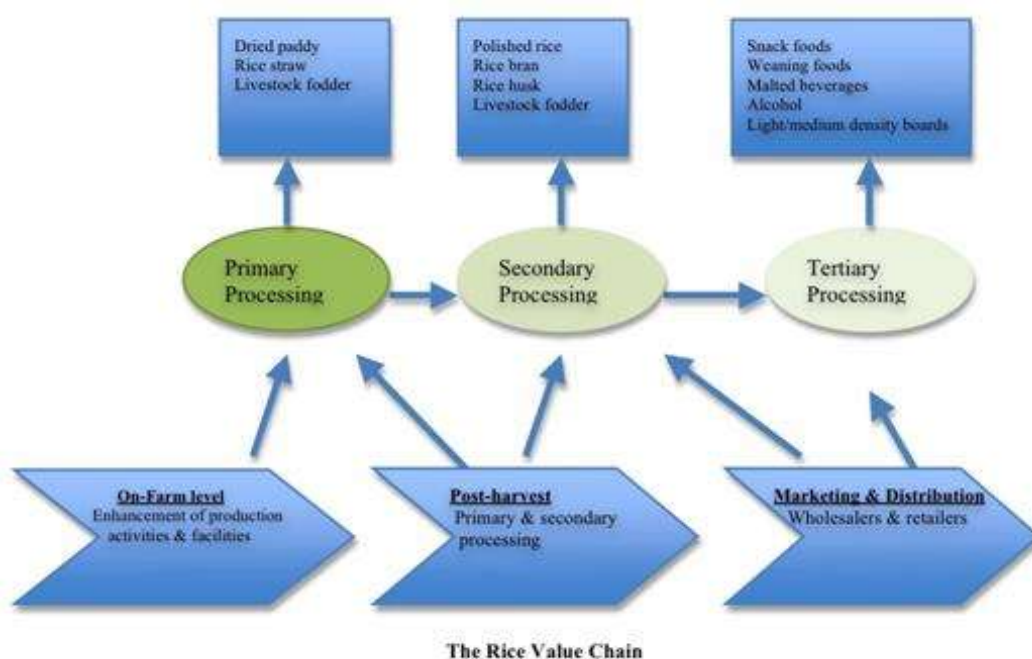


Figure 1: The Rice Value Chain – the production – processing – consumption continuum

To attain national rice self-sufficiency a total of 88,000 Ha will be put under cultivation each year. This includes expansion of area under cultivation in both the lowland rain-fed and lowland irrigated ecosystems, without increasing the current area under upland rice cultivation. This annual program will begin in 2014.

Projected Scenarios: In Liberia, rice is presently produced over a period of about 6 months in the upland environments. By cultivating a single crop per annum in lowland rain-fed and lowland irrigated rice farming areas, Liberia will be able to achieve rice self-sufficiency by 2018. However, by intensifying production to 1.5 crops per annum (3 crops over 2 years), Liberia can reach rice self-sufficiency by 2016 with a projected annual surplus of 172,000 metric tons being obtained by 2018.

The projected scenarios in area under rice cultivation, yield, and production under the various ecosystems are shown in Appendix 2.

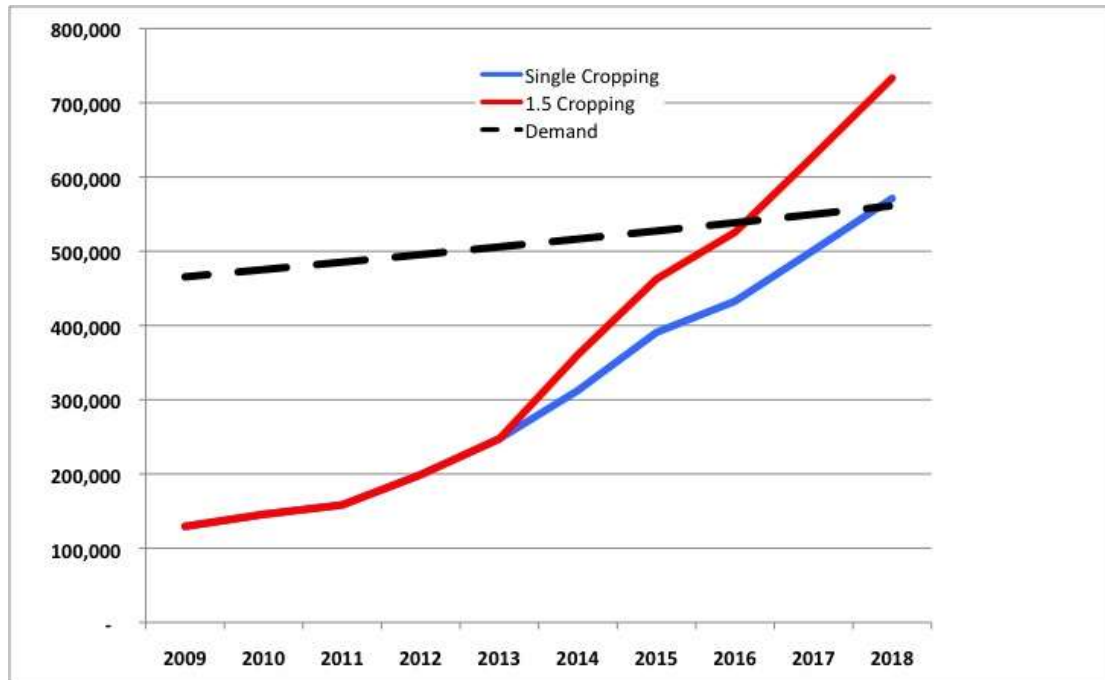


Figure 2: Rice production and demand (MT) projections 2009 – 2018, showing two production scenarios

In order to achieve the projected targets Liberia will pursue the following intervention approaches:

✚ Enhance productivity

- Introduce improved soil and water management techniques for lowland rain fed and lowland irrigated rice.
- Improve access to input supply – certified seeds; fertilizers; and appropriate pest, disease and weed control agro-chemicals.
- Improve access to agronomic packages, technologies and mechanization

✚ Reduce post-harvest losses

- Introduce improved post harvest handling techniques
- Enhance farmers capacity to minimize field and storage losses
- Facilitate and ensure adequate distribution and marketing channels
- Utilize and build on the potential of the Liberia Produce Marketing Corporation

✚ Strengthen extension, advisory and support services

- Invest in adaptive research and extension infrastructures
- Develop, promote and disseminate appropriate technologies
- Improve research-extension-farmer linkages
- Facilitate and promote private sector participation in the rice value chain
- Restart finance and credit facilities for farmers and other stakeholders

6. Detailed Strategies for the Sub-Sector

The following components represent the major strategic axes of LNRDS. The various sub-components and activities that will be pursued under each strategic component are shown in Appendix 3.

1. Land and water management
2. Increasing “availability and accessibility” to inputs
3. Enhancing post-harvest quality improvement
4. Increasing access to market
5. Institutional capacity building
6. Mechanization

Strategic Component.1: Land and Water Management

This component aims at rehabilitating existing irrigation infrastructure and construction of new infrastructure in lowlands. The major problems facing the irrigation sub-sector include;

- dilapidated irrigation infrastructure due to neglect during the 14-year long civil war; weak institutional capacity
- organizational challenges in communities that are just beginning to recover from a protracted civil conflict, and
- lack of skilled manpower resources

The LNRDS aims at an established operational, legal and institutional framework ensuring efficient development, utilization, management, monitoring and conservation of the water resources of the country for agriculture through the following strategic interventions;

- Establishing a Unit in MOA with human and physical capacities in land, irrigation and water resources development that will enable it to oversee the planning, coordination and monitoring of this sub-sector’s activities
- Developing and implementing a medium term National Water Resource Strategy (NWRS) in order to ensure integrated water resources use and management to meet urgent national needs in the rice sub sector
- Supporting training institutions to focus on water resource development and management
- Supporting and promoting private sector participation in capacity building, feasibility study, design, construction and investment in irrigation plan
- Ensuring that water conservation practices on upland slopes as well as in lowland rice production are prioritized to preserve and protect the environment for future generation
- Ensuring proper use of agricultural chemicals to prevent pollution of water bodies, and
- Supporting the establishment of a National Water and Ecological Information Center

This strategic component involves 4 sub components. The objectives and major activities to be pursued under each of the strategic subcomponent are described below:

Subcomponent.1.1. Expand area under lowland rice production

It is envisioned that by increasing area under rice cultivation into the lowlands, the total production and productivity of rice in Liberia will be substantially increased. This is a major strategic component in achieving self sufficiency in rice production in the country. The major activities under this sub component aim to;

- Reduce barriers to low-land production

- Assess the barriers & address them
- Identify the potential areas, conduct feasibility studies, and expand the area under rice cultivation
- Increased access to improved Inputs (improved seeds, technologies, etc.)
- Provision of extension & technical advisory services

Subcomponent.1.2. Irrigation infrastructure

The objective of this subcomponent is to improve the water distribution and water use efficiency in the lowlands. The lowlands in Liberia are highly heterogeneous. While there are swamps where excess water requires drainage facilities to be put in place, there are pockets of lowland zones where water is not equitably distributed throughout the year. In order to improve the use of water resources, there is a need to rehabilitate existing irrigation schemes and put under cultivation, in addition to newly developed perimeters of at least 44,500 Ha of lowland rain fed and 43,500 Ha of lowland irrigated during the next 5-10 years. The major activities under this subcomponent include;

- Assessment of the needs of existing irrigation schemes
- Development of a plan for rehabilitation
- Rehabilitation of existing Irrigation Scheme (especially in ADP areas of intervention)
- Development of new irrigation and drainage infrastructures for swamps

Subcomponent.1.3. Soil fertility management

The low input rice farming in uplands have substantially reduced the soil fertility and hence the productivity. This prompts a need to restore soil fertility in uplands and to manage soil fertility in lowland areas where rice cultivation will be expanded. This requires establishment of soil testing capacities, and recommendations of fertilizers and/or organic manures that will improve the soil fertility and sustainability of rice production.

There is documented evidence that fertilizer-responsive high yielding varieties (HYVs) in combination with fertilizers are the main *Green Revolution* technologies behind the dramatic increase in production and productivity in many Asian countries. However, the high cost and non availability of fertilizers to farmers is a major constraint to agricultural production and productivity in Liberia. In addition, the current lack of demand, partially fostered by the farmers' lack of knowledge regarding the benefits of this expensive input, has constrained the development of the fertilizer market.

The LNDRS will encourage the use of fertilizer with the aim of ensuring that smallholders have adequate access to affordable amount of fertilizers and that a competitive and well regulated distribution network of essential inputs, especially fertilizers, is established and operated by the private sector. The means will be sought, based on the good practices of other countries, for examples, bulk importation and smart subsidies with voucher distribution system.

The major activities under this subcomponent aim to;

- Assess soil fertility & composition in rehabilitated swamps to determine most appropriate nutrient enrichment
- Assess soil suitability in virgin swamps as a condition for development
- Develop soil testing capacities
- Test and recommend site/ecology specific fertilizers for rice production

- Encourage use of organic manures in both lowland and upland rice ecosystems

Subcomponent.1.4. Policy Issues

Water management is a very challenging issue in several rice growing countries. Since the LNRDS aims to expand area under rice cultivation in lowlands, this subcomponent aims to address several policy issues. The major issues around irrigation involve water sharing mechanisms (both between and inside the counties), ownership and maintenance of irrigation structures, water user charges, and land use/tenure. This subcomponent will attempt to;

- Research the Issues
- Form an Inter-ministerial Technical Committee to draft NWRS
- Create Public awareness & Sensitization
- Do at least 2 reviews Sections leading to validation & Cabinet endorsement

Strategic Component.2: Increasing “availability and accessibility” to inputs

Rice production in Liberia is engaged by smallholder farmers in uplands who are very wary of risks involved in farming. The low risk strategy however initiates a vicious cycle in which the low risk leads to low input rice farming, low productivity, low profitability, low sustainability, subsistence and poverty in rural livelihoods. This strategy component proposes to improve productivity of rice crops by increasing the accessibility and availability of major farm inputs in rice producing areas.

Pre- and post harvest crop losses due to pests and diseases are estimated at 40 to 50%. Most farmers depend on mechanical- and physical control actions while some, including urban and peri-urban farmers, depend on chemicals. Rising prices of chemicals for pests and disease control and increasing demand for organic foods have raised the need for non-chemical alternatives in agricultural production. As a result, the Integrated Pest and Disease Management (IPDM) system is increasingly being adopted in a wide range of farming systems and agro-climatic zones, benefiting farmers by reducing costs and potential hazards that may present themselves during the use of chemical agents. Hence increased access to inputs is important in raising the productivity of rice crop. The various subcomponents proposed are described below:

Subcomponent.2.1. Research

There is an urgent need for building the capacity of research in rice value chain. Research on crop improvement, pest & disease management, soil and water management, post harvest handling, quality improvement and marketability will aim at improving the productivity and profitability in smallholder rice farms. This subcomponent aims at;

- Training of Specialists/Scientists
- Organize Farmer Field School
- International/Regional collaboration on improved Varieties
- Multi- location trials
- Identification of Pest/Diseases
- Design crop management options

Subcomponent.2.2. Seed production, certification and distribution

There are already high yielding varieties (NERICA series, LAC 23, Suakoko 8, FKR 19, and WITA 4) with particular preferences to each of specific agro-ecological zones.

The MOA proposes increasing the *supply* of high quality rice seed by strengthening the two phases of seed multiplication: 1) breeder seed to foundation seed; and 2) foundation seed to certified seed. The Ministry’s Central Agricultural Research Institute (CARI) would undertake the first phase, and a network of Seed Banks (SB) would undertake the second phase.

In addition to the seed multiplication efforts described above, MOA proposes to undertake activities to increase *demand* for high quality rice seed. These include:

- Developing a rice seed certification process
- Setting rice seed prices in order to encourage farmers to participate in the SB Network and to buy certified seeds
- Increasing public awareness of the benefits of high quality (specifically, certified) rice seed

Phases of Seed Multiplication

Use of certified seed will significantly improve the yield of Liberian rice harvests. The MOA proposes to strengthen both phases of seed multiplication through the following activities:

Phase 1: Multiplying breeder seed into foundation seed

Each year, the Central Agricultural Research Institute (CARI) will purchase breeder seed from the West Africa Rice Development Agency (WARDA) and other International Research Agencies such as IRRI. CARI will multiply this breeder seed into foundation seed and will introduce stocks into the seed production network.

Phase 2: Multiplying foundation seed into certified seed

Implementing Partners (IPs) will undertake the second phase of seed multiplication (foundation seed into certified seed). Implementing Partner– private sector producers or NGOs – will produce seed under contracts with the MOA. Each IP will then subcontract to Farmer Based Organizations (FBOs) for the multiplication of foundation seed into pre-certified seed (seed that which results from foundation seed.)

Table 3: Seed Multiplication Procedure

Seed type	Research centers	Quantity	Responsible/Comments
Breeder	AfricaRice/IRRI		Import from WARDA
Foundation seed	CARI		Supplemented by importation and other seed producers
Certified seed	By IPs	As per market requirement	MOA contracted to IPs through seed growers

The MOA will train Seed Banks to certify the FBOs’ output. The certification process involves inspecting, testing, weighing, bagging, and labeling seeds. Each IP will carry out the certification process under the auspices of the MOA or its representative.

Table 4: Seed Chain Production Summary by Year (2008-2013)⁹

Year	Breeder seed (input)	Foundation seed (input)	Foundation seed (output)	Certified seed (output)	Percent of national requirement (6,529 t)
2008	2		50		
2009	3	50	80	2100	32%
2010	3	80	120	3520	54%
2011 - 2013				7000	85-100%

The use of improved inputs will go hand in hand with robust pre- and postharvest programs that will help to increase the yield through reduction of postharvest losses that typically average 40%. In lowland production sites, emphasis will be placed on water management, land operations and input usage including promotion of fertilizers.

This subcomponent aims at;

- Training of Specialists/Scientists
- Organize Farmer Field School
- International/Regional collaboration on improved Varieties
- Multi- location trials
- Identification of Pest/Diseases
- Design crop management options
- Rehabilitate and construct new storage facilities at CARI and at various IPs/Seed Bank
- Establish fully equipped laboratories for seed analysis and certification

Subcomponent.2.3. Private sector participation

The objective of this subcomponent is to facilitate an enabling environment for private sector to participate along the rice value chain. It is important to generate a genuine demand for inputs in the system in order to sustain private sector participation. Where it is necessary, the public investments will be sought. However, an exit strategy for public investments will be put in place. For instance after the initial wave of investments in such subsectors as mechanization, public sector shall withdraw and continue to remain as a catalyst for private investments and/or public-private ventures. This subcomponent aims to;

- Identify the potential entrepreneurs and stakeholders
- Promote collaboration among the stakeholders
- Encourage appropriate interventions through public-private partnerships

Subcomponent.2.4. Rural infrastructure

The transformation from subsistence rice farming to economically profitable and/or commercial rice farming requires improved access to farm inputs and farm outputs. This requires appropriate infrastructure to be put in place. Infrastructure such as roads, market structures, handling, processing, storage facilities, irrigation systems, water

⁹ Source: Ministry of Agriculture (2012)

supplies and communications networks are essential to stimulate production, productivity, and competitiveness of the sector.

The restoration of some public economic- and agricultural infrastructure damaged or destroyed during the period of civil disorder and the development of some new infrastructure that improves living and agricultural production conditions, and marketing access are among ongoing programs. The LNRDS will strengthen infrastructure development and sustainability by encouraging the full participation of beneficiary communities in the identification, initiation and implementation of infrastructural development projects, and in the maintenance of these facilities.

The objective of this subcomponent is to encourage establishment of rural infrastructure in rice producing areas. This subcomponent aims to;

- Identification of critical areas requiring market linkages
- Construction of farm to market-roads

Subcomponent.2.5. Finance

One of the reasons for the lack of availability of inputs in the market is the low demand for inputs. The projected demands of the various inputs required for rice production in Liberia under the implementation of LNRDS are shown in Appendix 5. The low demand is partially due to poor affordability and accessibility to finance. This subcomponent aims to increase the availability of finance in rice production areas through the following activities;

- Encourage farmer based organization/group formation
- Link farmers to financing organizations with special Loan product for farmers

Subcomponent.2.6. Incentives for input use

Incentives shall serve as a motivation tool the smallholder farmers to use inputs. Lessons from other countries such as Malawi, Rwanda and Ghana show that while incentives shall increase the demand, there is a danger of leakages (through the porous borders), demoralizing private sector, and political implications on devising an exit strategy¹⁰. Smart subsidies that are targeted and efficiently linked to returns may sustainably promote the input use. This subcomponent aims to;

- Assess the scopes for incentives of input/technology usage in various ecosystems and livelihoods
- Provide smart subsidies on input

Subcomponent.2.7. Input delivery systems

An efficient input delivery system is important for generating a genuine and sustainable demand for inputs in the country. This subcomponent will explore the feasibilities of establishing a decentralized distribution network, agro-dealerships, rural entrepreneurship, and community based organizations/cooperatives. The major activities under this subcomponent aim to;

- Provide information on farming activities to distributors
- Provide Credit facilities to input distributors
- Market determined price regulations

¹⁰ Agriculture and Social Protection in Africa – Policy Briefing; Future Agricultures, March 2009

Subcomponent.2.8. Extension and technical services

The current extension and technical services in Liberia is weak and far too fragmented. Most of the services in the country are currently provided by Non Government Organizations (NGOs). However there is a greater need to build national capacities, improve efficiency of technical and advisory services through public-private partnership on technologies (pluralistic) and effective information management. This subcomponent will aim to;

- Increase the number of extension and technical staff in the field
- Provide training for field staff
- Establish technology/demonstration center

Subcomponent.2.9. Labor saving technologies

Rice farming is largely done by the farm family members, often with women muscle. As labor becomes scarce and expensive in the country, there is a need for developing and promoting appropriate labor saving technologies in rice growing areas. These technologies should focus on increasing the efficiency and consistency of such field operations as land preparation, crop management, harvesting and post harvest handling practices. This subcomponent will aim to;

- Introduce machines such as Power tillers, bulldozers, tractors threshers, millers
- Conduct demonstration & training on the use of the machineries
- Provide Smart subsidies

Strategic Component.3: Enhancing post-harvest quality improvement

It is conceivable that there is a strong linkage between the quality of rice produced and the profitability of rice farming. According to the latest crop survey report, inadequate post-harvest facilities in Liberia have accounted for close to 20% loss of harvested food crops. To target increased production and productivity, intervention should be put in place to address post-harvest losses. There is also a need to improve the use of rice by products such as straw, bran and husk in Liberia.

Subcomponent.3.1. Improved techniques

Techniques that can improve the efficiency of harvesting, threshing, drying and winnowing/cleaning methods in upland and lowland environments are widely available in rice growing countries. These techniques need to be promoted in rice growing areas in Liberia. This subcomponent will aim to;

- Cutting: Sickle, Small scale harvesters may be required
- Threshing: To develop small-motorized threshers
- Winnowing: To develop small scale motorized winnowers
- Establish mechanization options for uplands, lowland rain fed and lowland irrigated rice production systems
- Encourage mechanization in post harvest handling and storage in smallholder farms

Subcomponent.3.2. Labor saving technologies

A major portion of post harvest losses occur during critical harvesting and post harvest handling operations. Introduction of selective labor saving technologies shall significantly improve the timing and efficiency of operations. Encouraging service provisions by private sectors and rural entrepreneurs shall facilitate such critical

operations and thereby contribute to minimizing the post harvest losses. This subcomponent will aim to;

- Promote service providers in high rice producing zones
- Demonstrate the profitability of mechanization
- Encourage rural entrepreneurs in mechanization/contract services
- Create knowledge and awareness of the importance of minimizing post harvest losses through appropriate mechanization options

Subcomponent.3.3. Improved Infrastructure

The infrastructure for drying, storage, packing and transportation are limiting the smallholder farmers' ability to improve the quality of rice produced in Liberia. This subcomponent will aim to;

- Encourage simple threshers with Tarpaulin and Drying
- Establish drying yards (concrete base) in high production areas
- Encourage Miller/Farmers agreement on product buying
- Provide bags for storage
- Construct storage facilities in high producing areas

Subcomponent.3.4. Quality improvement

Increasing production without addressing the quality issues could be self defeating to Liberia's rice sector. To improve the competitiveness of Liberia's rice farmers, several issues on the milling capacity, milling standards, grading and branding remain to be addressed. This subcomponent will aim to;

- Encourage mechanized winnowing/cleaning
- Promote setting up of mills by rural entrepreneurs
- Encourage private public partnership in setting up milling facilities
- Establish and enforce milling standards
- Encourage modern mobile mini milling and bagging facilities

Subcomponent.3.5. Value addition

Being a traditional staple food in Liberia, there is recognition for value addition in high end market segments and the urban rice consumers. Post harvest processing such as parboiling, flour/dough making and other processed rice products such as rice crisps, flakes and cookies are gaining marketability. This subcomponent will aim to;

- Promote mechanized parboiling
- Encourage millers to engage in value addition processes by providing information and linkages with markets
- Provide training on post harvest techniques to farmers, millers and other stakeholders

Subcomponent.3.6. Policy Issues

With increased globalization, there is a need to orient rice policies in Liberia with the dynamic trading practices the region. The integration will align the marketing, grading, and trading of both the inputs and outputs of rice farms. This subcomponent will aim to;

- Establish marketable grades of rice
- Promote paddy/rice grading equipments
- Promote packaging of milled rice in appropriate materials
- Integrate national policies with regional (MRU, ECOWAS) and international grades and standards of rice

Strategic Component.4: Increasing “access” to market

Access to markets is one of the major prerequisites to stimulate and underpin the transition from low-production subsistence farming to high-productivity commercial production. Further economic benefit is realized when complementarities and inter-dependence between agriculture and agribusiness are forged through promoting forward and backward linkages. In view of the limited size of the domestic market, Liberia should also take advantage of the opportunities presented by regional and international markets to achieve significant growth in the rice sub sector through agri-business.

Farmers’ access to both input and output market requires to be strengthened, through the involvement of the private sector and agro dealers. Based on the dedicated nature of the input market and the timely supply of agricultural inputs during production, Government will need to intervene on a need basis, with some clear time boundaries, so as to correct for producer risk.

Subcomponent.4.1. Rural infrastructure

Physical access to market shall be improved in high production areas by putting in place feeder roads, adequate storage facilities, and warehouses. Given the advantage of long shelf life of paddy and rice, rural investments in storage facilities and warehouses shall be made through public-private partnership models. This subcomponent will aim to;

- Conduct needs assessment in high production areas
- Identify/build farm-to-market roads linking production areas with storage and markets

Subcomponent.4.2. Market information

Information on production and marketing of locally produced rice is imperative for raising the profitability and sustainability of rice production in Liberia. There is a strong need to create awareness on the linkage between price and standards/grades of production amongst producers and traders. This subcomponent will aim to formulate;

- Legislation on standardization of weights and measures
- Pricing mechanisms based on metric quantities, purities, grades (quality)
- Awareness program on market information for rice inputs and outputs
- Establish an official market information dissemination system

Subcomponent.4.3. Networking of producers and traders

Farmer based organizations such as cooperatives can tap the advantages in access to finance and larger volumes and collective bargaining. Such organizations shall also provide stability to the market for traders and agro-dealers in rural areas. This subcomponent will aim to;

- Encourage farmer based organizations in marketing
- Establish finance guarantee scheme to support funding in rice sector

Subcomponent.4.4. Access to finance for traders

The locally produced rice is sold through unorganized rural traders. Often the finance required to sponsor the trading is a serious limitation in uplands. Increasing access to financial services for traders will increase the efficiency and profitability of rice producers. This subcomponent will aim to;

- Identify and encourage participation of rural entrepreneurs in the value chain

- Increase finance facilities/banks in rice producing areas
- Create special finance schemes for farmers to adopt new technologies/mechanization

Subcomponent.4.5. Linkages between producers and traders

The shift from subsistence farming to commercial farming shall be facilitated by increasing the linkages between farmers and traders. The farmers need to be integrated with trading and marketing network through organized awareness and access programs. This subcomponent will aim to;

- Conduct feasibility study in contract farming for rice
- Encourage utilization of rice by products such as straw, bran, and husk
- Pre-determined contracts between producers/producer organizations and traders

Strategic Component.5: Institutional capacity building

Strong and efficient human and institutional capacities of the public sector, civil society organizations and the private sector will be needed to strengthen and improve rice production.

CARI and the Extension Services were isolated from external support and had little chance to develop their capacity in research, seed multiplication and dissemination. The first step is to quickly rebuild the capacity of these development agents by providing them with updated knowledge and skills in every activity along the rice chain.

Advisory services will be provided through public-private partnership. NGOs, commercial plantations and FBOs will be involved in the provision of extension services. Training on rice production, processing and marketing will be done for common interest groups whenever the need arises. Farmers will be facilitated to form producer organizations to achieve economies of scale, ease access to services such as extension, market information and markets.

The Ministry of Agriculture (MOA) has direct responsibility for the subsector. Following a recent functional audit of the ministry, a major reorganization based on core functions is underway. The new structure will be comprised of three departments, each of which will have a number of function-based divisions. The Department of Regional Development and Extension Services will be responsible for agricultural research, agricultural extension, farmers' associations and cooperative, and regional development. The Department of Planning and Development will be responsible for foreign relations/aid, planning and projects, monitoring and evaluation, and food security. The Department of Administration and Finance will support the MOA while quarantine and fisheries will be strengthened and will be autonomous.

Thus, strengthening the capacities of the public sector, particularly the Ministry of Agriculture (MOA), and ensuring it is more effective and efficient to provide continuous services especially for policy development, planning, coordination, monitoring, technology transfer, regulation, resource mobilization, and information dissemination is a goal. This entails the following subcomponents:

Subcomponent.5.1. Technical Capacity

The objective of this subcomponent is to increase overall capacity of rice sector in technical research, education, on-job training for subject matter specialists, socio-

economists and policy makers. Technology generation will be spearheaded by the Technology Training Centers that are being established in selected counties to train farmer's groups and women's groups on various technologies. The current capacities and the projected requirement of human capacity needs in technical research are shown in Appendix 4. This subcomponent will aim to;

- Assess the specific needs of enriching institutional capacities
- Recruit and train institutional Staff in specialized Areas of rice research
- Strengthen the capacity of vocational school and related Institutions
- Reforming leading institutions by establishing core functions and clarifying roles and responsibilities of key institutions

Subcomponent.5.2. Extension services

The dissemination of information on improved rice technologies for upland and lowland ecosystems through extension services is an urgent need in Liberia. The current capacities and the projected requirement of human capacity needs in extension/advisory services are shown in Appendix 4. This subcomponent will aim to;

- Increase human capacities in extension/advisory services in rice producing areas
- Conduct Farmers' Field School
- Develop Extension Fact Sheets
- Promote (Lead) Farmers Exchange Program
- Establish appropriate operational mechanisms for intra-sectoral and inter-ministerial harmonization, as well as for coordination between and among stakeholders in the sector
- Prepare training manuals and disseminate new technologies through print and electronic media
- Organize Field days and demonstrations at periodic intervals

Subcomponent.5.3. Market Information

Presently research on consumer preference, statistics of input and output market, profitability of rice farming in uplands and lowlands, mechanization, price dynamics, forecasts are absent in Liberia. This subcomponent aim to;

- Conduct analyses of production, processing and marketing variables that have an influence on profitability of rice farmers and other stakeholders
- Survey production, trade and consumer preferences in the markets
- Train Farmers to Produce Quality Products
- Link Farmers to Market
- Disseminate Price Information

Subcomponent.5.4. Administration

Overall policy tools linking agriculture sector with other other sectors such as finance, land, labor, industry and local administration are important means of transferring the benefits of rice farming to the rural livelihoods. These tools shall influence the outcomes of both within the livelihoods and between livelihoods, and thereby effectively mediate the social transformation. This subcomponent aim to;

- Perform impact analyses, and advisory services
- Develop Appropriate National Policies (Labor, Extension, Fertilizer, etc.)
- Enhance the effectiveness of the MOA through generation, processing, and dissemination of agricultural statistics, data and information
- Enable communication between stakeholders of the interlinked sectors

Strategic Component.6: Mechanization

One of the major limitation of increasing rice productivity in Liberia is the over reliance on human, often women labor. Increase in labor productivity shall not only increase the overall productivity, but also expansion of lowland area under rice. Experience from Asia, Latin America and in some African countries show that labor productivity shall be greatly enhanced by using alternate farm powers such as motorized engines and draught animals.

Mechanization, along with other farm inputs such as fertilizers, improved seeds and pesticides, can improve agricultural productivity and overall production. Thus mechanization is a powerful tool in achieving sustainable rice production because it enhances human capacity with the potential users or beneficiaries being men, women and children. It allows timeliness, efficiency and consistency in field operations. This is critical for land preparation in both uplands and lowlands where there is scope for sequential rotation of rice and other food crops. It can also relieve the growing seasonal labor constraints that are experienced by farmers in several parts of the country.

The projected requirements of farm machineries under the implementation of the LNRDS are shown in Appendix 6. Mechanization will be promoted under the proposed strategies through the following subcomponents.

Subcomponent.6.1. Mechanization Options

Owning machineries involve several variable and fixed costs depending on the nature of machines. While all smallholder farmers may not be able to own the machineries, rural entrepreneurs who can invest in mechanization shall embark on providing services. It is therefore important to lay emphasis on validation of the various mechanization options and the economic feasibility. Under this subcomponent efforts will be taken to;

- Perform cost-benefit analyses of mechanization in smallholder rice farms
- Assess the feasibility and economic profitability of using draft animals farm operations and livelihoods in uplands, lowlands
- Develop appropriate machinery options for the uplands, lowlands
- Conduct technical, socio-economic and environmental feasibilities of the mechanization options
- Establish the use of treadle pump for irrigation in rice fields

Subcomponent.6.2. Human resources

Sustainability of mechanization in smallholder rice farms will depend on the availability of human resources along the value chain – from mechanics and artisans at the grass root level to design engineers at the technical level. The following activities will be undertaken under this subcomponent;

- Training of farm groups, rural entrepreneurs (service providers), extension agents, local artisans, and mechanics
- Training of trainers for representatives of local farmers
- On-job training for engineers and extension officers
- Recruitment of engineers and extension officers

Subcomponent.6.3. Policy tools

The participation of private sector is essential for the promotion of mechanization in the country. Policy tools that will improve the cost efficiency of business operations such

as dealerships, importation of machineries and implements, local manufacturing, training of mechanics, service provision and extension services will provide the enabling environment for private sector. This subcomponent will aim to;

- Encourage public-private partnerships in logistics and importation of machineries and implements
- Waive import tariffs, VAT and other hidden taxes/duties on importation of farm machineries
- Oversee regulations on technical and extension services
- Develop and recommend appropriate finance mechanisms/guarantee schemes for the stakeholders in the value chain for mechanization
- Create awareness and knowledge on the advantages of mechanization in high production areas

Subcomponent.6.4. Research and development

The designs of such machineries and implements imported from overseas often need to be fine-tuned to improve the adoption in local environments. Furthermore, there may be instances where a special design of already existing machineries and/or implements will become necessary to improve the operational- and cost efficiency of machineries. This subcomponent will aim to;

- Conduct adaptive trials on appropriate tools
- Promote national, regional and international collaboration on research and designing of locally available/suitable tools
- Introduce parboiling and other appropriate value addition in rice processing

Subcomponent.6.5. Testing and standardization

When private sector is engaged in promotion of mechanization, inevitably the sector will introduce machineries and implements from overseas manufacturers into the country. The quality and standards of these machineries and implements may not be universally suited. For instance, the soil conditions in which rice is grown may demand varying degrees of strength of metal. Hence local testing, standardization and authorization of machineries and implements will improve the longevity and hence the profitability of machineries in smallholder farms. This subcomponent will aim to;

- Establish quality standards of machineries and implements being sold in the country
- Identify institutions and assign responsibilities of testing and standardization procedures along the value chain
- Perform testing of mechanization options in farmers fields
- Conduct testing of imported machineries and implements

Subcomponent.6.6. Promotional Activities

Mechanization shall be adopted more readily by smallholder farmers if the appropriateness of technologies is thoroughly evaluated and profitability becomes visible. Several Asian countries where mechanization has been successfully adopted by smallholder farmers continue to embark on promoting mechanization amongst the stakeholders along the value chain. This subcomponent will aim to;

- Aggressive awareness campaign amongst farmer on new technology
- Organize routine workshops, radio programs, brochures (flyers/ posters) and other multimedia tools for dissemination of mechanization, markets and prices
- Public-private partnerships in mechanical services, extension services, financial services, demonstrations and standardization

7. Overall policies on rice development

Since the recent food crisis, rice production has been considered as a priority by the GOL as the “import bill” is too high for a staple that could be produced domestically. Currently, Liberia is producing around 40 to 48% of its rice consumption needs. Consumption has outstripped production so there is need to focus on strategies that enhance production in order to reduce dependency on imports and help increase the income of small farmers. The priorities of rice sector are shown in a subsector intervention element matrix format in Appendix 7.

7.1. Technical issues

- Training of MOA’s staff, researchers, extension officers and farmers on modern rice production techniques and utilization
- Revitalization of the existing training institutions to undertake capacity building in rice- specific courses supporting and strengthening rice institutions, especially CARI

7.2. Farm inputs and equipments

- Facilitate accessibility and affordability of farm inputs, especially seeds
- The Government through the LNRDS will play a key role in rice development, maintenance and seed production in partnership with other stakeholders, especially the private sector

7.3. Infrastructural development

- Improve roads and transport facilities in rice growing areas
- Rehabilitate, study and construct irrigation infrastructures
- Encourage private sector partnerships in rice processing and in the value chain

7.4. Marketing structure improvement

- The Government will promote seed production and distribution
- Strengthen farmer organizations in the rice marketing chain
- Rehabilitate access roads

7.5. Governance structure

Liberia National Rice Development Strategy (LNRDS) aims at providing adequate institutional framework to mobilize sufficient resources to achieve its objectives in rice production. The proposed governance structure for the overall implementation of LNRDS is shown in Appendix 8. The proposed strategies will be implemented by the National Rice Sector Technical Working Group (RSTWG), under the supervision of the Ministry of Agriculture.

The RSTWG is composed of representative members from across the rice value chain. They include private sector, the Government of the Republic of Liberia, as well as representatives of farmers. The role of the committee will be:

- To ensure a coordinated, consistent, efficient and realistic development Liberia’s rice sector;
- To engage the effective participation of all sector actors (rice farmers, seed producers, millers, agro-dealers, traders, service providers and consumers)
- To identify the role and coordinate the point of entries of individuals and all private and public institutions, and
- Provide a framework for effective coordination, monitoring, and review of sector development activities, as well as programs of all stakeholders

7.6. Monitoring and Evaluation

There is need for updating and strengthening a suitable monitoring and evaluation system/ mechanism to track the implementation of LNRDS activities. This includes use of results/ logical frameworks, work plans, field visits, quarterly and annual reports, mid-term review and evaluation, and end term evaluation form inputs for the next strategic plan. The government will seek assistance on M&E from national and international partners to update and strengthen efforts of promoting rice production in Liberia.

Appendices

Appendix 1: Alignment of the various components, sub-components described under NRDS with Liberia Agriculture Sector Investment Program (LASIP)

LNRDS' Strategic Component	LNRDS' Sub-component	Program/Sub-program of LASIP
1. Land and water management	1.1. Expand area under lowland rice production	1.1. Food Crops Production and Productivity Enhancement 4.3. Expansion of Irrigable Land
	1.2. Irrigation infrastructure	4.3. Expansion of Irrigable Land
	1.3. Soil fertility management	4.4. Improved Wet and Degraded Land Management
	1.4. Policy issues	4.1. Land Reform and Capacity Building 3.1. Rebuilding the Ministry of Agriculture and Improved Coordination and Management
2. Increasing “availability and accessibility” to inputs	2.1. Research	3.3. Building Extension and Enhancing Technologies 3.5. Revitalizing Agricultural Research 3.6. Renewing Agricultural Education and Training
	2.2. Seed production, certification and distribution	1.1. Food Crops Production and Productivity Enhancement
	2.3. Private sector participation along the value chain	2.1. Rehabilitation and Expansion of Rural Roads 2.2: Rural Agricultural Infrastructure and Technology 2.3. Market and Enterprise Development 2.4 Rural Financial Services
	2.3. Rural infrastructure	2.1. Rehabilitation and Expansion of Rural Roads
	2.4. Finance	2.4 Rural Financial Services
	2.5. Incentivize the input use	3.3. Building Extension and Enhancing Technologies
	2.6. Input delivery systems	3.3. Building Extension and Enhancing Technologies
	2.7. Extension and technical services	3.3. Building Extension and Enhancing Technologies
	2.8. Labor saving technologies in land preparation and crop	1.1. Food Crops Production and Productivity Enhancement

LNRDS' Strategic Component	LNRDS' Sub-component	Program/Sub-program of LASIP
	management	
3. Enhancing post-harvest quality improvement	3.1. Improved techniques of harvesting, threshing, drying, winnowing/cleaning	2.2. Rural Agricultural Infrastructure and Technology
	3.2. Labor saving technologies	1.1. Food Crops Production and Productivity Enhancement
	3.3. Improved infrastructure	2.2. Rural Agricultural Infrastructure and Technology
	3.4. Quality improvement	2.2. Rural Agricultural Infrastructure and Technology 2.3. Market and Enterprise Development
	3.5. Management of by-products	2.3. Market and Enterprise Development 1.5. Livestock Development and Promotion
	3.6. Value addition	2.2. Rural Agricultural Infrastructure and Technology 2.3. Market and Enterprise Development
	3.7. Policy on quality and trade	3.1. Rebuilding the Ministry of Agriculture and Improved Coordination and Management 2.4. Rural Financial Services
4. Increasing "access" to market	4.1. Rural infrastructure	2.1. Rehabilitation and Expansion of Rural Roads 2.2. Rural Agricultural Infrastructure and Technology
	4.2. Market information	2.3. Market and Enterprise Development 2.4. Rural Financial Services
	4.3. Network of traders	3.4. Capacity Building of Farm-based Organizations 2.3. Market and Enterprise Development 2.4. Rural Financial Services
	4.4. Access to finance for traders	2.3. Market and Enterprise Development 2.4. Rural Financial Services
	4.5. Pre-determined contracts between producers/producer organizations and traders	2.3. Market and Enterprise Development 3.1. Rebuilding the Ministry of Agriculture and Improved Coordination and Management
5. Institutional capacity building	5.1. Technical	3.5. Revitalizing Agricultural Research 3.6. Renewing Agricultural Education and Training
	5.2. Extension	3.3. Building Extension and Enhancing Technologies 3.4. Capacity Building of Farm-based Organizations
	5.3. Marketing	2.3. Market and Enterprise Development

LNRDS' Strategic Component	LNRDS' Sub-component	Program/Sub-program of LASIP
	5.4. Administration	3.1. Rebuilding the Ministry of Agriculture and Improved Coordination and Management 3.2. Reviewing and Upgrading Selected Agricultural Parastatals
6. Mechanization	6.1. Appropriate machinery options for the uplands, lowlands	1.1. Food Crops Production and Productivity Enhancement
	6.2. Human resources	3.3. Building Extension and Enhancing Technologies 3.6. Renewing Agricultural Education and Training
	6.3. Policy tools for encouraging public, private sector participation in imports of machineries and spare parts, local manufacturing	3.1. Rebuilding the Ministry of Agriculture and Improved Coordination and Management 2.3. Market and Enterprise Development
	6.4. Research and Designing of locally available/suitable tools	2.2. Rural Agricultural Infrastructure and Technology 3.3. Building Extension and Enhancing Technologies 3.5. Revitalizing Agricultural Research
	6.5. Testing and Standardization of machineries and implements	2.3. Market and Enterprise Development 3.1. Rebuilding the Ministry of Agriculture and Improved Coordination and Management
	6.6. Promotion of mechanization	2.1. Rehabilitation and Expansion of Rural Roads 2.2. Rural Agricultural Infrastructure and Technology 2.3. Market and Enterprise Development 2.4. Rural Financial Services

Appendix 2: Rice Production based on Area and Yield in 2008/09 and 2018 Targets in Future by production system

Year	Upland			Lowland Rain-fed			Irrigated Lowland			Total Production	Milled Equivalent (MT)	Demand Milled (MT)
	Area (Ha)	Yield (MT/Ha)	Production (MT)	Area (Ha)	Yield (MT/Ha)	Production (MT)	Area (Ha)	Yield (MT/Ha)	Production (MT)			
2009	190,000	0.90	171,000	20,000	1.2	24,000	2,000	2.0	4,000	199,000	129,350	465,500
2010	190,000	0.95	180,500	22,000	1.5	33,000	5,000	2.1	10,500	224,000	145,600	475,276
2011	190,000	0.95	180,500	24,000	2.0	48,000	6,000	2.5	15,000	243,500	158,275	485,256
2012	190,000	1.20	228,000	26,000	2.2	57,200	7,000	3.0	21,000	306,200	199,030	495,447
2013	190,000	1.50	285,000	27,000	2.5	67,500	8,000	3.5	28,000	380,500	247,325	505,851
2014	190,000	1.75	332,500	34,500	2.5	86,250	15,500	4.0	62,000	480,750	312,488	516,474
2015	190,000	2.00	380,000	42,000	2.8	117,600	23,000	4.5	103,500	601,100	390,715	527,320
2016	190,000	2.00	380,000	49,500	3.0	148,500	30,500	4.5	137,250	665,750	432,738	538,394
2017	190,000	2.00	380,000	57,000	3.2	182,400	38,000	5.5	209,000	771,400	501,410	549,700
2018	190,000	2.00	380,000	64,500	3.5	225,750	45,500	6.0	273,000	878,750	571,188	561,244

Appendix 3: Major elements of Liberia's National Rice Development Strategies

Strategic Component	Sub-component	Activities
1. Land and water management	1.1. Expand area under lowland rice production	<ul style="list-style-type: none"> • Reduce barriers to low-land production • Assess the barriers & address them • Identify the potential areas, conduct feasibility studies, and expand the area under rice cultivation • Increased access to improved Inputs (improved Seeds; etc) • Provision of extension & technical advisory services
	1.2. Irrigation infrastructure (drainage and water storage)	<ul style="list-style-type: none"> • Assess the needs of existing irrigation schemes • Develop Plan for rehabilitation • Rehabilitate existing Irrigation Scheme (especially in ADP areas of intervention) • To develop irrigation and drainage infrastructures for swamps
	1.3. Soil fertility management (soil testing, crop response to fertilizers)	<ul style="list-style-type: none"> • Assess soil fertility & composition in rehabilitated swamps to determine most appropriate nutrient enrichment • Assess soil suitability in virgin swamps as a condition for development • Develop soil testing capacities • Test and recommend site/ecology specific fertilizers for rice production • Encourage use of organic manures in both lowland and upland rice ecosystems
	1.4. Policy issues (ownership and maintenance of irrigation structures, water user charges, land use, land tenure)	<ul style="list-style-type: none"> • Research the Issues • Form an Inter-ministerial Technical Committee to draft NWRS • Create Public awareness & Sensitization • Do at least 2 reviews Sections leading to validation & Cabinet endorsement
2. Enhancing “availability and accessibility” to inputs	2.1. Research (Capacity building, improved varieties (crop improvement), pest & disease management, germplasm)	<ul style="list-style-type: none"> • Training of Specialists/Scientists • Organize Farmer Field School • International/Regional collaboration on improved Varieties

Strategic Component	Sub-component	Activities
		<ul style="list-style-type: none"> • Multi- location trials • Identification of Pest/Diseases • Design crop management options
	2.2. Seed production, certification and distribution	<ul style="list-style-type: none"> • Seed policy/law • Identify specific growers • Establish seed laboratories & certification agencies • Create marketing policy for seed distribution
	2.3. Private sector participation along the value chain	<ul style="list-style-type: none"> • Identify the potential entrepreneurs and stakeholders • Promote collaboration among the stakeholders
	2.4. Rural infrastructure (roads, bridges)	<ul style="list-style-type: none"> • Identification of critical areas requiring market linkages • Construction of farm to market-roads
	2.5. Finance (banks, microfinance institutions)	<ul style="list-style-type: none"> • Encourage farmer based organization/group formation • Link farmers to financing organizations with special Loan product for farmers
	2.6. Incentivize the input use	<ul style="list-style-type: none"> • Assess the scopes for incentives of input/technology usage in various ecosystems and livelihoods • Provide smart subsidies on input
	2.7. Input delivery systems (decentralized distribution network, agro-dealers, farmer entrepreneurship, community based organizations/cooperatives)	<ul style="list-style-type: none"> • Provide information on farming activities to distributors • Provide Credit facilities to input distributors • Market determined price regulations
	2.8. Extension and technical services (capacity development, improved technical and advisory service, public-private partnership on technologies (pluralistic), information management)	<ul style="list-style-type: none"> • Increase the number of extension and technical staff in the field • Provide training for field staff • Establish technology/demonstration center
	2.9. Labor saving technologies in land preparation and crop management	<ul style="list-style-type: none"> • Introduce machines such as Power tillers, bulldozers, tractors threshers, millers • Conduct demonstration & training on the use of the machineries • Provide Smart subsidies

Strategic Component	Sub-component	Activities
3. Enhancing post-harvest quality improvement	3.1. Improved techniques of harvesting, threshing, drying, winnowing/cleaning	<ul style="list-style-type: none"> • Cutting: Sickle, Small scale harvesters may be required • Threshing: To develop small-motorized threshers • Winnowing: To develop small scale motorized winnowers • Establish mechanization options for uplands, lowland rain fed and lowland irrigated rice production systems • Encourage mechanization in post harvest handling and storage in smallholder farms
	3.2. Labor saving technologies (timing, knowledge of field operations and appropriate mechanization options)	<ul style="list-style-type: none"> • Promote service providers in high rice producing zones • Demonstrate the profitability of mechanization • Encourage rural entrepreneurs in mechanization/contract services
	3.3. Improved infrastructure (drying, storage, packaging, transportation)	<ul style="list-style-type: none"> • Encourage simple threshers with Tarpaulin and Drying • Establish drying yards (concrete base) in high production areas • Encourage Miller/Farmers agreement on product buying • Provide bags for storage
	3.4. Quality improvement (milling capacity, milling standards, grading and branding)	<ul style="list-style-type: none"> • Encourage mechanized winnowing/cleaning • Promote setting up of mills by rural entrepreneurs • Encourage private public partnership in setting up milling facilities • Establish and enforce milling standards • Encourage modern mobile mini milling and bagging facilities
	3.5. Value addition (parboiling, other post harvest processing)	<ul style="list-style-type: none"> • Promote mechanized parboiling • Encourage millers to perform parboiling • Provide training on post harvest techniques to farmers, millers and other stakeholders
	3.6. Policy on quality and trade (National, sub-regional (MRU/ECOWAS) and regional)	<ul style="list-style-type: none"> • Establish marketable grades of rice • Integrate regional and international grades and standards of rice
4. Enhancing “access” to market	4.1. Rural infrastructure (feeder roads, storage/warehouses)	<ul style="list-style-type: none"> • Conduct needs assessment in high production areas

Strategic Component	Sub-component	Activities
		<ul style="list-style-type: none"> Identify/build farm-to-market roads linking production areas with storage and markets
	4.2. Market information (price, standards, grades)	<ul style="list-style-type: none"> Legislation to standardize weights and measures Prices will be determined by measures (Quantity) Prices will be influenced by the grades (Quality) Establish an official market information dissemination system
	4.3. Network of traders (cooperatives/farmer based organizations, agro dealers)	<ul style="list-style-type: none"> Encourage farmer based organizations in marketing Establish finance guarantee scheme to support funding in rice sector
	4.4. Access to finance for traders	<ul style="list-style-type: none"> Identify and encourage participation of rural entrepreneurs in the value chain Increase finance facilities/banks in rice producing areas Create special finance schemes for farmers to adopt new technologies/mechanization
	4.5. Linkages between producers and traders	<ul style="list-style-type: none"> Conduct feasibility study in contract farming for rice Encourage utilization of rice by products such as straw, bran, and husk Pre-determined contracts between producers/producer organizations and traders
5. Institutional capacity building	5.1. Technical (research, education, on-job training, subject matter specialists, socio-economic analyses)	<ul style="list-style-type: none"> Institutional Capacity Needs Assessment Recruit and Train Institutional Staff in Specialized Areas Strengthen the capacity of Vocational School and Related Institutions
	5.2. Extension (dissemination of information, demonstration, farmer field schools)	<ul style="list-style-type: none"> Conduct Farmers' Field School Develop Extension Fact Sheets Promote (Lead) Farmers Exchange Program
	5.3. Marketing (research, training, information system)	<ul style="list-style-type: none"> Conduct Market Survey Analyses Train Farmers to Produce Quality Products Link Farmers to Market Disseminate Price Information
	5.4. Administration (policy development,	<ul style="list-style-type: none"> Develop Appropriate National Policies (Extension, Fertilizer, Labor

Strategic Component	Sub-component	Activities
	impact analyses, and advisory services)	etc.)
6. Mechanization	6.1. Appropriate machinery options for the uplands, lowlands (technical, socio-economic and environmental feasibilities)	<ul style="list-style-type: none"> • Perform cost-benefit analyses of mechanization in smallholder rice farms • Assess the feasibility and economic profitability of using draft animals farm operations and livelihoods in uplands, lowlands • Establish the use of treadle pump for irrigation in rice fields
	6.2. Human resources (training of artisans, mechanics, engineers)	<ul style="list-style-type: none"> • Training of farm groups, rural entrepreneurs (service providers), extension agents, local artisans, and mechanics • Training of trainers for representatives of local farmers • On-job training for engineers and extension officers
	6.3. Policy tools for encouraging public, private sector participation in imports of machineries and spare parts, local manufacturing	<ul style="list-style-type: none"> • Waive import tariffs, VAT and other hidden taxes/duties on importation of farm machineries • Oversee service regulations and business/dealership
	6.4. Research and Designing of locally available/suitable tools	<ul style="list-style-type: none"> • Conduct adaptive trials on appropriate tools • Introduce parboiling and other appropriate value addition in rice processing
	6.5. Testing and Standardization of machineries and implements	<ul style="list-style-type: none"> • Establish quality standards of machineries and implements being sold in the country • Identify institutions and assign responsibilities of testing and standardization procedures along the value chain • Testing of mechanization options in farmers fields
	6.6. Promotion of mechanization (extension, information, marketing, servicing)	<ul style="list-style-type: none"> • Aggressive awareness campaign amongst farmer on new technology • Organize routine workshops, radio programs, brochures (flyers/posters) and other multimedia tools for dissemination of mechanization, markets and prices

Appendix 4: Human Capacities: Number of Researchers, Technicians and Extension Workers in 2009 and the future requirements

Year	Agricultural Researchers with MA or PhD			Agriculture Technicians			Extension Workers		
	Total	Specialists with PhD	Specialists with MA	Total	Specialists with PhD	Specialists with MA	Total	Specialists (part time)	Specialists (full time)
2008	2	0	2	0	0	0	0	0	0
2009	5	1	4	6	1	5	10	5	5
2010	5	1	4	6	1	5	10	5	5
2011	7	1	6	6	1	5	10	5	5
2012	7	1	6	6	1	5	10	5	5
2013	10	2	8	6	1	5	15	5	10
2014	10	2	8	6	1	5	15	5	10
2015	10	2	8	6	1	5	15	5	10
2016	10	2	8	6	1	5	15	5	10
2017	12	2	10	6	1	5	15	5	10
2018	12	2	10	6	1	5	15	5	10
Total	90	16	74	60	10	50	130	50	80

Appendix 5: Projected seed and agrochemical requirements for Liberia under LNRDS

Item / Year	Land area (Ha)	Seed (t)	Fertilizer (t)		Insecticide (L)	Herbicide (L)
			Compound	Urea		
2008	22,000	660	4,400	2,200	22,000	22,000
2009	22,000	660	4,400	2,200	22,000	22,000
2010	27,000	810	5,400	2,750	27,000	27,000
2011	30,000	900	6,000	3,000	30,000	30,000
2012	33,000	990	6,600	3,300	33,000	33,000
2013	35,000	1,050	7,000	3,500	35,000	35,000
2014	50,000	1,500	10,000	5,000	50,000	50,000
2015	65,000	1,950	13,000	6,500	65,000	65,000
2016	80,000	2,400	16,000	8,000	80,000	80,000
2017	95,000	2,850	19,000	9,500	95,000	95,000
2018	110,000	3,300	22,000	11,000	110,000	110,000

Seed rate per hectare = 20 - 30 kg
 Fertilizer application rate per hectare = 200 kg NPK (15:15:15)
 100 kg Urea (46%N)
 Insecticide application rate per hectare = 1 liter
 Fungicide application rate per hectare = 1 liter

Appendix 6: Projected requirements for Farm mechanization in Liberia under LNRDS

Land area (ha)		30,000	50,000	110,000	
Operation	Equipment	2011	2014	2018	Total
Land preparation	Tractor	15	45	45	90
	Power-tiller	20	150	150	300
Planting/ Transplanting	Bulldozer	-	15	15	30
	Low-loader transporter	-	15	-	15
	Seed drill				
	Transplanter				
Harvesting	Thresher (1 ton/hr)		35	35	70
	Winnower		35	35	70
	Mini combine harvesters		5	10	15
	Reapers binders		20	10	30
Processing	Cement drying floor (tarpaulin)		375	375	750
	Milling station (milling machine, dryers, storage, packing, drying floor) 5 ton/hr capacity		15	15	30

Appendix 7: Priorities of rice sector in Liberia

	Policy / Institutional	Infrastructure	Human resources capacity	Provision / Support	Information / Knowledge
Seed	Sufficient	Priorities	Priorities	Insufficient	Insufficient
Fertilizer	Demand; Not addressed	Demand; Not addressed	Insufficient	Demand; Not addressed	Demand; Not addressed
Irrigation / Water management	Demand; Not addressed	Priorities	Priorities	Demand; Not addressed	Demand; Not addressed
On farm technology dissemination (E)	Demand; Not addressed	Insufficient	Priorities	Insufficient	Insufficient
Mechanization	Demand; Not addressed	Demand; Not addressed	Insufficient	Insufficient	Insufficient
Quality improvement	Demand; Not addressed	Priorities	Insufficient	Insufficient	Demand; Not addressed
Access to market	Demand; Not addressed	Insufficient	Insufficient	Demand; Not addressed	Insufficient
Access to Finance	Priorities	Insufficient	Insufficient	Insufficient	Insufficient
Overall policy tools	Insufficient	Insufficient	Priorities	Insufficient	Insufficient

Legend:

- Sufficient
- Demand; Not addressed
- Insufficient
- Priorities**

Appendix 8: Proposed governance structure for implementation of LNRDS

