REPUBLIC OF GHANA
MINISTRY OF FOOD AND AGRICULTURE

NATIONAL RICE DEVELOPMENT STRATEGY 2

(NRDS II: 2019 - 2030)

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ACKNOWLEDGEMENTS

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FOREWORD

The Coalition for African Rice Development (CARD) initiative was launched in May 2008 following the Fourth Tokyo International Conference on African Development (TICAD IV). The National Rice Development Strategy (NRDS) is an outcome of Ghana Government's subscription to the vision of the initiative to double rice production in Africa by 2018. The strategy is consistent with Economic Community of West African States Agricultural Policy/ Comprehensive Africa Agriculture Development Programme (ECOWAP/CAADP), New Partnership for Africa's Development (NEPAD), Ghana's Food and Agriculture Sector Development Policy (FASDEP) as well as its implementation plan, Medium Term Agriculture Sector Investment Plan (METASIP) which provide an integrated framework to support agricultural growth, rural development and food security. The NRDS also contributes to the Sustainable Development Goals (SDGs) 1, 2, 3, 5, 12, 13 and 17.

The Ghana National Rice Development Strategy I (G-NRDS I), which covered the period from 2008 to 2018, was a response to forestall the effects of the 2008 global food crisis. This current NRDS II has been revised accordingly due to the rapid changing dynamics in the global, regional and national trends aimed at catalyzing the growth of the local rice industry to make local rice production vibrant and competitive.

The strategy seeks to double rice production taking into consideration the comparative production capacities of the two major ecologies (rain-fed and irrigated) and growth of consumption. Over the span of 10 years (1999-2008), per capita rice consumption increased from 17.5kg to 26.0kg, which increased to about 36kg in 2016. The current per capita consumption is estimated at 45kg because of rapid population growth, consumption trends and urbanization. It is evident that the projected per capita rice consumption will increase significantly by 2030.

In developing the strategy, expertise from multi-sectorial backgrounds at the Ministry of Food and Agriculture (MoFA) and other rice sector stakeholders operating in Ghana enriched the document with valuable inputs. Major constraints such as poor land tenure arrangements and land development; poor seed quality and availability; high cost of fertilizer; inadequate human resource capacity; inadequate harvesting and post-harvest management technology; weak local rice marketing system; and the role of Government and related agencies in addressing the

constraints were identified. A governance structure comprising the key actors in the rice sector has been proposed.

Seven (7) thematic strategy areas have been identified namely: Seed System; Fertilizer Marketing, Distribution and Usage; Post-Harvest Handling and Marketing; as well as Irrigation and Water Control Investment. Others include Equipment Access and Maintenance; Research, Technology Development and Transfer; Community Mobilization, Farmer-Based Organizations and Credit Management. For each of the thematic areas, some key actions have been proposed to address major challenges. Monitoring and Evaluation implementation framework has also been developed to track progress of the various thematic areas.

The roles of government, public sector, private sector, Non-Governmental Organizations (NGOs) and other relevant stakeholders have been considered crucial for the attainment of the goals of the strategy. The strategy will go a long way to guide new initiatives in the rice industry.

Through cooperation, coordination and commitment of all rice sector stakeholders (Ministries, Departments and Agencies (MDAs), Metropolitan, Municipal and District Assemblies (MMDAs), Private Sector, including Farmers, Processors, Traders, NGOs, Traditional Rulers and Civil Society, Development Partners (DPs), among others, the strategy if well deployed would enhance balanced growth of the rice industry, create employment, increase incomes, reduce poverty and achieve food security for its people within the context of an environmentally sustainable and transformed rural economy.

HON. YAW FRIMPONG ADDO (MP)
DEPUTY MINISTER FOR FOOD AND AGRICULTURE

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ABBREVIATIONS AND ACRONYMS

AAGDS:	Accelerated Agricultural Growth and Development Strategy
AEAs:	Agricultural Extension Agents
AESD:	Agricultural Engineering Services Directorate
AfCFTA:	African Continental Free Trade Area
AFAP:	African Fertilizer and Agribusiness Partnership
AGRA:	Alliance for Green Revolution in Africa
AMSECs:	Agricultural Mechanization Services Enterprise Centres
ARI:	Agricultural Research Institute
ASN:	African Seed Network
ATVET:	Agriculture Technical Vocational Education and Training
AU:	African Union
AWD:	Alternate Wetting and Drying
BRCs:	Business Resource Centres
CAADP:	Comprehensive African Agriculture Development Programme
CARD:	Coalition for African Rice Development
CARES:	COVID-19 Alleviation and Revitalization of Enterprises Support
CARI:	Competitive African Rice Initiative
CILSS:	The Permanent Inter-State Committee for Drought Control in the Sahel
CIRAD:	The French Agricultural Research Centre for International Development
CORAF:	Conference of the Agricultural Research Leaders
CP:	CAADP Pillar
CRI:	Crop Research Institute
CRS:	Catholic Relief Services
CSIR:	Council for Scientific and Industrial Research
CSOs:	Civil Society Organizations
DACF:	District Assembly Common Fund
DAES:	Directorate of Agricultural Extension Services
DCS:	Directorate of Crop Services
DPs:	Development Partners
DVLA:	Driver and Vehicle Licensing Authority
ECOWAP:	Economic Community of West African States Agricultural Policy

ECOWAS:	Economic Community of West African States
EDAIF:	Export Trade, Agricultural and Industrial Development Fund
EGS:	Early Generation Seeds
Etc.:	Et cetera
Eg.:	Example
FAO:	Food and Agriculture Organization of the United Nations
FARA:	Forum for Agricultural Research in Africa
FASDEP:	Food and Agricultural Sector Development Policy
FBOs:	Farmer Based Organizations
FDA:	Food and Drugs Authority
FIs:	Financial Institutions
FRI:	Food Research Institute
GAIDA:	Ghana Agri-Input Dealers Association
GDP:	Gross Domestic Product
GFEP:	Ghana Fertilizer Expansion Programme
GH:	Ghana
GHP:	Good Hygiene Practice
GLDB:	Grains and Legumes Development Board
GIDA:	Ghana Irrigation Development Authority
GIPC:	Ghana Investment Promotion Centre
GIRSAL:	Ghana-Incentive-Based Risk-Sharing System for Agricultural Lending
GIZ:	German Technical Cooperation
GMOs:	Genetically Modified Organisms
GoG:	Government of Ghana
GPRS/G:	Ghana Poverty Reduction Strategy
GRATIS:	Ghana Regional Appropriate Technology Industrial Service
GRIB:	Ghana Rice Inter-professional body
GS:	Ghana Standards
GSA:	Ghana Standards Authority
GSGDA:	Ghana Shared Growth and Development Agenda
GSID:	Ghana Seed Inspection Division
GSS:	Ghana Statistical Service

G-NRDS:	Ghana National Rice Development Strategy
Ha:	Hectare
Hon.	Honourable
HRMD:	Human Resource Management and Development
ICT:	Information Communication Technology
IFC:	International Finance Corporation
IFDC:	International Centre for Fertilizer and Agricultural Development
IFJ:	Investing for Food and Jobs
IIR:	Institute of Industrial Research
ITTU:	Intermediate Technology Transfer Unit
ISO:	International Organization for Standardization
JAKF:	John Agyekum Kufuor Foundation
JICA:	Japan International Cooperation Agency
JIRCAS:	Japan International Research Center for Agricultural Sciences
Kg:	Kilogram
KR:	Kennedy Round
LI:	Legislative Instruments
Ltr;	Litre
MDAs:	Ministries, Departments and Other Agencies
MESTI:	Ministry of Environment, Science, Technology and Innovation
METASIP:	Medium Term Agriculture Sector Investment Plan
METSS:	Monitoring, Evaluation and Technical Support Services
MLGDRD:	Ministry of Local Government, Decentralization and Rural Development
MLNR:	Ministry of Lands and Natural Resources
MMDAs:	Metropolitan, Municipal and District Assemblies
MoF:	Ministry of Finance
MoFA:	Ministry of Food and Agriculture
MoJAG:	Ministry of Justice and Attorney General
MoTI:	Ministry of Trade and Industry
MRH/DFR:	Ministry of Roads and Highways/Department of Feeder Roads
MT:	Metric Tons
MTADP:	Medium Term Agricultural Development Programme

M&E:	Monitoring and Evaluation
NAFCO:	National Food Buffer Stock Company Limited
NARP:	National Agricultural Research Programme
NASTAG:	National Seed Trade Association of Ghana
NEPAD:	New Partnership for Africa's Development
NERICA:	New Rice for Africa
NGOs:	Non-Governmental Organizations
NRDS:	National Rice Development Strategy
NRLD:	National Rice Liaison Desk
NRCC:	National Rice Coordinating Committee
NVRRC:	National Variety Release and Registration Committee
N/A:	Not Available
PADS:	Participatory Adaptation and Diffusion of Technologies for Rice Based Systems in West Africa
PCUs:	Project Coordination Units
PFJ:	Planting for Food and Jobs
PLAR:	Participatory Learning and Action Oriented Research
PLWD	Persons Living With Disabilities
Pp:	Pages
PPMED:	Policy Planning Monitoring and Evaluation Directorate
PPP:	Public Private Partnership
PPRSD:	Plant Protection and Regulatory Services Directorate
RAD:	Regional Agricultural Department
REC:	Regional Economic Commission
RELCs:	Research-Extension-Farmer Linkage Committees
RICE:	Resilience, Industrialization, Competitiveness, Empowerment
RS:	Rice Strategy
RYMV:	Rice Yellow Mottle Virus
R&D:	Research and Development
SARI:	Savannah Agricultural Research Institute
SDGs:	Sustainable Development Goals
SIEM:	Strategic Intervention Element Matrix

SMEs:	Small and Medium Enterprises
SPIP:	Solar Powered Irrigation Pumps
SPIS:	Solar Powered Irrigation Systems
SRI:	Soil Research Institute
SRID:	Statistics, Research and Information Directorate
TICAD:	Tokyo International Conference on African Development
ToR:	Terms of Reference
UEMOA:	The West African Economic and Monetary Union
UG:	University of Ghana
UN:	United Nations
UNIDO:	United Nations Industrial Development
USAID:	United States Agency for International Development
USD:	United States Dollar
WAAPP:	West Africa Agricultural Productivity Programme
WBG:	World Bank Group
WECARD:	West and Central African Council for Agricultural Research and Development
WIAD:	Women in Agricultural Development Directorate
WUAs:	Water User Associations

EXECUTIVE SUMMARY

The Government of Ghana (GoG) has developed policies and plans aimed at developing the Agricultural Sector with the goal of addressing food security and poverty reduction. Prominent among these policies and plans are the Food and Agriculture Sector Development Policy (FASDEP II), and the Medium-Term Agriculture Sector Investment Plan (METASIP I & II). These are policies, which have led to an increase in agricultural production.

The rice sector development in Ghana is mainly guided by the National Rice Development Strategy (NRDS), which was formulated in 2009 and revised in 2024. This document, developed by the Ministry of Food and Agriculture (MoFA) in collaboration with the Coalition for African Rice Development (CARD), has set out strategic intervention areas which when addressed will lead to the government achieving its vision of increasing rice production by an average of 15% per annum and attaining self-sufficiency by 2028.

As a commodity-based strategy, the Ghana National Rice Development Strategy (G-NRDS II) is aimed at addressing the challenges of low agricultural production by focusing on the bottlenecks along the rice value chain, which hitherto have inhibited the growth of the rice industry.

In developing the rice sector, the following thematic areas have been critically examined and solutions proffered: these include seed system; fertilizer marketing, distribution and usage; post-harvest handling and marketing system; irrigation and water control investment; equipment access and maintenance system; research, technology development and transfer; community mobilization; farmer-based organizations and credit management system; and monitoring and evaluation.

The G-NRDS II has proposed a governance structure, which will lead to efficient intra and inter-value chain operations thus achieving the expected policy goal of attaining self-sufficiency in rice production by 2028.

1 INTRODUCTION

Rice has become an important strategic crop in the economy of Ghana and its consumption keeps increasing because of population growth, urbanization and change in consumer habits. In 2022, the total national consumption of milled rice was estimated to be 1.44 million MT, with per capita consumption of approximately 43.5 kg per annum, compared to 0.55 million MT in 2008, with a per capita consumption of 22.6 kg per annum. Domestic paddy rice production in 2022 was estimated at 1.28 million MT on an area of 382,000 ha, yielding 0.68 million MT milled rice. Net Paddy rice production in 2008 stood at 256,000 MT on an area of 133,000 ha. The increase in production from 2008 to 2022 was largely due to an approximately 187% increase in the area under cultivation and minor yield increases as indicated in Figure 1.

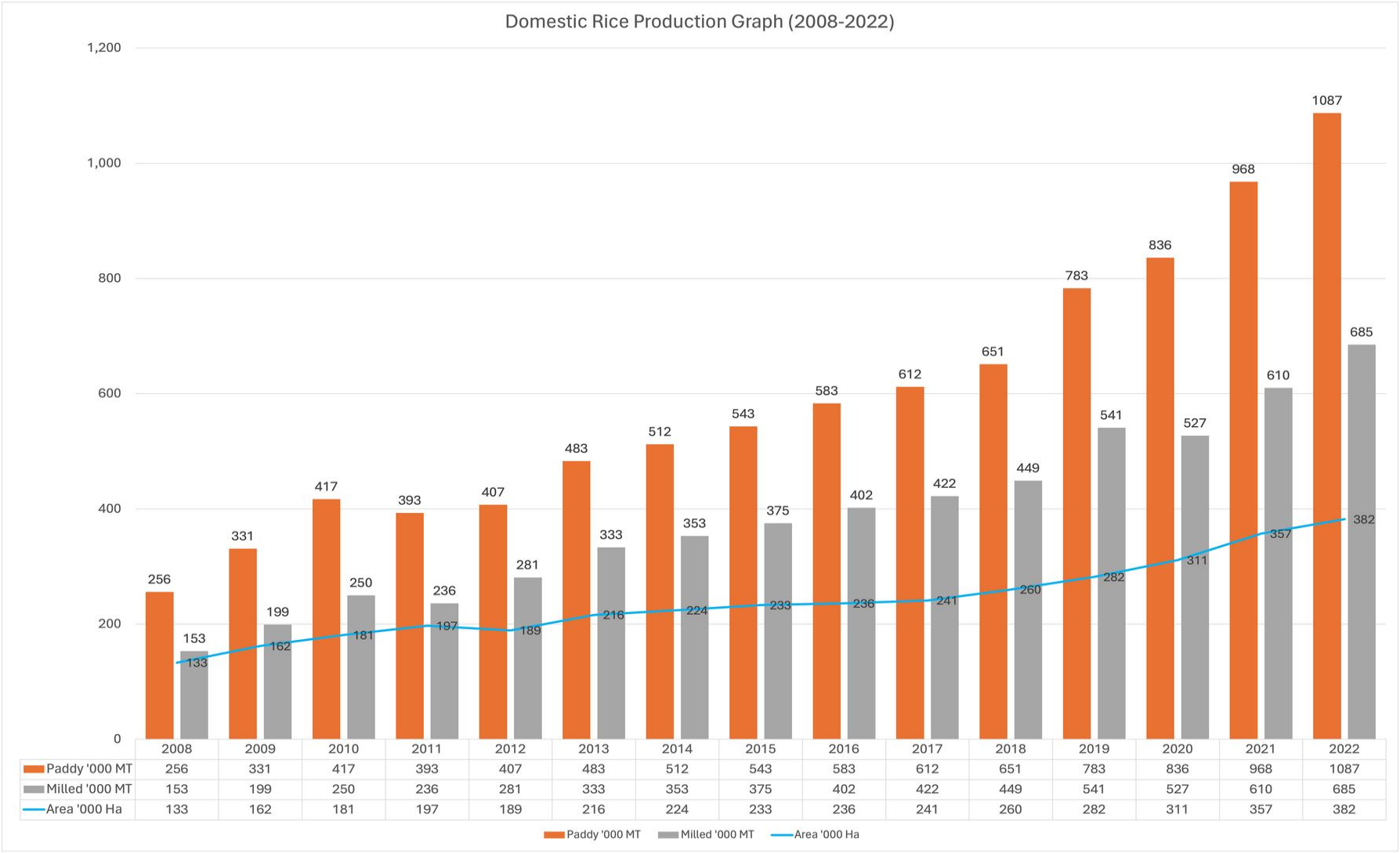
The domestic production levels of milled rice have consistently fallen short of consumption level, with the shortfall being compensated for by imports. The national objective is to achieve self-sufficiency by 2028, with a total paddy rice production of 3.31 million MT as shown in Table 1.

Table 1: Production Targets and Self Sufficiency Levels

Period	Year	Area (ha)	Yield (MT/ha)	Production (MT) (Paddy)	Available for Consumption (MT) (Paddy)	Available for Consumption (MT) (Milled)	Total Demand (MT)	Gap/Surplus (MT)	% Self Sufficiency
Baseline	2022	381,663	3.36	1,283,261	1,086,922	684,761	1,440,413	755,652	47.5
Immediate	2023	389,296	3.40	1,323,607	1,121,095	706,290	1,483,625	777,335	47.6
Short Term	2024	447,691	3.80	1,701,225	1,440,937	907,790	1,528,134	620,343	59.4
Medium Term	2025	514,844	4.00	2,059,377	1,744,293	1,133,790	1,573,978	440,188	72.0
Long Term	2026	592,071	4.20	2,486,698	2,106,233	1,369,052	1,621,197	252,146	84.4
	2027	657,199	4.60	3,023,114	2,560,578	1,664,376	1,669,833	5,458	99.7
	2028	690,059	4.80	3,312,282	2,805,503	1,823,577	1,719,928	(103,649)	106.0

(Source: MoFA, 2023)

It is important for stakeholders in the food and agriculture sector to ensure increased and sustained domestic production of good quality rice for food security, import substitution and savings in foreign exchange.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Paddy '000 MT	256	331	417	393	407	483	512	543	583	612	651	783	836	968	1087
Milled '000 MT	153	199	250	236	281	333	353	375	402	422	449	541	527	610	685
Area '000 Ha	133	162	181	197	189	216	224	233	236	241	260	282	311	357	382

Figure 1: Trends in Rice (Net Paddy) Production and Area Cultivated (2008-2022)

2 REVIEW OF THE NATIONAL RICE SECTOR

2.1 Status of Rice in National Policies

Policy strategies over the years, as captured in Food and Agricultural Sector Development Policy I (FASDEP I: 2002); Ghana Poverty Reduction Strategy I and II (GPRS I: 2003 - 2005 & II: 2006 - 2009); Medium Term Agricultural Development Programme (MTADP: 1988 - 1991); Accelerated Agricultural Growth and Development Strategy (AAGDS: 2000); and other Ministry of Food and Agriculture (MoFA) policy documents, have sought to promote rice production to address food security and poverty reduction. The Food and Agriculture Sector Development Policy (FASDEP II: 2007) contributes to the Ghana Shared Growth Development Agenda (GSGDA II: 2014 - 2017). The strategic objectives of FASDEP II fall in line with the Comprehensive African Agriculture Development Programme (CAADP) that seeks to accelerate food security in Sub-Saharan Africa. Under the FASDEP II, the policy objectives “food security and emergency preparedness” as well as “improved growth in incomes” place emphasis on rice as one of the key commodities to be promoted. Specific measures, among others, to reach the level of self-sufficiency in rice production are land acquisition and property rights, increased mechanization, enhancing access to credit and inputs, increasing access to extension services, increased cultivation of inland valleys and efficient utilization of existing irrigation systems. In addition, varietal improvement and increased seed production and utilization are to be pursued vigorously.

The FASDEP II is aligned to Medium Term National Development Policy Framework “An Agenda for Jobs: Creating Prosperity and Equal Opportunities for All” (2018 - 2021). The current implementation plan for FASDEP II is “Investing for Food and Jobs” (IFJ). The Planting for Food and Jobs (PFJ) Campaign, which is captured in the IFJ is a major driver in transforming and modernizing agriculture in Ghana. The PFJ prioritizes interventions in seed access and development; fertilizer access and fertilizer systems development; extension services; marketing; and e-agriculture. Presently, the Campaign which is in its second phase of implementation, dubbed “Planting for Food and Jobs Phase II (PFJ 2.0)” has rice as one of the focus crops. These Agricultural documents, especially FASDEP II, are largely in conformity with African Union - New Partnership for Africa’s Development - Comprehensive African Agriculture Development Programme (AU-NEPAD-CAADP) principles.

2.2 The CARD Initiative and National Rice Development Strategy

The Japan International Cooperation Agency (JICA) and the Alliance for a Green Revolution in Africa (AGRA) partnered with the New Partnership for Africa's Development (NEPAD) to launch the Coalition for African Rice Development (CARD) in 2008. The goal of the initiative is to contribute to food security and economic growth at the household, national and regional levels by doubling rice production in sub-Saharan Africa from 14 to 28 million metric tons in ten years from 2008 to 2018 (CARD Phase I) in an environmentally sustainable manner. The initiative aims to harmonize efforts of key stakeholders to develop the rice sector in sub-Saharan African countries, based on Government-identified needs in their national rice development strategies. CARD contributes to Sustainable Development Goal; SDG 2 (Zero hunger); SDG 8 (Decent work and economic growth); and SDG 17 (Partnership for the goals).

The Coalition assisted the Governments of 23 sub-Saharan African countries in formulating their national rice development strategies during CARD Phase I [Ghana developed its first National Rice Development Strategy (NRDS I) in 2009].

CARD Phase I attained its goal of doubling domestic rice production in Africa and paved the way for CARD Phase II (2019 to 2030) which was approved during the 7th CARD General Meeting in Tokyo, Japan.

CARD Phase II has a goal of doubling rice production in Sub-Saharan Africa from 28 to 56 million metric tons from 2019 to 2030. To achieve this goal, the strategy will adopt the "RICE" approach (Resilience, Industrialization, Competitiveness, and Empowerment) to help deepen the analysis of the current situation along the rice value chain and come up with most relevant priority actions and formulation as well as better monitor the progress in the implementation of the NRDS 2.

The RICE Approach is the new strategic direction adopted by CARD Phase II.

- Resilience (R): Making rice production and supply systems more stable and sustainable to cope with any kind of shocks, in particular climate change and the population increase;
- Industrialization (I): Promoting industrialization in all categories of actors along the rice value chain through working with the private sector;
- Competitiveness (C): Strengthening market competitiveness of locally produced rice in terms of accessibility, quality and price against imported rice; and
- Empowerment (E): Improving livelihood and welfare of all actors along the rice value chain through capacity building.

The strategy will also employ the Public Private Partnership (PPP) approach in line with the Ghana Public Private Partnership (PPP) Act, 2020 (Act 1039). The objectives of the PPP which seek to improve the legislative, institutional, financial, fiduciary and technical framework would be deployed to implement the NRDS II. The PPP approach positions the private sector as frontal in addressing most of the challenges facing the rice sector towards achieving self-sufficiency in rice production. See details in Annex IX.

2.3 Rice Consumer Preferences, Per Capita Consumption and Demand Projections

There is a wide variation in rice consumer preference in Ghana based on grain characteristics. However, most consumers prefer long grain perfumed rice of good taste, and good appearance with whole grains, although broken grains have their place in specific local dishes. Health-conscious consumers patronize local brown rice while parboiled rice is preferred in the five regions of Northern Ghana. Annual per capita rice consumption during 2002-2004 was 22.6kg on the average. This average increased to 43kg during 2018 - 2020. In the same period, per

capita rice consumption increased to about 3.2% per annum, higher than the population growth of 2.3% per annum.

2.4 Typology and Number of Rice Farmers

Rice production in Ghana is categorized by three agroecologies namely irrigated, rain-fed lowland and rain-fed upland. In general, the rain-fed lowland and upland systems covers about 88% and 2% of the arable area respectively while the irrigated system covers 10%.

Based on access to resources and scale of operation, rice farmers in Ghana can be categorized as shown in Table 2.

Table 2: Typology and Percentage Proportion of Rice Farmers

Type	**Main Characteristics**	**% Proportion**
Resource Poor Rice Growers	1.1 Subsistence: often female headed or elderly headed households, young farmers and persons with disability (PWD); face labour constraints; have no resources to fall on in the event of external shocks.	15%
Marginal Rice Smallholders	2.1 Could produce a small marketable surplus; may have some resources on which to fall (i.e. greater physical strength; better health; more land, small savings etc.). Significant proportion of adult household members may migrate during off-season.	25%
Viable Small Scale Rice Growers	3.1 Poor but potentially viable small-scale farmers; not necessarily factor constrained (have land and/or labor); often have assets that are used inefficiently because of lack of access to markets; poor infrastructure or weather-related risks; limited access to technologies (e.g. improved seeds). Willingness to take some risk.	40%

Emerging Commercial Rice growers	4.1 Grow rice mainly as cash crop; market oriented; could own small equipment like tractors; use improved seeds and fertilizers; may have access to irrigation facilities; and can hire additional labour.	15%
Established Commercial Ventures	5.1 Grow and process rice as cash crop. Market oriented; owns medium to sophisticated equipment like tractors, graders, seeders, combine harvesters and rice mills. Use of improved seeds, fertilizers and irrigation facilities and/or can improve land with water harvesting and regulatory structures. They can hire labour and/or engage other farmers as out-growers.	5%

2.5 Gender Dimensions of Rice Production, Processing and Marketing

Although men dominate rice production in all the ecologies, at specific locations in Ghana, women are actively involved. In the processing and marketing sectors, women are the major actors at the small to medium scale levels. Within the marketing chain, the main categories recognized are importers, wholesalers, retailers and consumers. Generally, three (3) categories of marketers are recognized:

- Wholesalers: These are rice traders operating in large shops, selling mostly in large quantities of 25 or 50 kg bags. They operate in the big cities and function as intermediaries between large scale producers/importers and retailers.

- Retailers: These are traders who procure rice from wholesalers and sell to consumers. They sell rice in bags of various sizes, as well as in bowls and tins.

- Itinerant Rice Traders: These are traders who buy mainly paddy or milled rice from rice producing communities. The paddy is assembled and milled at central points for sale to retailers. On a relatively small scale, farmers mill their paddy and sell to traders or local retailers.

Gender involvement along the rice value chain is indicated in Table 3:

Table 3: Rice Value Chain Stages and Gender

Value Chain Stage	**Description**
Production: Female - 40%; Male - 60%	▪ Generally, smallholder (2 hectares and below). ▪ Rice is a significant cash crop for many farmers. ▪ Averagely, about 50% of produce are sold. ▪ About 50% store paddy for about 6 months. ▪ 50% sell half of produce at harvest time.
Aggregation: Female - 70% Male - 30%	▪ Buy paddy from farmers. ▪ Three categories are involved (small, medium and large-scale aggregators). ▪ About 20% of the small/medium scale aggregators follow up with milling. ▪ Most large-scale aggregators have sophisticated milling facilities (packaging and branding).
Processing: Female - 70% Male - 30%	▪ Two main known types of milling technologies: - Small Engelberg mill (55% recovery rate); and - Rubber roller technology (65% recovery rate): • Mills have an intense activity during harvest period; • Besides the milling technology, know-how and post-harvest practices influence quality of milled rice e.g. parboiling.
Marketing Female – 50% Male – 50%	(a) This consists of local traders who supply consuming centres around the production areas either by • Processing it at the local milling centre (e.g. in some areas, local traders buy paddy, parboil it before milling), or. • Selling it directly to consumers or to other traders. (b) Regional traders have similar marketing functions but

	operate on larger coverage. (c) Inter- Regional Traders: • Link regions with surplus to major consuming centres. • Buy, mill and organize transportation of milled rice. • Sell milled rice to wholesalers/retailers. (d) Retailers: • May deal only with local rice or with both (local + imported)

2.6 Comparative Advantage of Domestic Rice Production, Processing and Trading

JICA (2008) reported that Ghana has over 4 million ha of unexploited rain-fed lowlands. There are also numerous water bodies suitable for irrigation across the country. Rice, as one of the country's food security crops, is cultivated in all 16 regions with majority of the labour force being the youth (60% of population - 31.1 million in 2020)[1].

Demand for rice has been increasing gradually with a per capita consumption of about 45 kg over the years. This increase is a result of population growth, urbanization, change in consumer preferences. The government with support from the private sector and Development Partners has put incentives in the rice sector (land development and rehabilitation, subsidy, machinery support etc.) which has reduced the cost of production and facilitated competitive pricing for Ghana rice to some imported rice brands from Vietnam, Thailand and United States of America. Also, women parboilers process rice that are over-dried into wholegrain and nutritious rice products. However, the negative perception of most consumers from past experiences of the poor quality of domestically produced rice among others need to change in accepting Ghana rice. The demand for rice by-products such as the bran is increasingly being used as livestock feed.

[1] Source: datacatalog.worldbank.org

Ghana is reported to have comparative advantage in the production of paddy rice over other countries in the sub-region (Assuming-Brempong, 1998). However, this advantage reduces as rice is processed and distributed, due to associated high cost of processing and transportation. By increasing rice yields, introducing standard rice mills, improving parboiling equipment, providing storage and drying facilities, it is expected that competitiveness would be enhanced. Access roads to rice producing areas and marketing centres also need to be improved.

Research has shown that the perceived poor quality of locally produced rice is a major constraint to its acceptability compared to imported rice, and hence the higher demand for imported rice over locally produced rice (Bam et al., 2013). As a result, Thai and Vietnamese rice is popular in the urban areas, where consumers are less price conscious (even though the difference in price is not big). In view of the quality gap, Amanor-Boadu (2012) has suggested that policy focus needs to shift from merely expanding rice production in the country to enhancing the quality of domestic rice with an objective of making it competitive on Ghanaian consumers' preference scale.

Imported rice has become one of the most widely consumed food grains in many African countries including Ghana. The rice crop serves as a major food security and strategic crop in many countries in the developing region of Africa, especially in sub-Saharan Africa. Cultivating rice therefore has become one of the major survival strategies for households living in communities where the crop is cultivated. With interest in the crop reaching international and continental levels, governments are encouraging more households, particularly poor rural people who are either jobless or underemployed to venture into the production and processing of the crop through various initiatives.

3 CHALLENGES AND OPPORTUNITIES IN THE RICE INDUSTRY

Ghana has a relatively long history of rice production. Despite policy interventions aimed at developing the industry, challenges and opportunities in the following key areas have been identified:

3.1 Land Tenure

The land tenure system is a constraint to rice production in Ghana because of its general effects on both access and security. The system tends to limit the size of holdings and investments towards land development, especially in the lowland rain-fed ecology. The existing land tenure system favours the men over women in some parts of the country. The country has a large rain-fed lowland ecology that is suitable for rice production but remains largely unexploited. Inventories will be taken of all the ecologies suitable for rice production. NRDS II proposes government engagement with traditional rulers and/or landowners and Metropolitan, Municipal and District Assemblies (MMDAs), Financial Institutions and Farmer Groups prior to the development of the specific ecology for long-term lease or using land as equity in the investment. Once secured, a joint public-private land investment partnership arrangement will be put in place to ensure security and sustainability in land use.

3.2 Socio-Cultural Issues

In communities where women are engaged in rice production as a major source of livelihood, development of the rice industry would improve their standards of living. It has also been found that, women are actively engaged in certain aspects of the rice value chain at the level of aggregation, processing and marketing. However, gender inequalities in land ownership, inheritance, reproductive roles, etc. prevent many women from accessing land and agricultural credit even though studies have shown that women are more credit worthy. Whilst efforts are being put in place to promote rice production, low literacy rates adversely affect technology adoption and utilization among many women and rural youth. There is the need to improve the skills of women, young people and PWDs in technology-based agriculture to enhance productivity and intensify sensitisation, awareness and community engagement on gender inclusive rice production.

3.3 Trans-boundary/Regional Issues

The Economic Community of West African States (ECOWAS) protocol allows free movement of goods and services across countries within the sub-region. As a result, there is the potential to improve trans-boundary rice trade, exchange of market information, research findings and seed varieties. The protocol could however have negative effects (e.g. Phyto-sanitary problems) on food security, if the appropriate regulatory measures are not put in place. Regulated regional varietal release systems are anticipated to ensure easy access to promising seed varieties capable of contributing to food security and poverty reduction in the sub-region. The African Continental Free Trade Area (AfCFTA) will enhance the regional seed trade.

3.4 Local Rice in Rural Poverty Reduction and Economic Growth

Among the different actors identified in the rice value chain, majority of them are smallholder male producers and women-dominated processors. Local rice production is characterized by relatively low yields and poor quality, which affect its availability, marketability and returns. However, current demand levels for rice indicates that promoting the local rice industry will enhance the output and income of the smallholder farmers, processors and traders**.** If the above issues are addressed, it will promote national economic growth.

3.5 Evidence-based Rice Research and Development (R & D) Approaches

The Research-Extension-Farmer Linkage Committees (RELCs) ensure that constraints of farmers and other actors along the rice value chain are reviewed and prioritized during annual planning meetings among researchers, MoFA staff and stakeholder representatives at the regional and district levels. Due to inadequate funding, many research interventions are not implemented while periodic reviews are not carried out at the district level. There is the need to strengthen the operation of the RELCs. Other approaches include the Participatory Adaptation and Diffusion of Technologies for Rice Based Systems in West Africa (PADS) and Participatory Learning and Action Oriented Research (PLAR) programmes that bring researchers, extension agents and farmers closer. These approaches enhance the technology transfer and diffusion processes and empower rice farmers to increase production. Under the National Agricultural Research Programme (NARP), the rain-fed lowland system was identified as a viable and sustainable option for rice production in Ghana. It is important to identify, characterize and

select suitable valleys to develop designs suitable for sustainable and cost-effective rice production.

3.6 Human and Institutional Capacities

There is inadequacy of technicians and extension staff for dissemination and use of technologies by stakeholders along the rice value chain. Technology generation and dissemination under the RELCs have been less effective and need to be strengthened in terms of staffing and logistics. Private sector institutions such as Ghana Rice Inter-professional Body (GRIB) are increasingly active in dissemination of technologies. However, there is also inadequate funds for research and other private sector institutions and organizations for their operations.

3.7 Global Issues and its effects on rice exports and imports

The Coronavirus disease (COVID-19) has triggered uncertainties over the stability of global network of rice production and supply chains. Bulk of the rice in Africa including Ghana are imported from Asia. Generally, rice production and processing in Africa and Asia involves labour intensive and operation support along the rice value chain.

Since Africa is a net importer, if the major Asian rice exporting countries suffer from lower rice production and/or introduce bans/export restrictions, or stockpile their domestic rice through purchase programs, Africa markets may be short of rice supplies. Coupled with volatility in exchange rates, such distortions in rice production and supply chains could lead to substantial hikes in domestic prices thereby impacting negatively on food security, poverty reduction and socio-economic development of several African countries including Ghana.

Nevertheless, the pandemic has created an opportunity for Ghana since the supply of imported rice has created a gap to be filled by Ghana rice. Ghana therefore needs to vigorously pursue the production of quality rice to increase its market share to sharpen its competitiveness and self-reliance.

3.8 Other Major Challenges

Some of the other major challenges facing the rice industry in Ghana include the following;

- Limited use of improved seeds, fertilizer and other inputs
- Limited irrigation infrastructure
- Low soil fertility on most of the rice fields
- Insufficient mechanized services when needed
- Limited access to credit to support activities along the value chain
- Poor feeder road networks
- Poor/limited storage infrastructure for paddy rice
- Expensive spare parts and accessories of farm machinery and equipment
- Competition with cheap rice imports
- Weak local marketing system especially the distribution systems
- Expensive packaging materials
- Expensive parboiling vessels
- High cost of borrowing (high interest rate offered by financial institutions)
- High cost of production
- Economic instability

4 PRIORITY ECOLOGIES AND APPROACH

4.1 Rice Ecologies in Terms of National Production Potential

Rice is cultivated in Ghana under two (2) main production systems namely rain-fed lowland and irrigation. The rain-fed lowland ecology is dominant, covering about 90% of the total cropped area, whereas the irrigated ecology covers about 10%. It is feasible to have a rice cropping intensity of 1.5 in the rain-fed lowland and irrigated ecologies.

4.1.1 Rain-fed Lowland Ecology

This ecology has water management problems as a result of frequent flooding from groundwater and precipitation. However, when well developed (with simple mechanized water management techniques), its yield potential can be substantially enhanced. According to a study by Assuming-Brempong (1998) and confirmed by Lancon *et al*., (2002), rain-fed lowland ecology is the most profitable for rice production provided water management and cultural practices are improved. Ghana's strategy conforms to CARD's goal, which targets this ecology for increased rice production. Suitable lowlands will be identified in various rice growing districts and developed with simple water regulatory structures to enhance rice productivity.

4.1.2 Irrigated Ecology

This ecology records the highest rice yields because the levels of technology utilization are higher when compared to rain-fed lowland and upland ecologies (e.g., improved land preparation, improved varieties, fertilizer application and weed control through water management). It may be suitable for rice-fish culture. Existing irrigation schemes will be rehabilitated and expanded where possible. Potential areas will also be identified and mapped out for development, and possible collaboration with investors.

5 VISION AND SCOPE OF NATIONAL RICE DEVELOPMENT STRATEGY II

Per capita rice consumption in Ghana has increased from 17.5kg to 26.0kg per person per year over a decade (1999 - 2008). From 2018 to 2020, the per capita rice consumption has increased to an average of 43kg per person per year. The self-sufficiency ratio of rice in Ghana had increased to about 48% in 2022. It is projected that by 2028, Ghana would be self-sufficient in domestic rice production. This is expected to contribute to food security and increased income of actors. The modalities for achieving this are guided by the following goal and objectives:

Goal:

To contribute to food security through the attainment of rice self-sufficiency for an increased income towards poverty reduction.

Objectives:

i. To create an enabling environment for private sector investment in the rice sector.
ii. To increase domestic production by 15% annually using gender responsive and productivity enhancing innovations for actors along the rice value chain.
iii. To increase the number of young people participating in rice value chain to enhance their livelihood.
iv. To research and identify technologies that are responsive to the needs of PWDs to engage in rice value chains
v. To improve quality of local rice to meet both domestic and sub-regional market standards.
vi. To build the capacity of stakeholders to enhance their operations.
vii. To establish an efficient information management system for rice.
viii. To create platforms for information sharing among rice stakeholders.

5.1 Rice Sector Projections

Projections for average rice production in the rice ecologies and human resource capacity is indicated in Table 4. Over the twelve-year period (2019 - 2030), the average yields are expected to increase from 3.14 MT/ha to 5.52 MT/ha under rain-fed ecology; as well as from 4.53 MT/ha to 8.05 MT/ha under irrigated ecology (Table 4).

Based on current production trends and government commitment to promoting domestic rice production, it is projected that, by 2028, Ghana will be self-sufficient in rice production. In 2028, it is expected that a total area of about 690,000 ha would be put under domestic rice production. This is estimated to translate into a total production of about 3,300,000 MT of paddy (about 1,800,000 MT milled rice).

Table 4: Projection Statistics on Rice from 2019 to 2030 (CARD Phase II)

Year	Domestic Production			Rain-fed lowland			Irrigated		
	Total Area ('000ha)	Yield (MT/ha)	Total Production ('000MT)	Area ('000 ha)	Yield (MT/ha)	Production ('000MT)	Area ('000 ha)	Yield (MT/ha)	Production ('000MT)
2019	282.0	3.28	925	253.8	3.14	796.9	28.2	4.53	127.7
2020	311.0	3.18	989	279.9	3.05	853.7	31.1	4.35	135.3
2021	357.0	3.20	1,143	321.3	3.06	983.2	35.7	4.47	159.6
2022	382.0	3.36	1,283	343.8	3.18	1,093.3	38.2	4.97	189.9
2023	389.0	3.40	1,324	350.1	3.20	1,120.3	38.9	5.23	203.4
2024	448.0	3.80	1,701	403.2	3.58	1,443.5	44.8	5.75	257.6
2025	515.0	4.00	2,059	463.5	3.76	1,742.8	51.5	6.14	316.2
2026	592.0	4.20	2,487	532.8	3.94	2,099.2	59.2	6.55	387.8
2027	657.0	4.60	3,023	591.3	4.30	2,542.6	65.7	7.31	480.3
2028	**690.0**	**4.80**	**3,312**	**621.0**	**4.48**	**2,782.1**	**69.0**	**7.68**	**529.9**
2029	718.0	5.00	3,588	646.2	4.70	3,037.1	71.8	7.67	550.7
2030	746.0	5.50	4,105	671.4	5.22	3,504.7	74.6	8.05	600.5

Source: MoFA, 2023.[2]

[2] * Year for the attainment of national rice self-sufficiency target

Based on the assumption of expected growth rate in rice per capita consumption, population and urbanization, Ghana's rice requirement will be in the range of 1.8 – 2.1 million MT per annum by 2030 (MoFA, 2023).

The total number of rice researchers and technicians engaged in the rice sector as of 2021, stands at 76 (researchers - 35; technicians - 41) and this number is expected to double by 2030. This would be done through collaborative effort among MoFA, CSIR and the Universities (Table 5).

Table 5: Human Capacity Targets for the Rice Sector

Year	**MSc, MPhil or PhD Scientists**			***Technicians***			***Extension Workers***		
	Total	***Full time***	***Part time***	***Total***	***Full time***	***Part time***	***Total***	***Full time***	***Part time***
2008	*48*	*28*	*20*	*24*	*15*	*9*	*2,757*	*70*	*2,687*
2018	*30*	*18*	*12*	*25*	*15*	*10*	*5,586*	*1,586*	*4,000*
*2024**	*39*	*22*	*17*	*55*	*32*	*23*	*9,486*	*4,286*	*5,200*
2030	*53*	*30*	*23*	*102*	*50*	*52*	*13,500*	*6,500*	*7,000*

Source: (MoFA, 2021; CSIR, 2021).[3] [4]

5.2 Governance of NRDS

Given the strategic importance of rice in attaining food security and import substitution, there is the need for an inter-ministerial collaboration to achieve the objectives of the NRDS II. The implementation of the strategy will be led by the National Rice Coordinating Committee (NRCC) to oversee and guide the formulation and implementation of rice related policies, programmes and projects in line with the NRDS. The NRCC will be responsible for giving policy direction with respect to emerging technical issues that require executive intervention. A Technical Working Group of the NRCC will be responsible for all rice development initiatives in-country. The National

[3] * Target not actual

[4] Data on researchers and technicians specifically for rice while data on extension workers for general extension

Rice Liaison Desk (NRLD) is expected to function as the Secretariat for the NRCC to coordinate its daily activities.

5.3 National Rice Coordinating Committee (NRCC)

5.3.1 Goal

To coordinate and create synergies among rice value chain stakeholders to boost production, processing, marketing and consumption of Ghana produced rice.

5.3.2 Objectives of NRCC

The objectives of the Committee are to:

1. Harmonize the development and implementation of rice Research and Development (R&D) programmes and projects nationwide to improve their management,
2. Develop common strategies to address challenges and explore opportunities along the rice value chain,
3. Oversee the preparation of Rice Sector Development Policy,
4. Supervise the development of an inclusive rice value chain policy,
5. Provide guidance for the implementation of the National Rice Development Strategy (NRDS) and other rice related programmes/projects,
6. Establish an up-to-date rice database, and
7. Collaborate with sub-region, regional and international organizations to enhance in-country rice sector development.

5.3.3 Proposed composition of the NRCC

The NRCC is responsible for giving policy direction with respect to emerging technical issues that require executive intervention.

A Technical Working Group is constituted to provide technical support to the NRCC and will be responsible for all rice development initiatives in-country.

The Membership of the NRCC will include the following:

Table 6: Membership of the NRCC

Hon. Deputy Minister for Food and Agriculture (Annual Crops)	Chairperson
Chief Director of Ministry of Food and Agriculture	1st Alternative Chair
Director, Directorate of Crop Services, MoFA	2nd Alternative Chair
Director, Directorate of Agricultural Extension Services, MoFA	Member
Director, Agricultural Engineering Services Directorate, MoFA	Member
Director, Policy Planning, Monitoring and Evaluation Directorate, MoFA	Member
Director, Plant Protection and Regulatory Services Directorate, MoFA	Member
Director, Statistics, Research and Information Directorate, MoFA	Member
Chief Executive, Ghana Irrigation Development Authority, GIDA	Member
Representative, Ministry of Finance, MoF	Member
Representative, Ministry of Trade and Industry, MoTI	Member
Representative, Ministry of Local Government, Decentralization and Rural Development, MLGDRD	Member
President, Ghana Rice Inter-Professional Body, GRIB	Member
CARD Focal Person	Member/Secretary
National Rice Desk Officer	Support Staff

The Technical Working Group will include the following:

Table 7: Membership of the Technical Working Group

Director, Directorate of Crop Services, MoFA	Chairperson
Representative, Directorate of Crop Services – Food Crops Unit, MoFA	Member
Representative, Directorate of Agricultural Extension Services, MoFA	Member
Representative, Agricultural Engineering Services Directorate, MoFA	Member

Representative, Plant Protection and Regulatory Services Directorate, MoFA	Member
Representative, Statistics, Research and Information Directorate, MoFA	Member
Representative, Ghana Standards Authority, GSA	Member
Representative, Food and Drugs Authority, FDA	Member
Representative, Women in Agricultural Development Directorate, WIAD	Member
Representative, Ghana Investment Promotion Centre, GIPC	Member
Representative, Ghana Irrigation Development Authority, GIDA	Member
Representative, CSIR - Crop Research Institute, CRI	Member
Representative, CSIR - Savannah Agricultural Research Institute, SARI	Member
Representative, CSIR - Soil Research Institute, SRI	Member
Representative, CSIR - Food Research Institute, FRI	Member
Representative, University of Ghana, UG	Member
Representative, Ghana Rice Inter-professional Body, GRIB	Member
Representative, National Seed Trade Association of Ghana, NASTAG	Member
Representative, Lands Commission	Member
Representative, Hopeline Institute	Member
Coordinators, On-going MoFA Rice Projects	Member
CARD Focal Person	Member/Secretary
National Rice Desk Officer	Support Staff
Development Partners	Observers

5.3.4 Operational strategy of the NRCC

The proposed operational strategy is as follows:

- An operational Secretariat (National Rice Liaison Desk) will be established,
- The Secretariat will be housed in the Directorate of Crop Services, MoFA,
- The NRCC will call for project/programme briefing meetings quarterly,
- Funding will be sourced from various partners to start up the Secretariat, and
- Directorate of Crop Services will budget to support the Secretariat.

5.3.4.1 National Rice Liaison Desk

The National Rice Liaison Desk (NRLD) serves as the Secretariat for NRCC with the following Terms of Reference (ToR):

1) To function as the Focal Point for entities who are interested in investing in the rice sector in Ghana and provide necessary information and assistance to promote investments; and
2) To closely communicate with Agricultural Sector Working Group and conduct fund matching activities with potential Development Partners as necessary.

5.3.4.1.1 Composition of NRLD

- Head, Food Crops Unit Directorate of Crop Services, MoFA as Chairperson.
- National Rice Desk Officer, DCS as Secretary.
- Head, Seed Unit, DCS - Member.
- Head, M & E, PPMED MoFA - Member.
- Representative from SRID, MoFA - Member.

5.3.5 Functions of the NRCC

The functions of the Committee are to:

a. Update Information and Coordination among Development Partners' projects/programmes,
b. Enhance overall linkages among rice sector stakeholders,
c. Provide technical support and guidance in rice production and other key areas of the rice value chain
d. Monitor the implementation of the National Rice Development Strategy, and
e. Provide technical support to financial institutions to design an inclusive rice value chain innovative financial product.

5.3.6 Management Structure of the NRCC

The organogram of the NRCC is as follows:

- The NRCC will report directly to the Honourable Minister for Food and Agriculture through the Chief Director of MoFA.
- The NRCC would have linkages with the Council for Scientific and Industrial Research (CSIR), Development Partners, Private Sector and all Project Coordination Units (PCUs) of rice projects/programmes.
- The office of the Honourable Minister for Food and Agriculture will liaise with Ministry of Finance (MoF) to discuss issues relating to funding and financing of all public-funded projects in the rice sector.

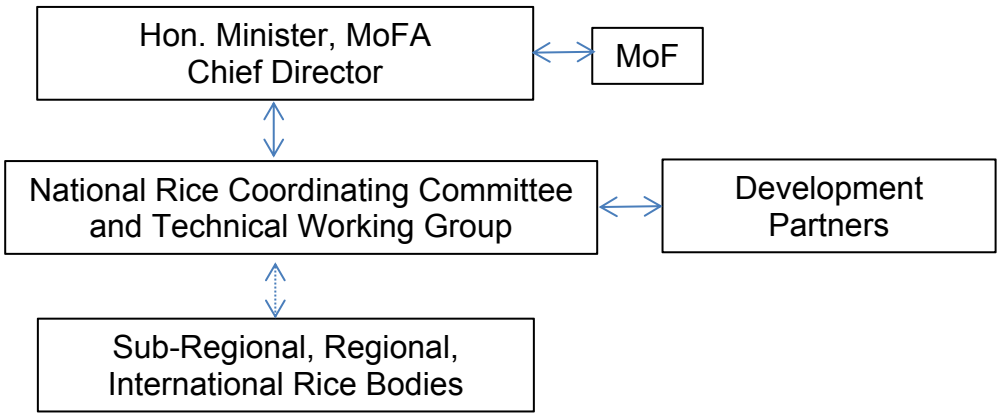


Figure 2: Organogram of the NRCC

5.4 Financial and Human Resource Commitment of Government

In accordance with the Malabo declaration 2014, which re - affirmed that every African Government is required to allocate at least 10% of national annual budget to agricultural development, it is expected that the Government of Ghana will provide counterpart support to contributions from development partners to facilitate the implementation of the strategy. It is also anticipated that, Government of Ghana (MoFA, CSIR, Universities and other allied agencies) will make available the necessary human resource to successfully implement the strategy.

5.5 National Stakeholders and Linkages to Trans-Boundary/Regional Initiatives

The Ministry of Food and Agriculture (MoFA) currently collaborates with the Universities, Council for Scientific and Industrial Research (CSIR), Non-Governmental Organizations (NGOs), Private Sector operators (farmers, processors, and traders), Ghana Rice Inter-professional Body (GRIB) and Development Partners (DPs), Ghana Standards Authority, Food and Drugs Authority, on issues bordering the rice industry. Linkages will also be strengthened with other national, sub-regional, and international programmes such as Africa Rice, International Rice Research Institute (IRRI), The French Agricultural Research Centre for International Development (CIRAD), Agricultural Research Institute (ARI), Conference of the Agricultural Research Leaders/West and Central African Council for Agricultural Research and Development (CORAF/WECARD), AfricaSeeds, National Agricultural Seed Trade Association of Ghana (NASTAG), African Seed Network (ASN), African Seed Trade Association (AfSTA**)** and Forum for Agricultural Research in Africa (FARA) for implementation of the strategy. Some of the key regional activities target collaboration on market information, germplasm exchange, seed systems management and policy review and implementation. The implementation of the strategy will seek to harmonize both on-going and pipeline programs/projects to ensure attainment of national goals, objectives and outputs in the rice sector. The Ministry of Food and Agriculture will continue to serve as the lead facilitator in the harmonization process.

5.6 Key Interventions of the Strategy

The strategy will focus on the following innovations and technologies: development of water control structures; mechanization; varietal improvement; seed production; integrated soil fertility management; harvest and post-harvest handling; value addition; and monitoring and evaluation. Institutions such as Ghana Regional Appropriate Technology Industrial Service (GRATIS) and Intermediate Technology Transfer Unit (ITTU) will collaborate with CSIR-Food Research Institute (FRI), Institute of Industrial Research (IIR) in the fabrication of production and post-production equipment for rice.

FASDEP II lays emphasis on the following areas: Improving research and extension delivery in the context of emerging innovative systems; promoting micro-finance for agricultural production; capacity building for rice stakeholders; improving inter- and intra-regional communication and collaboration; developing rice information system through ICT; improving seed supply; promoting public-private partnerships; addressing gender mainstreaming; promoting human health; ensuring sound environment management; and creation of a credible database on rice.

6 STRATEGIES FOR THE VARIOUS SUB-SECTORS

6.1 Seed System

The rice seed system in Ghana is currently dominated by the informal sector. However, in the medium to long term, the approach is to move towards the formal seed system, which is supported, by the ECOWAS-UEMOA-CILSS Seed Regulation, National Seed Policy (2013), National Seed Plan (2015), Seeds (Certification and Standards) Regulation (2018) (L.I. 2363), Plant and Fertilizer Act, 2010 (Act 803) and Plant Variety Protection Act, 2020 (Act. 1050). The part two (2) of the Plants and Fertilizer Act, 2010 (Act 803) section 31, sub-section one (1) creates the avenue for a person to import, export, produce, clean or sell rice seed in commercial quantities. However, due to the limited participation of the private sector in Early Generation Seed (EGS), i.e., breeder and foundation production, the public institutions (CSIR, Universities, GLDB) will in the short term continue to be the major facilitators and catalysts. The private sector is expected to be a major foundation seed producer in the long term. For certified seed production, out grower schemes including women, youth and PWDs will be empowered.

The Ghana Seed Inspection Division (GSID) of PPRSD, MoFA under the guidance of the National Seed Council, will continue to provide a responsive regulatory regime for the seed sector in line with the Seed Certification and Standard Regulation, 2018. There will be intensification of post certification surveillance for all rice seed classes. Digital tools will be deployed to help traceability of true seeds to reduce seed adulteration. Insurance packages should also be developed to support rice seed producers. Rice genetic resources in the country will be maintained whilst introducing new germplasm to augment existing ones.

For variety identification, modern technologies (i.e., molecular markers, modern phenotyping and digital tools) will be deployed. In the short to medium term, existing long grain and Jasmine-type (aromatic and soft-cooking) rice varieties will be promoted for adoption under suitable ecologies. In the medium to long term, breeding and

selection of suitable climate smart varieties including speciality varieties for dessert, breakfast cereals, health, etc. will be developed.

Some of the key requirements for improvement of the seed system include rehabilitation of existing and provision of new infrastructure such as irrigable rice fields, appropriate storage facilities (short and medium term), seed production, purification and processing (conditioning) equipment and market infrastructure to enhance domestic and regional markets. Additionally, the development of gender-inclusive human capacity for breeding; seed production and certification; and marketing are also to be improved. Appropriate financing arrangements including investment from Government, Development Partners, Private Sector and Financial Institutions will be required to achieve the seed needs for rice self-sufficiency. Efforts will be made to include at least 40% women, of which 10% should be youth and another 10% for PWDs in the seed industry.

Table 8: Projections for Seed Requirement

Year	Area (000 Ha)	Certified Seed (MT)	Foundation Seed (MT)	Breeder Seed (MT)
2019	282	14,100.0	282.0	7.1
2020	311	15,550.0	311.0	7.8
2021	357	17,850.0	357.0	8.6
2022	382	19,100.0	382.0	8.9
2023	389	29,175.0	875.3	14.3
2024	448	33,600.0	1,008.0	14.6
2025	515	30,900.0	741.6	13.4
2026	592	35,520.0	852.5	15.5
2027	657	32,850.0	657.0	14.8
2028	690	34,500.0	690.0	16.4
2029	718	35,900.0	718.0	17.3
2030	746	37,300.0	746.0	18.0

Source: MoFA, 2021[5]

[5] Seed rate (2023-2024 = 75 kg/ha; 2025-2026 = 60 kg/ha; 2027-2030 = 50 kg/ha)

6.1.1 Logistic Requirements for Seed System

To effectively implement this strategy, funds will be required to maintain and produce adequate quantities of all rice seed classes, build the capacities for rice seed inspection and certification as well as rehabilitate and expand existing storage facilities. Additionally, efficient distribution systems for Early Generation Seeds and certified seeds will be put in place to support the development of strategies to grow rice seed businesses (planning, capacity building, access to credit and markets). Again, an inclusive targeted financial product will be designed with a financial service provider to enhance the participation of women, youth and PWDs in seed production.

6.1.2 Proposed Actions

1. Institute a functional maintenance breeding program to maintain the genetic and physical purity of all released varieties at the research/breeding institutes.
2. Produce adequate quantities of breeder, foundation and certified seeds from released rice varieties adaptable to rice growing ecologies.
3. Build capacity for rice seed inspection and certification (at least 40% women, youth and PWDs).
4. Build, rehabilitate and expand existing seed conditioning and storage facilities.
5. Develop strategies to improve rice seed businesses targeting at least 40% women, youth and PWDs.
6. Sensitize communities including women and youth groups as well as PWDs on the need to undertake seed production as business.
7. Promote, sensitize and demonstrate to farmer groups the need to use certified seed in rice production.
8. Develop efficient irrigation systems to support seed production.
9. Mobilize and link women, PWDs and youth to certified seed out grower schemes.
10. Develop and implement seed tracking system (traceability/barcoding) to reduce seed adulteration.

Certified seed yield: 3.0 MT/ha; Foundation seed yield: 2.5 MT/ha; Breeder seed yield = 2.0 MT/ha

11. Link seed companies to national agricultural research centres to access improved rice varieties.
12. Improve quality and increase quantity of Early Generation Seed (EGS) supply by training/increasing the number of professional actors involved.
13. Allocate at least 15% of the available area at irrigation sites to seed production.
14. Upgrade the National Seed Testing Laboratory (NSTL) to meet international standard (ISTA) in rice seed quality assurance

6.2 Fertilizer Marketing, Distribution and Usage Strategy

The African Union Fertilizer Summit of 2006, in Abuja, Nigeria, called on the African Development Bank to establish fertilizer production facilities to enhance African member states' access to and affordability of fertilizers. It further encouraged member states to purchase fertilizer in bulk where the facility does not exist.

The vision of the fertilizer industry is to develop a competitive fertilizer sub-sector that ensures environmentally sustainable agricultural production through timely dissemination of adequate quantities of quality and affordable fertilizer products and information on them. The objective of the strategy is to promote a viable agro-industrial economy, integrated for sustainable environmental management and industrial growth.

In Ghana, fertilizer requirement is largely met by imports, while there is also local blending of fertilizer types by the private sector using imported active ingredients. About 35% of fertilizer requirement comes from local blending and there are plans to increase this capacity. However, the distribution of fertilizers, access and affordability by smallholder farmers remains a fundamental challenge. Low application of fertilizers coupled with declining soil fertility contribute to low rice yields. Blanket application of fertilizers (e.g., NPK 15:15:15) for rice production in the various rice growing ecologies also contributes significantly to low rice yields. It is important to maintain and improve the fertility status of soils. There is a need to conduct studies into land suitability, land use and delineation for rice-based cropping. It is important to conduct soil tests to

establish fertility status for appropriate soil amendments. Soil test must be comprehensive to include other soil analysis such as soil pathogens.

Table 9: Actual Fertilizer Usage

Year	Total Area ('000 Ha)	Total Quantity of NPK ('000 MT)	Total Quantity of Urea ('000 MT)
2019	282	85	28
2020	311	93	31
2021	357	107	36
2022	382	115	38
2023	389	117	39

Source: MoFA, 2023

Table 10: Projections for Fertilizer Requirement

Year	Total Area ('000 Ha)	Total Quantity of NPK ('000 MT)	Total Quantity of Urea ('000 MT)
2024	448	134	45
2025	515	155	52
2026	592	178	59
2027	657	197	66
2028	690	207	69
2029	718	215	72
2030	746	224	75

Source: MoFA, 2021.[6]

The NRDS II proposes to encourage the private sector participation in the blending of appropriate straight fertilizers based on the ecology, soil type and variety to be adopted by farmers. The use of organic fertilizer will be promoted for rice cultivation.

[6]Calculation is based on 6 bags (50kg/bag) of blended NPK; 2 bags (50kg/bag) of Urea per hectare (based on current research recommendations)

Incorporation of rice straw and other waste farm products into soils, as an alternative to burning crop residue, will be encouraged to minimize environmental pollution and greenhouse gas (GHS) emissions. This would add organic matter and nutrients to the soil. Crop rotation with nitrogen-fixing plants will also be pursued.

In the short to medium term, Government would continue to support farmers with recommended blended fertilizers to promote its use and pursue the establishment of a fertilizer manufacturing plant based on efforts that have been made. Other low-cost and green fertilizer production technologies such as the plasma technology would also be explored.

6.2.1 Logistic Requirements for Fertilizer Marketing, Distribution and Usage Strategy

1. Improvement of road network to rice farming communities.
2. Establishment of new storage facilities and improvement of existing storage facilities within the farming communities.
3. Partner with Universities to design digital marketing and distribution solutions for fertilizer.
4. Promote the packaging of fertilizer into appropriate smaller packages.
5. Improve quality control and testing facilities for fertilizer quality assurance.
6. Promote the use of simple soil testing kits, including testing kits for testing soil pathogens.
7. Set up a fertilizer producing plant or facility in Ghana in the long term.

6.2.2 Proposed Actions

1. Encourage continuous research into specific/appropriate fertilizer blends for rice cultivation in the various agroecologies.
2. Ensure timely production/importation of fertilizers.

3. Develop an efficient system of storage and distribution (in affordable packages) of recommended fertilizers to enhance availability and accessibility.
4. Promote timely access to fertilizer through the provision of efficient credit systems.
5. Promote the use of organic fertilizers through awareness creation, training and field demonstrations.
6. Facilitate private sector investment in fertilizer production and distribution in the medium to long term.
7. Establish fertilizer testing laboratories and operationalise fertilizer quality control framework.
8. Increase continuous gender-inclusive capacity building for farmers including women, youth and PWDs on efficient and safe fertilizer use, as well as fertilizer blending companies on good blending and handling practices.
9. Strengthen efforts to curtail smuggling of fertilizers since smuggling of fertilizers to neighbouring countries continues to remain a major challenge due to porous borders.
10. Promote the use of modern fertilizer application technologies including drones, boom sprayers for small and large-scale farming.
11. Train PWDs and young women on drone technology and operation.
12. Develop a framework for marketing and quality assurance of locally produced fertilizers. Continuous gender-inclusive capacity building of farmers including youth, women and PWDs in the right use of fertilizers and other value actors on appropriate handling, storage and blending of fertilizers.
13. Facilitate the use of ICT to disseminate information on fertilizer availability and the appropriate use.
14. Promote the use of biochar and lime in areas with high soil acidity levels.
15. Build capacity of the youth, women, and PWDs with digital marketing skills to promote locally produced fertilizers online.
16. Facilitate studies on the effects of rice production systems on greenhouse gas emissions and come up with sustainable measures.

17. Sensitise farmers on the Ghana and ECOWAS laws on pesticides and fertilizer usage.

6.3 Harvesting, Post- Harvest and Marketing Strategy

To promote and sustain profitable rice production, it is essential to minimize harvest and post-harvest losses; reduce processing and marketing costs; and improve rice quality and value mostly by women and youth for the market. The use of appropriate harvesting and threshing facilities (small to medium-scale harvesters and threshers) will be available. Harvesting of paddy should be carried out at appropriate moisture content (25-18%) to obtain quality paddy to enhance the milling recovery rate of rice grains. The provision of raised drying platforms, solar tent dryers, mechanical dryers, moisture meters and improved parboiling equipment is necessary to improve the quality of rice. Additionally, women, youth and PWD rice processors should be trained on good practices for parboiling Ghana rice using improved and PWD sensitive parboiling equipment.

Paddy rice will be processed using small to medium-scale and improved rice mills (equipped with pre-cleaners, destoners, hullers, polishers, paddy separators, aspirators, and graders including colour sorters) to meet national, regional and international standards to make Ghana rice competitive. Existing one-pass mills will be improved by adding appropriate attachments while processing centres will be equipped with storage facilities for paddy and milled rice. Silos and warehouses shall be provided with the optimum temperature and relative humidity for storage of paddy and milled rice.

Silos and warehouses should be managed by the master Aggregators and the private sector as per the arrangement under PFJ 2.0.

Good storage and warehousing Practices, Facility Licensing, including product registration, for Rice Quality and Safety shall conform to Part Seven of the Public Health Act 2012, (Act 851) of the Food and Drugs Authority. Sensitization and advocacy on the need to consume Made in Ghana rice should be enhanced through policy commitment and decisions.

Trade relationships will be strengthened to enhance the marketing of rice within the sub-region through African Continental Free Trade Area (AfCFTA) and e.g., ECOWAS Rice Observatory (ERO). Consumption of brown and parboiled rice will be promoted through awareness creation programs on its nutritional benefit to consumers. The capacity of local artisans (women, youth, PWDs) will be built to fabricate simple parts (e.g., destoners, polishers) and attachments of milling plants using local material. Actors within the post-harvest chain will be trained on proper handling, quality improvement and food safety in processing and storage of value-added rice products. To enhance preference for consumption of Ghana rice, the following marketing strategies will be adopted to enhance competitiveness: packaging, branding, promotion, and retailing in all supermarkets. Additionally, social media and e-commerce platforms will be created where consumers can easily purchase Ghana rice for doorstep delivery. Food bazaars and decentralized rice festivals at the district and regional and national levels will be organized to promote Ghana rice. Ghana rice ambassadors will be appointed in an inclusive way to drive the strategy for promotion of Ghana rice brands through mass and social media. With the vision to produce more rice, there would be the need to establish additional warehouses through government policies for milled rice at central locations of major production and consumption areas. The value chain actors will be empowered through sustained rice marketing credit lines, building capacity of marketers and processors, prioritising women, PWDs and youth, to add value to rice, thereby improving its availability and accessibility to production areas and marketing centres through appropriate haulage systems. In the light of all these, collaboration with relevant agencies, notably Department of Feeder Roads and Metropolitan, Municipal and District Assemblies for improved farm tracks and rural road networks and private transporters would be enhanced.

6.3.1 Logistic Requirements for Harvesting, Post-Harvest and Marketing Strategy

To enhance the competitiveness of Ghana rice, it is important to reduce the harvesting losses by improving accessibility to production areas, use of mechanical means such as

reapers, shellers and combine harvesters. Additionally, there is the need to improve the storage of the harvested grains by providing a cleaner, destoner, drying (provision of moisture meters for mechanical drying, sun drying and solar drying); and silos, provision of improved parboiling equipment (parboiling vessels and stoves) and milling facilities by introducing standard rice mills; upgrading existing rice mills; as well as appropriate packaging materials and sealing equipment. Furthermore, improved storage methods and storage facilities such as silos and warehouses for paddy and milled rice should be provided. Marketing and distribution centres should be equipped with modern storage facilities. A well-structured market linkage by the government (e.g., the Ghana School Feeding Program, Senior High schools feeding, prisons, hospitals, etc.) must be vigorously pursued. Expanding the capacity of the National Food Buffer Stock Company Limited to license selling centres for farmers to enable millers off-take quality paddy at a good price during peak periods.

The National Food Buffer Stock Company Limited or any suitable agency should be resourced to own a one-stop collection point in the rice growing enclaves. This should include a weighing bridge, a cleaning destoning unit, a drying unit and a silo unit. This will attract farmers to bring their produce from far and near to sell. This collection point will ensure a clean dry and quality paddy ready for milling. Rice millers will then go to these collection points to access the quality paddy to be milled.

The policy for importers to purchase certain percentage of Ghana rice should be enforced (quota system). More importers with established distribution and marketing channels would be encouraged to launch their local brands.

6.3.2 Proposed Actions

1. Enhance quality of milled rice to meet national/ISO standards through provision of appropriate machinery and enhanced capacity building in harvesting and post-harvest handling through the enforcement of the paddy/milled rice standards by Ghana Standards Authority (GSA) in collaboration with Ghana Rice Inter-Professional Body (GRIB), Food and Drugs Authority (FDA) and the local assembly. This can be achieved by

enhanced mandatory certification to the Ghana Standards for rice. Regulatory controls such as auditing and monitoring the source of paddy and milled rice should be strengthened to control re-bagging of cheap imported rice as Ghana rice.

2. Provide aggregation/marketing centres with raised drying platforms, solar tent dryers, mechanical dryers and storage facilities like silos and warehouses with optimum temperature and relative humidity for small-scale farmers in major rice producing areas.
3. Manage silos and warehouses, marketing and distribution centres conforming to good storage and warehousing practices and Good Hygiene Practices (GS 1042, GHP).
4. Promote the use of eco-friendly, biodegradable, recyclable packaging materials that preserves the freshness and quality of rice.
5. Brand and label strategy for Ghana rice should be attractive to promote the consumption of Ghana rice.
6. Decentralize Ghana rice festivals as a way of promoting its patronage.
7. Establish youth and young women's clubs in the value chains to take over from the aging men and women.
8. Strengthen the relationship among GSA, FDA, GRIB and other relevant actors to enforce the standards and certification of Ghana rice.
9. Develop a sustainable rice value chain by enhancing capacity of all actors, especially women and youth to adhere to a strict quality assurance system.
10. Strengthen GRIB to support the rice value chain actors.
11. Develop reliable market information system(s) for use by stakeholders along the rice value chain in collaboration with organisations such as Farmer line, Esoko Group, and Ghana Commodity Exchange among others.
12. Facilitate private sector linkages to financing schemes, for example, matching grants, credit lines, interest rate subsidies, etc. and entrepreneurs including youth and women within the rice production clusters along the rice value chain.

13. Facilitate the use of rice mills equipped with biomass drying facilities to use the husk to fire the furnace thereby eliminating the environmental hazard of the disposal of husks, turning the husk into briquette and biochar in replacement of charcoal, diesel or electricity. Milling centers should have appropriate drying floors/raised platforms, etc., as well as quarterly inspection of cleanliness and maintenance of storage facilities by FDA, GSA, etc.
14. Facilitate collaboration among public sector agencies with specific developmental roles in major rice producing areas to enhance access to reliable and affordable energy with good transportation network. MoFA should be collaborating with MoTI, EPA, FRI, Ministry of transport to promote quality rice production and marketing.
15. Promote the use of appropriate harvesting equipment to support farmers to enable them to undertake their operations on time.
16. Encourage the use of Ghana rice ambassadors to drive the promotion of Ghana rice brands and consumption through mass and social media. Additionally, there is the need to deliberately promote parboiled rice and its nutritional benefits in southern Ghana.
17. Train and retrain women and youth parboilers on Good Parboiling Practices to enhance the quality and competitiveness of parboiled rice.
18. Promote circular economy in the rice vale chain: use of by products to create clean energy for harvesting and post-harvest activities.
19. Encourage the production of Innovative value-added rice products
20. Create special stands of Ghana rice in supermarkets etc
21. Create a strong visual identity that reflect the uniqueness of Ghana rice through Agro tourism to invoke a sense of local heritage.

6.4 Irrigation and Water Control Investment Strategy

The total land area of Ghana is 23.9 million ha, with an agriculture land area of about 13.6 million ha, out of which 1.9 million ha have been designated as potential for water harvesting/irrigation and water control investment (MoFA 2022).

Water availability is key to food and nutrition security in this era of climate variability. Hence, more effort should be geared towards increasing rice production in rain-fed lowlands and irrigated areas. The rain-fed ecology accounts for about 90 percent of the rice cultivated area in Ghana (MoFA 2023).

It is projected that the total land area (about 448,000 ha) under rice production in 2024 would be increased to about 746,000 ha by 2030. This is to enable Ghana to meet the Coalition for African Rice Development (CARD) goal of doubling rice production in sub-Saharan Africa.

The following measures are therefore deemed paramount in achieving the above goal through the Resilience, Industrialization, Competitiveness and Empowerment (RICE) approach.

- Existing broken-down schemes would be rehabilitated and new ones such as gravity schemes, tube wells, water harvesting structures (contour bunding) developed.
- Smallholder rice farmers, including women, youth and PWDs would be supported to develop sustainable shallow ponds fitted with Solar Powered Irrigation Systems (SPIS) within valleys with high water tables for rice production.
- All Pump Irrigation Schemes, dependent on the national grid or fossil fuel, would be gradually phased out with alternative renewable energy sources such as Solar Powered Irrigation Pumps (SPIP) to reduce the over-dependence on relatively expensive and unsustainable power sources, as well as reduction in greenhouse gas emissions.
- The public and private sectors would be involved to participate in the design, construction, and development of resilient, simple and low-cost water harvesting and regulatory structures such as dykes, bunds, catchment area protection, and diversion weirs.
- Water User Associations (backed by the establishment of L.I. 2230 of 2015) consisting of irrigation farmers would be formed and empowered through consistent capacity building at all irrigation schemes to help in the sustainable

operation and maintenance of irrigation schemes, water harvesting and regulatory structures on rain-fed systems.

- There shall be a continuous capacity building or training in sustainable on-field soil and water management practices for rice production. Priority shall be given to women, PWDs and youth rice producers.
- Water measuring devices and automation of irrigation facilities would be provided to irrigation schemes for improved and precision water application as a mitigation measure to climate change. For example, alternate wetting and drying method of water control in rice fields will be deployed.
- Private investors with usufruct rights or interest in a particular scheme would be encouraged to operate nucleus and out-grower schemes to ensure dignified and fulfilling employment for indigenes, women, PWDs and youth through fair arrangements and agreements among parties.
- Subsidized tariff regimes on grid energy would be introduced to support rice farmers on irrigation schemes. This will help to reduce their high energy input costs.
- Ghana Irrigation Development Authority (GIDA) would provide design, construction supervision and management support to both public and private sectors in modern irrigation systems.
- Alternate Wetting and Drying (AWD) methods would be promoted while giving the needed tools to beneficiaries to work with. This will regulate the use of limited water resources to mitigate the effects of methane emissions and acute water shortages during the cropping period while maintaining potential yield/productivity levels.
- There shall be the establishment of sustainable irrigation systems in each potential rice district

Table 11: Total Area Projected for rice production from 2019 to 2030

Year	Total Area ('000 ha)	Rain-fed Lowland ('000 ha)	Irrigation ('000 ha)
2019	282	254	28
2020	311	280	31
2021	357	321	36
2022	382	344	38
2023	389	350	39
2024	448	403	45
2025	515	464	52
2026	592	533	59
2027	657	591	66
2028	690	621	69
2029	718	646	72
2030	746	671	75

Source: MoFA, 2021

6.4.1 Logistic Requirements for Irrigation and Water Control Investment Strategies

1. Identification and protection of land banks to facilitate the easy acquisition of land for rice production, especially for women, youth and PWD farmers.
2. Regular revenue generation opportunity, i.e., Irrigation Service Charge for the relevant management entity towards the operation, management, and maintenance of the irrigation schemes.
3. Developmental fund for long-term construction, rehabilitation, and expansion of irrigation schemes.
4. Community irrigation schemes, where Government and Development Partners (DPs) only provide intake head works and primary distribution systems to improve water delivery.

5. Affordable solar pumps and accessories, water measuring devices and spare parts through reduction of import tariffs.
6. Affordable credit for land development for both upland/lowland areas and irrigation infrastructure.
7. Requisite machinery and manpower capacity for sustainable land development.

6.4.2 Proposed Actions

1. Rehabilitate non-functional irrigation infrastructures and expand existing and functional ones to support the rice value chain.
2. Conduct environmental and social impact assessment on potential lowland, upland and irrigated areas before land development.
3. Identify, design and construct new and other improved potential irrigation schemes to help increase rice production.
4. Identify and acquire potential irrigable land to be developed by government and other development partners. This is to enable expansion in rice production through proper land acquisition arrangement by ensuring that all the legal documentations and MOUs concerning the land acquisition have been properly addressed with all the stakeholders engaged in the process. These stakeholders include the traditional authority, the landowners or paramountcy, and the affected communities.
5. Prior to the land acquisition, extensive stakeholder engagement should be carried out in the communities to ensure that all the stakeholders have agreed on the project.
6. Promote Public Private Partnership (PPP) in designing, developing, and managing all irrigation schemes.

7. Identify and map out (digitize) all potential inland valleys and lowlands for rice production.
8. Design and construct sustainable and gender friendly (including PWDs) water harvesting and regulatory structures for all identified inland valleys and lowlands for rice cultivation.
9. Promote the use of solar pumps on existing and newly designed irrigation schemes. In addition, explore other alternative and sustainable energy sources for promotion in the sector.
10. Develop the capacity of beneficiary farmers including women, youth and PWDs in the operation, management, and maintenance of Solar Powered Irrigation Systems (SPIS).
11. Form Water User Associations (WUAs) and build their capacities in the management and maintenance of irrigation infrastructure and other water control systems with at least 40% women, PWDs and youth participation
12. Capacitate women to take leadership roles and positions in WUAs management.
13. Monitor constantly the performance of WUAs and other soil and water management bodies in irrigation and rain-fed schemes and enforce the necessary regulations governing their activities to enable them to function effectively and efficiently.
14. Ensure conformity to existing regulations and guidelines (i.e., National Irrigation Policy, Strategies and Regulatory Measures 2011, L.I. 2230 of 2015, etc.) governing the activities of WUAs, nucleus and out grower schemes in rice producing areas.
15. Revise existing regulations and byelaws (L.I. 2230 of 2015) of Water User Associations in line with climate change impact mitigation and/or adaptation policies.

6.5 Equipment Access and Maintenance Strategy

To ensure that all farmers have easy and timely access to mechanization services for rice production and other activities, Government in the short to medium term shall facilitate and promote the establishment, expansion and management of privately owned Agricultural Mechanization Services Providers such as Master Agricultural Mechanization Services Enterprise Centres (Master AMSECs), District AMSECs, Anchor Farmers, Machinery Owners to supply and provide mechanization support services along the rice value chain to farmers at a fee. The Master AMSECs will be engaged in the importation and supply of machinery and equipment while the District AMSECs will be engaged in the provision of mechanised services to farmers.

The strategy shall be pursued by providing incentives such as targeted subsidies and matching grants to private entrepreneurs/AMSECs to own agricultural machinery and equipment for hiring out services to farmers. Additionally, during the short to medium term, the Government through bilateral agreements with Development Partners shall facilitate the procurement of a gender-responsive and disability friendly machinery and equipment. This shall include simple to complex machinery/equipment to improve easy and timely access to machinery and equipment services under concessional terms. This machinery and equipment to be imported shall include power tillers and accessories; tractor drawn implements such as rotovators, laser land levellers, transplanters, seed drills, spreaders and boom sprayers. Others include drones, combine harvesters, and rice reapers. The post-harvest machinery will include rice threshers, parboiling equipment, dryers, storage facilities (silos), modern/upgraded rice mills and accessories to enhance milling recovery and quality. The importation of these equipment and machinery should fit the Ghanaian ecosystem with the necessary backup spares for maintenance and requisite skills to operate and manage them.

Machinery operators, farmers' and Agricultural Extension Agents' (AEAs) knowledge on the selection, and use of modern and efficient mechanization options shall be enhanced. This will be done through on-farm demonstrations and trial of agricultural machinery such as rotovators, boom sprayers, transplanters, seeders and spreaders, rice reapers,

rice mills, etc. to ensure that the agricultural mechanization entrepreneurs (i.e. AMSECs, Anchors farmers, Individual Owners) have the requisite capacities to manage and operate the centres efficiently and profitably. The skills and technical know-how of these entrepreneurs and machinery operators will be developed and upgraded through training in areas of business and financial management, machinery maintenance and handling among others at well-resourced training centres such as Adidome and Wenchi Farm Mechanization Training Centers. The entrepreneurs shall be encouraged to employ certified and licensed machinery operators and technicians for the operation and maintenance of their machinery and equipment. Besides local mechanics and technicians operating in communities, interested people including women, PWDs and youth shall be identified, trained and resourced with mobile vans and requisite tools by the local agents and suppliers of machinery to provide repair and maintenance services.

In the medium to long term, the skills of local artisans and fabricators shall be developed through a series of training and mentoring programmes to design and fabricate simple, gender-responsive, and efficient on-farm implements, spare parts and processing equipment to support rice farmers in the local communities. This shall be pursued through facilitating the local assembly of equipment in Ghana as well as the award of contracts to local artisans and fabricators to manufacture simple standard designs such as trailers, threshers, and seed drills. In the long term, the Government shall facilitate the establishment of machinery assembly plant(s) to promote local assembly of knockdown imported rice machinery and equipment for the rice sub-sector. Additionally, the Government shall provide incentives to local businesses and women-led and/or women owned enterprises to import fast-moving spare parts to ensure that mechanization service providers have timely access to parts to maintain their machinery and equipment.

For the efficient utilization of farm machinery and equipment, farmlands must be conducive and free from obstacles such as tree stumps, shrubs, and boulders. As a result, the Government shall prioritize the proper development of farmlands through the efficient and sustainable use of heavy-duty equipment such as bulldozers, backhoe,

stump shredders, etc. In prioritizing land development, the skill capacities of bulldozer operators and contractors shall be built to avoid the destruction of topsoil, reduce compaction and prevent excessive damage to the vegetation.

6.5.1 Logistic Requirements for Equipment Access and Maintenance Strategy

To implement the above strategy, there shall be the need to build the capacity of communities, Agricultural Extension Agents (AEAs), machinery operators, mechanics, farmers including women, PWDs and youth, and entrepreneurs to access, operate and maintain rice production and processing machinery and equipment. At the production stage, equipment such as power tillers with accessories, tractors with implements, seed drills, spreaders, transplanters, boom sprayers, drones, combine harvesters and reapers, shall be made available and adequately maintained under a private sector-led and market-driven approach (AMSECs). Similarly, processing equipment such as rice threshers and winnowers; dryers; drying floors and tarpaulins; storage facilities (silos); rice mills with colour sorters; destoners, graders and packaging equipment will be made easily accessible.

6.5.2 Proposed Actions

1. Facilitate the importation of gender-responsive small, medium and large-scale agricultural machinery/equipment for land development and seedbed preparation, planting, crop maintenance, harvesting, threshing, storage and primary processing through PPP arrangement (existing local entrepreneurs and suppliers - AMSECs).
2. Facilitate the linkages between Master AMSECs and District AMSECs to provide mechanized services to farmers (at least 40% women, PWDs and youth inclusion).
3. Promote the use of digital platforms to collate demand and supply as well as monitor the operation and maintenance of machinery and equipment.

4. Provide regulatory framework on after-sales services and support through tax incentives, reliefs and credit facilities for the importation of agricultural spare and component parts.
5. Strengthen the collaboration with Agricultural Technical Vocational Education and Training (ATVET), Vocational and Technical institutions and the private sector especially women and youth in building capacity to locally fabricate or assemble appropriate agricultural machinery to standard (trailers, threshers, harvesters, seed drills, rotary hoes, etc.). Women, PWDs and youth fabricators would be identified and encouraged to participate.
6. Promote access to finance for the procurement of tools and equipment for local fabricators and artisans.
7. Facilitate the setting up of agricultural machinery and equipment training centres to provide training, certification and licensing on management, operation, and maintenance of agricultural machinery and equipment to machinery operators especially women, PWDs and youth.
8. Collate and maintain an up-to-date database on the demand and supply for agricultural equipment/mechanization services.
9. Intensify the Government's support for appropriate land development through a PPP arrangement/District Road Improvement Programme (DRIP), etc.
10. Build capacity of heavy-duty equipment (bulldozer) operators and contractors on proper farmland development.
11. Promote matching grants to interested entrepreneurs/start-ups especially PWDs and youth-led and/or owned to acquire modern and suitable machines for seeding, mechanised nursery and transplanting (where applicable), harvesting and storage to establish more mechanization service centres (AMSECs) and leasing schemes, with adequate backup of parts.
12. Encourage anchor farmers to provide mechanized services to other farmers (at least 40% women, PWDs and youth).
13. Encourage the existing agricultural machinery service providers' associations to form a national apex body to play an advocacy role.

14. Provide matching grants to local mechanics to set up well-resourced maintenance/repair workshops and garages at strategic locations including mobile service workshops.
15. Promote the use of conservational, i.e., minimum tillage, environmentally and gender-friendly agricultural machinery and equipment.
16. Build capacity of at least 40% young women and PWDs in research and development of agricultural machinery and equipment for the rice value chain.
17. NRDS II shall be aligned to existing agricultural engineering policy and strategy with intra-sector policies.

6.6 Research, Technology Development and Transfer Strategy

Research, technology development and transfer of technologies should be aggressively pursued to support the continuous improvement of the rice industry in Ghana. Technologies will be developed for all the relevant areas along the value chain including breeding, production (Seed and grain production), post-harvest activities and marketing of Ghana rice.

Research should focus on genetic resource conservation and use, development/ adoption of market-driven and climate-smart varieties (i.e., tolerant to biotic and abiotic stresses), production of Early Generation Seed (EGS) and maintenance of rice varieties. Additionally, research into rice agronomy including soil health, soil fertility management, water management, pest and diseases management; mechanization of activities along the value chain; harvest and post-harvest handling; and processing technology would be pursued. Issues with grain quality including grain appearance, cooking quality, taste, nutrition, aroma etc. and market research will also be prioritised and covered. The general policy environment should also be continuously studied to advise the government on policy and developmental issues.

Transfer of the technologies developed through research will be carried out in line with the National Agricultural Extension Policy. The Research-Extension-Farmer Linkage Committees (RELCs) will ensure that constraints of men and women and PWD farmers

and other actors along the value chain are reviewed and prioritized during annual planning meetings among researchers, MoFA staff, farmers and other stakeholders. The RELCs will continue to facilitate the exchange of technology and information among researchers, extension officers and farmers. Researchers will develop protocols for the technologies generated while Extension Officers will further develop this information into dissemination-friendly formats. The technologies will be disseminated by Agricultural Extension Agents (AEAs) through both conventional and participatory extension approaches including on-farm demonstrations, training manuals, videos, fact sheets, posters etc., and e-extension.

Training and re-training of the required human resource as indicated in Table 4 will be done to ensure efficient technology development and dissemination. Priority will be given to young women, PWDs and youth in the recruitment and training of the required human resources.

6.6.1 Logistic Requirements for Research, Technology Development and Transfer

The Government and the Private Sector should commit to support research and extension. All efforts should be made for plant breeders/breeding institutions to benefit from the Plant Variety Protection Act 2020 (Act 1050). Research and Extension should be provided with adequate equipment, infrastructure and consistent capacity building programs to make them more effective. Funds and the needed expertise will be provided to support the development and dissemination of technologies and their commercialization. The National Seed Council should look for support to fund the activities of the National Variety Release and Registration Committee (NVRRC).

6.6.2 Proposed Actions

1. Increase genetic gains on farmers' fields by developing high-yielding consumer-preferred rice varieties that are climate-smart and gender-responsive. Major

biotic stresses that should be bred for include: Rice Yellow Mottle Virus (RYMV), blast, brown spot and false smut diseases. Major abiotic stresses that will be bred for include drought stress and submergence tolerance, nitrogen-use efficiency, and tolerance to anaerobic germination for direct seeding to reduce poor germination in lowland and flood-prone environments. There should be an elaborate IPM strategy for pest control in rice.

2. Promote inclusive climate-smart agronomic technologies to increase yields and bridge the yield gaps between researchers and farmers' fields. Research into water management such as alternate wetting and drying, water control structures (Field bunding, levelling, flood control embankments), site-specific nutrient management and other soil health technologies etc.
3. Establish a unit within one of the current CSIR institutions dedicated to research and development of robust, user and gender-friendly and affordable machinery adapted to the rice ecologies in Ghana.
4. Research and technology development into value-added new products from rice and rice by-products.
5. Research into post-harvest management, milling, packaging, branding and marketing of Ghana rice to make it more competitive.
6. Develop a funding mechanism that supports rice research.
7. Train and re-train rice scientists, technicians, extension workers, seed producers and farmers with a special focus on women and youth to improve their capacities.
8. Provide state-of-the-art equipment and infrastructure such as laboratories, research fields, cold rooms, and screen houses for rice research.
9. Strengthen commercialization units of research institutions/universities to promote their technologies and products.
10. Strengthen Research-Extension-Farmer Linkage Committees (RELCs) to better respond to the needs of farmers (especially women and PWDs) and implement evidence-based research based on RELCs reports.
11. Create active dialogue platforms for research, private companies and other stakeholders along the rice value chain to address the needs of the industry.

12. Use modern and participatory extension methods to promote relevant rice technologies to all farmers and other stakeholders in the rice industry.

6.7 Community Mobilization, Farmer Based Organizations and Credit Management Strategy

Community mobilization and Extension advisory services in Ghana are generally pluralistic. Given the nature of the rice industry, the key actors (i.e., smallholder, medium and large-scale producers, processors, traders, input dealers, mechanization service providers) must be mobilized and animated into cohesive and well-functioning inclusive groups by both the public and private sectors within the National Agricultural Extension Policy. This will increase their resilience, voice for collective action and ability to access more resources. Farmer-to-farmer and other extension methods will be promoted towards shared knowledge from participatory technology transfer approaches to speed up the dissemination process. As stipulated in the National Agricultural Extension Policy (2002), MoFA and other promotion agencies will empower farmers through the formation and development of Farmer Based Organisations (FBOs) including marketing and agro-processing associations and co-operatives in collaboration with the Department of Co-operatives and other relevant regulatory agencies. The strategy will promote the linkage of farmers/FBOs to credit sources and ensure easy and equitable access to inputs, equipment and market. Furthermore, emerging trends in commodity-based clusters such as in-and-out grower schemes, and the commodity value chain clusters along with other approaches are gaining traction for stakeholder mobilization, access to input credit schemes and technology dissemination and uptake. These approaches will be pursued.

Training of FBOs in digital innovations, enterprise development, value additions, produce and products utilization, environmental and social management systems (climate-smart technologies), marketing and effective management of credit will be pursued both at projects and mainstream extension services to address the elements of Industrialization and Competitiveness as part of implementing the RICE Approach. The

formation of value chain organizations into an umbrella organization, preferably GRIB, at district, regional and national levels, will be encouraged as part of granting them an industrial status.

Sustainable agricultural financing models should take care of credit, warehouse receipt system, and insurance. Currently, agricultural credit management schemes comprise ongoing agricultural projects, financial institutions, traditional banks, credit unions and microfinance. Towards attaining self-sufficiency in rice production in Ghana by 2028, PPP is being pursued as one of the cardinal pathways in addressing the limited and high cost of credit. This pathway will pursue affordable (low-cost), viable and accessible credit management schemes as part of project mainstream strategies. To make agriculture financing competitive and sustainable, the private sector would be attracted to invest in viable business model while the public sector focuses on direct investment (high capital investments).

As part of community mobilization, the strategy will promote the engagement of women, youth and Persons with Disabilities (PWDs) in the rice value chain for employment and income generation. In implementing the strategy, specific gender-related issues/needs along the rice value chain will also be identified and addressed.

Credit Management Scheme: [7]Access to financing is vital for the growth of the agricultural sector in Ghana, mainly for working capital such as acquiring inputs (Seeds/seedlings, fertilizers, etc), hiring labour, and for fixed capital acquisition such as machinery and land. The limited access to financial products, slowdown expansion of farm size, impedes agricultural growth with consequences for the macro economy. In Ghana, the financial sector players involved in agricultural financing include commercial banks, rural banks, savings and loans companies, microfinance institutions and insurance companies as well as Village Savings and Loans Associations (VSLA).

[7] Alliance for Financial Inclusion

According to the Global Findex Database for 2021, the share of adults making or receiving digital payments in developing economies grew from 35% in 2014 to 57% in 2021 outpacing growth in account ownership. Among the economies experiencing significant growth since 2017 are Brazil, Ghana, Morocco, and South Africa, each of which has seen double-digit growth in account ownership.

The 2021 data reflect continued global leadership by Sub-Saharan Africa in mobile money account ownership, with 33 percent of adults in the region having a mobile money account, compared with 10 percent of adults globally.

6.7.1 Logistic Requirements for FBOs and Credit Management Strategy

1. Identify sources of credit for farmers, processors including parboilers and traders (e.g. Multilateral, bilateral, Development Projects, Agricultural Sector Projects, FIs, FBOs, and informal sources).
2. Equip stakeholders with relevant logistics.
3. Training support for rice value chain actors by government, private sector and Non-Governmental Organisations (NGOs).
4. Encourage other alternative and gender-responsive extension approaches in the dissemination of technologies (e.g., e-extension, farmer-to-farmer, Agriculture-As-A-Business, etc.).
5. Capacitate farmers with financial literacy to understand credit requirements, and to enable them to make informed decisions with their creditors.
6. A regulation to channel central government import levies (at least 25% per annum) on rice into a fund for the formation and strengthening of the rice industry including investments, capacity building of value chain actors and extension service providers and increasing production and quality. A regulation for allocation of a part of the District Assembly Common Fund (DACF) as a revolving fund for enterprise-based District FBOs.

6.7.2 Proposed Actions

1. Map out and document rice value chain actors at the district, regional and national levels that specify the needs of gender inclusiveness, PWDs, youth and social groups.
2. Promote data collection using innovative data collection systems including digital platforms to collect information along the rice value chain including data on agricultural credit. This will contribute to derisking agricultural financing.
3. Provide appropriate training in collaboration with the private sector based on needs assessment for all actors along the rice value chain.
4. Strengthen new and existing farmer organizations to work as enterprises. These include bookkeeping, access to credit, mechanization services quality standards and effective management.
5. Strengthen value chain associations to promote and advocate the consumption of Ghana rice through food fairs, media engagements and policy briefs.
6. Link key value chain actors to reliable and sustainable markets such as input suppliers, marketing outlets, state institutions, regional markets and funding options (PPP models).
7. Strengthen the continuous dialogues with the regional and district offices for dissemination of information on rice varieties.
8. Additional Alternate livelihoods development for farmers and FBOs to promote income diversification using rice products and by-products.
9. Create an enabling environment to attract public-private investment in infrastructural development and tailored financial products.
10. Clarify roles and responsibilities in PPP arrangements to support opportunities for value chain actors.
11. Implement a responsive agricultural insurance scheme to reduce risk associated with climate change and fire outbreaks, diseases and pests, post-harvest losses etc. to attract marginal groups into the rice value chain.
12. Intensify functional gender-responsive literacy programmes among FBOs.

13. Strengthen the linkage between FBOs and Business Resources Centres (BRCs) and other relevant institutions.
14. Collaborate with the Ghana Incentive-Based Risk Sharing Agricultural Lending System (GIRSAL), Development Bank Ghana, Exim Bank etc. to guarantee credit.
15. Continuous engagement among MoFA, GRIB and other relevant stakeholders to set annual targets on production, and certified seed uptake etc. for the rice sector.
16. Develop the capacity of female-owned and PWDs owned agribusinesses on financial management system.
17. Develop the capacity of female and PWD owned or led businesses to be credit ready.
18. Facilitate the design and development of an innovative and inclusive finance products with financial service providers to support value chain actors.
19. Facilitate a platform where women, youth and PWDs can engage for partnership, learn and share experiences for improved livelihoods in rice value chains.

6.8 Monitoring and Evaluation Strategy

To track the progress of implementation of the strategy, this Monitoring and Evaluation (M&E) framework will be used as a guide. Indicators to measure achievement of set objectives are indicated in Table 10. Monitoring the implementation of the strategy will be conducted quarterly, annually, mid-term and end of the implementation period. Monitoring and evaluation will be conducted at the various implementation levels and supervised by the Directorate of Crop Services.

Table 12: Monitoring & Evaluation framework

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
Impact	Self-sufficiency rate of local rice produced	**%**	Coverage rate of rice needs by local production	2019	37.0%	106%	Annually	SRID	National, Regional and District
	Share of local rice in the market	**%**	Share of locally produced rice compared with total quantity of rice procured by major retail stores	2019	N/A	85	Annually	DCS, SRID	National, Regional and District
Seed System	**Strategic objective: Increase seed production (breeder, foundation and certified seed) by 30% annually from released rice varieties adaptable to rice growing ecologies**								
	Percentage change in area under seed production (Foundation, Breeder & certified)	**%**	Area under seed production (Foundation, Breeder & certified) as a proportion of total cultivated land area by 100 ***{(Current area – Previous area)/Previous area) *100}***	2019*	8.5	5.0	Annually	DCS, GSID, Research	National, Regional and District
	Area under breeder seed production	Ha	Total area of breeder seeds cultivated measured in hectares	2019	3.6	8.4	Annually	DCS, GSID, Research, Universities	National, Regional and District
	Area under foundation seed production	Ha	Total area of foundation seeds cultivated measured in hectares	2019	112.8	266.8	Annually	DCS, GSID, Research	National, Regional and District
	Area under Certified Seed production	Ha	Total area of certified seeds cultivated measured in hectares	2019	3,294.20	11,115.40	Annually	DCS, GSID, Research	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Percentage Change in quantity of seeds produced (Foundation, Breeder & certified)	***%***	Total quantity of seeds produced (Foundation, Breeder & certified) as a proportion of total seeds used by farmers multiplied by 100	2019	8.5	5.0	Annually	DCS, GSID, Research	National, Regional and District
	Quantity of resilient variety seeds	MT	Quantity of seeds of locally preferred varieties with resilient characteristics, locally produced and/or imported annually	2019	8,353.80 MT:AGRA-7518.42 Amankwatia - 417.69 Gbewaa-250.61 Legon Rice 1-167	32,550 MT	Annually	GSID	National, Regional and District
	Quantity of high yielding variety seeds	MT	. Quantity (Tons) of seeds of locally preferred varieties with high-yielding attributes, locally produced and/or imported annually	2019	8,354.13 MT AGRA-7518.42Amankwatia-417.69 Gbewaa-250.61 Legon Rice 1- 167.08 Others= 0.3286	32,550 MT MT	Annually	GSIDPPRSD, Head Office, Accra	National, Regional and District
	Quantity of breeder seeds produced by variety	MT	Total quantity of breeder seeds produced by variety	2019	7.1	16.7	Annually	DCS, GSID, Research, Universities	National, Regional and District
	Quantity of foundation Seeds produced by	MT	Total quantity of foundation seeds produced by variety	2019	282	666.9	Annually	DCS, GSID, Research	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	variety								
	Quantity of certified Seed produced by variety	MT	Total quantity of certified seeds produced by variety	2019	14,100	33,346.30	Annually	DCS, GSID, Research	National, Regional and District
	Number of rice seed inspectors trained by gender	Number	Count of rice seed inspectors trained by gender	2019	N/A	200	Quarterly and annually	PPRSD and DCS	National, Regional and District
	Strategic Objective: Construct, rehabilitate and expand existing storage facilities for seed								
	Number of cold storage facilities rehabilitated for rice seeds	Number	Count of cold storage facilities rehabilitated	2019	4	8	Annually	PPRSD, AESD, GLDB and DCS	National, Regional and District
	Total Capacity of rehabilitated cold storage facilities for rice seeds	MT	Total capacity of rehabilitated cold storage facilities	2019	N/A	5,000	Annually	PPRSD, AESD, GLDB and DCS	National, Regional and District
	Number of cold storage facilities constructed for rice seeds	Number	Count of storage facilities constructed	2019	N/A	5	2030	AESD	National, Regional and District
	Total Capacity of constructed cold storage facilities for rice seeds	MT	Total capacity of constructed cold storage facilities	2019	N/A	3,000	2030	AESD	National
	Number of warehouses rehabilitated for rice seeds	Number	Count of warehouses rehabilitated	2019	N/A	10	Annually	PPRSD, AESD, GLDB and DCS	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Total capacity of rehabilitated warehouses for rice seeds	MT	Total capacity of rehabilitated warehouses	2019	N/A	10,000	Annually	PPRSD, AESD, GLDB and DCS	National, Regional and District
	Number of warehouses constructed for rice seeds	Number	Count of warehouses constructed	2019	N/A	20	Annually	AESD	National, Regional and District
	Total capacity of constructed warehouses for rice seeds	MT	Total capacity of constructed warehouses	2019	N/A	20,000	Annually	AESD	National
	Strategic Objective: Increase rice production								
	Quantity of rice seeds produced	***MT***	Total quantity of rice seeds produced	2019	14,381.10	34,029.90	Annually	PPRSD, SRID and DCS	National, Regional and District
	Productivity /Yield	***MT/HA***	Production of rice per unit area of land cultivated	2019	3.28	4.80	Annually	SRID and DCS	National, Regional and District
	Strategic Objective: Sensitize farmer groups on the need to use certified seed to maintain the purity of the rice crop								
	Percentage of farmers using certified seeds	*%*	Number of farmers using certified seeds as proportion of total number of farmers multiplied by 100	2019	46.4	70.1	Annually	PPRSD and DCS	National, Regional and District
	Number of farmers trained on the importance of certified seeds usage	Number	Count of male, PWDs and female farmers trained on the importance of certified seed usage	2019	65,440	236,270	Quarterly	PPRSD	Sex, youth and PLWD
	Number of trainings organized for FBOs	Number	Count of total trainings organized for FBOs	2019	N/A	*20*	Quarterly	DAES	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of male, PWDs and female seed growers trained on GAPS	Number	Count of total male, PWDs and female seed growers trained on GAPs	2019	N/A	*300*	Quarterly	PPRSD	Sex, youth and PLWD
	Number of irrigation systems developed to support seed production	Number	Count of irrigation systems developed to support seed production	2019	N/A	4	2030	GIDA	National, Regional and District
	Number of smallholder farmers trained on Good Agronomic Practices for rice	Number	Percentage (%) of smallholder in pre-selected farmers' groups/associations regularly accessing necessary technical training (in rice producing areas)	2023	92.93%	100%	Annually	DCS	National, Regional and District
	Number of smallholder farmers accessing mechanization services	Number	Percentage (%) of smallholder in pre-selected farmers' groups/associations regularly accessing necessary mechanization services (in rice producing areas)	2019	N/A		Annually	AESD	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Percentage area of land at irrigation site allocated for seed production	***%***	Irrigated land area under seed production as a proportion of total irrigated land area by 100	2019	1.22%	10	2030	GIDA	
	Strategic Objective: Develop an efficient system of distributing breeder, foundation and certified seeds								
	Number of seed distribution outlets established	Number	Count of seed distribution outlets	2019	N/A	150	Quarterly and annually	PPRSD	District, Regional, and National
	Number of institutions distributing breeder seeds by type	Number	Count of institutions distributing breeder seeds	2019	3	4	Quarterly and annually	PPRSD	National, Regional and District
	Number of total foundation seed distribution outlet (a)	Number	Count of total foundation seed distribution outlets	2019	6	7	Quarterly and annually	PPRSD, NASTAG, DCS and Research Institutions	National, Regional and District
	Quantity of breeder seeds utilised by foundation seed producers	MT	Total quantity of breeder seeds utilized by foundation seed producers	2019	7.1	16.7	Annually	PPRSD, NASTAG, DCS and Research Institutions	National, Regional and District
	Quantity of foundation seeds utilised by certified seed producers	MT	Total quantity of foundation seeds utilized by certified seed producers	2019	282	666.9	Annually	PPRSD, NASTAG, DCS and Research Institutions	National, Regional and District
	Strategic Objective: Develop strategies to grow rice seed business								

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of businesses identified within the rice seed value chain	Number	Count of identified businesses within the rice seed value chain	2019	N/A	100	Quarterly	Ghana Enterprises Agency and PPRSD	National, Regional, District
	Number of business concepts/proposals developed	Number	Count of business concepts/proposals developed	2019	5	10	Annually	DCS	National
Fertilizer Marketing, Distribution and Usage	**Strategic Objective: Formulate the appropriate fertilizers for rice cultivation in the different ecological zones**								
	Number of fertilizer formulations approved for rice production in the agroecological zones	Number	Count of fertilizer formulations approved for rice production in the agroecological zones	2019	5	8	Annually	SRI, DCS and PPRSD	National, Regional and District
	Number of rice production demonstrations conducted on fertilizer use	Number	Count of rice fertilizer use demonstrations carried out for farmers	2019	50	250	Quarterly and annually	DAES, DCS and SRI	Regional and District
	Number of participants in rice production demonstration	Number	Count of the total farmers by gender who participated	2019	2,500	12,500	Quarterly and annually	Research, DCS and DAES	Sex, youth and PLWD
	Quantity of fertilizer imported	Ltr/MT	Total fertilizer imported to be utilized by farmers in Ghana	2019	113,000	267,000	Annually	DCS, PPRSD, IFDC, GSS and SRID	National, Regional and District
	Quantity of fertilizer distributed	Ltr/MT	Total quantity of fertilizer distributed to male PWD and female farmers	2019	113,000	267,000	Annually	GAIDA, DCS, PPMED and SRID	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Quantity of fertilizers used by rice farmers	Ltr/MT	Total quantity of fertilizer utilized by male and female farmers	2019	113,000	267,000	Annually	DAES, DCS, PPMED, SRID and IFDC	National, Regional and District
	Number of fertilizer storage facilities constructed	Number	Count of fertilizer storage facilities constructed	2019	4	16	Quarterly and annually	DCS, SRID, PPMED and AFAP	National, Regional and District
	Number of operational fertilizer distribution outlets	Number	Count of operational fertilizer distribution outlets	2019	1,500	4,000	Quarterly and annually	AFAP, DCS and PPRSD	National, Regional and District
	Number of awareness creation/workshops on the use of organic fertilizer for farmers	Number	Count of awareness creation workshop on the use of organic fertilizer	2019	10	50	Quarterly and annually	DCS, DAES, AFAP and IFDC	National, Regional and District
	Quantity of organic liquid fertilizer produced/imported	Ltr	Total organic liquid fertilizer produced/imported to be utilized by farmers in Ghana measured in metric tons	2019	1,200,000	4,000,000	Quarterly and annually	Fertilizer Companies, PPRSD and DCS	National and Regional
	Quantity of organic granular fertilizer produced/imported	MT	Total organic granular fertilizer produced/imported to be utilized by farmers in Ghana measured in metric tons	2019	8,000	20,000	Quarterly and annually	Fertilizer Companies, PPRSD and DCS	National and Regional

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Quantity of organic liquid fertilizers used for rice production	Ltr	Total quantity of organic liquid fertilizers produced measured	2019	300,000	1,000,000	Quarterly and annually	DCS, DAES, SRID, IFDC and AFAP	National, Regional and District
	Quantity of organic granular fertilizers used for rice production	MT	Total quantity of organic granular fertilizers produced measured	2019	2,000	8,000	Quarterly and annually	DCS, DAES, SRID, IFDC and AFAP	National, Regional and District
	Number of organic fertilizer production companies/institutions	Number	Total number of organic fertilizer production companies/institutions	2019	12	100	Quarterly and annually	PPRSD	National
	Number of demonstrations on organic fertilizer usage	Number	Total number of demonstrations established on organic fertilizer usage	2019	20	80	Quarterly and annually	DAES, PPRSD and DCS	National
	Strategic Objective: Facilitate private sector investment in fertilizer production and distribution in the long term								
	Number of conventional fertilizer manufacturing plants established.	Number	Count of fertilizer manufacturing plants established	2019	N/A	1	Quarterly and annually	DCS, PPRSD and GFEP	National
	Number of green fertilizer production centres established	Number	Count of green fertilizer production centres	2019	N/A	5	Quarterly and annually	DCS, PPRSD and GFEP	National and Regional
	Number of fertilizers blending plants established	Number	Count of fertilizer blending plants established	2019	6	10	Quarterly and annually	DCS, PPRSD, GFEP, IFDC and	National and Regional

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
								AFAP	
	Number of Fertilizer testing labs established.	Number	Count of fertilizer testing labs established	2019	4	10	Quarterly and annually	DCS, PPRSD, GFEP, IFDC and AFAP	National and Regional
Research, Technology Development and Transfer	Number and type of other climate-smart technologies developed.	Number	Count of types of other climate-smart technologies developed.	2019	5	10	Annually	Research Institutions, Universities	National
	Number of climate-resilient varieties promoted	Number	Count of climate-resilient varieties promoted	2019	3	5	Annually	Research Institutions, DCS, DAES	National
	Number of technologies commercialized	Number	Count of technologies commercialized	2019	5	8	Annually	Research Institutions	National
	Number of rice research products and by-products promoted	Number	Count of rice research products and by-products promoted	2019	6	8	Annually	FRI, WIAD and DAES	National
	Number of rice research commissioned	Number	Count of rice research commissioned	2019	N/A	10	Annually	Research Institutions	National
	Number of rice equipment procured for research	Number	Count of rice equipment procured for research	2019	N/A	5	Annually	Research Institutions, AESD, GRATIS	National
	Number of rice scientists trained	Number	Count of rice research scientists trained by sex and PWD gender	2019	30	53	Annually	Research Institutions	National

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of rice technicians trained	Number	Count of rice research technicians trained by sex and PWD gender	2019	25	102	Annually	Research Institutions	Sex, youth and PLWD
	Number of extension officers trained on technologies developed	Number	Count of extension officers trained by sex and PWD gender	2019	5,586	13,500	Annually	DAES	Sex, youth and PLWD
Post Harvest and Marketing	**Strategic Objective: Promote value addition (quality milled rice)**								
	Number of rice processors trained in post-harvest handling	Number	Count of male, PWD and female rice processors trained in post-harvest handling	2019	160	900	Quarterly	AESD, DCS,	Sex, youth and PLWD
	Number of efficient rice mills in operation (pre-cleaner, destoner, huller, aspirator, polisher, colour sorter, grader)	Number	Count of standard mills (pre-cleaner, destoner, huller, aspirator, polisher, colour sorter, grader)	2019	N/A	50	Annually	AESD, Processors, Paddy Aggregators, Traders, MMDAs, NAFCO	National, Regional and District
	Level of industrial milling capacity	%	Ratio of installed capacity of medium and large mills (3 MT and above) among all functional mills	2021	i). Milling Capacity:Small-Scale Mills ≤ 1.5 31.3Tons per hour/56.1Tons per hour = 0.56 (56.0%)Medium-Large	i). Milling Capacity:Small-Scale Mills ≤ 1.5 31.3Tons per hour/56.1Tons per hour (70.0%)Medium-Large Mills ≥1.6 Tons/Hour	Annually	AESD, SRID and DCS	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
					Mills ≥1.6 Tons/Hour 24.8Tons per hour/56.1 Tons per hour = 0.44 (44.0%) ii). Number ratio:Small-Scale Village Mills ≤ 1.5 Tons/Hour = 33/44 (77.3%)-MediumLarge Mills ≥1.6 Tons/Hour = 10/44 (22.7%)	24.8Tons per hour/56.1 Tons per hour (60.0%) ii). Number ratio:Small-Scale Village Mills ≤ 1.5 Tons/Hour (90%)-MediumLarge Mills ≥1.6 Tons/Hour (50%)			
	Number of rice packaging materials approved by the regulatory authorities	Number	Count of rice packaging materials approved by the regulatory authorities	2019	482	984	Quarterly and annually	FDA, GSA	National, Regional and District
	Number of locally produced rice brands introduced by the regulatory authorities	Number	Count of locally produced rice brands introduced by the regulatory authorities	2019	41	100	Quarterly and annually	FDA, GSA	National

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of processing actors adhering to quality control procedures	Number	Count of male, PWD and female processing actors approved by the regulatory authorities.	2019	33	200	Quarterly and annually	FDA, GSA	Districts and Regional
	Number of Ghana rice brands at major marketing outlets	Number	Count of Ghana rice brands at marketing outlets (mini and supermarkets)	2019	41	100	Quarterly and annually	FDA, GSA, SRID	National
	Number of imported rice brands at major marketing outlets	Number	Count of imported rice brands at marketing outlets (mini and supermarkets)	2019	7	4	Annually	SRID, DCS, MoTI	National
	Quantity of paddy rice produced	MT	Total quantity of paddy rice produced	2019	925,000	,312,282 MT	Annually	SRID, DCS	National, Regional and District
	Quantity of milled rice	MT	Total quantity of milled rice	2019	638,250	2,546,990	Annually	SRID, DCS	National, Regional and District
	Quantity of imported rice	MT	Total quantity of imported rice	2019	1,088,000	11,900	Annually	SRID, DCS, MoTI	National
	Retail prices per Kg for representative rice brands/varieties for local and imported rice	GHC	Average retail prices of both representative Ghana Rice (white rice) and imported rice brands		Local rice (average retail price-JanDec. 2019) = GHS 4.76 (0.86 USD) Per KG-Imported rice (average retail price-Jan Dec.	$$$$			

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
					2019) = 6.03 GHS (1.09 USD) GHS per KG				
	Strategic Objective: Facilitate private sector linkages to financing schemes (e.g., matching grants, credit lines etc.) to improve access to credits								
	Number of offtakers/aggregators and processors linked to financial schemes	Number	Number of offtakers/aggregators and processors linked to financial schemes by gender	2019	5	250	Annually	Financial Institutions, GIRSAL, MoFA, MoF	National, Regional and District
	Number of financial institutions offering credits	Number	Count of financial institutions offering credits	2019	11	30	Annually	Financial Institutions, GIRSAL, MoFA, MoF	National, Regional and District
	Smallholder rice farmers' accessibility to financial services	Percentage (%) of smallholder farmers having access to financial services (in rice producing areas)	Farmers with records such as; Introductory letter to Fina Institutions • Business plan preparati • Proposal preparation • Formation of Village Sa & Loans Association (VL Land preparation on crec • Input credit	2023	38.02 %	50%	Annually	Agribusiness Unit (PPMED)	National, Regional and District
Irrigation and Water Control Investment	**Strategic Objective: Develop, rehabilitate and expand irrigation and water control structures to increase area of rice production**								
	New areas developed under irrigation	Ha	Total area developed under irrigation.	2019	26,000	46,345	Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	Total area rehabilitated under irrigation	Ha	Total area under irrigation rehabilitated.	2019	26,000	46,345	Annually	GIDA, DCS, SRID and RAD	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Total area expanded at existing irrigation sites	Ha	Additional area developed at existing irrigation sites.	2019	26,000	66,690	Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	New areas developed under rainfed	Ha	Total area developed under rainfed.	2019	253,800	496,300	Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	Total area rehabilitated under rainfed	Ha	Total area under rainfed rehabilitated.	2019	253,800	357,730	Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	Total area expanded at existing rain fed site	Ha	Additional area developed at existing rain fed sites.	2019	253,800	600,230	Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	Total area under rice cultivation	Ha	Total area under rice cultivation	2019	282,000	690,059	Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	Area under irrigation	Ha	Area (Ha) under rice cultivation with supplementary irrigation that could mitigate the negative impacts of weather fluctuations on rice production	2019	11,601.98		Annually	GIDA, DCS, SRID and RAD	National, Regional and District
	Number of scheme management entities /Water User Associations established	Number	Count of scheme management entities/WUAs established	2019	22	140	Annually	GIDA	National
	Number of solar pumps procured and distributed to rice farmers along rivers	Number	Count of solar pumps procured and distributed to rice farmers by sex and PWD gender along rivers and water bodies	2019	N/A	100	Annually	Private Sector, GIDA, DPs, AESD	National

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	and water bodies								
	Number of inland valleys/lowlands	Number	Count of inland valleys/lowlands	2019	N/A	500	Quarterly and annually		Regional and District
Equipment Access and Maintenance Strategy	**Strategic Objective: To Improve access to agricultural mechanization services**								
	Number and type of appropriate agricultural machinery imported under government incentive/subsidy	Number	Count and types of agricultural machinery for land development, planting, crop maintenance harvesting, threshing, etc.	2019	8,560	11,357	Annually	AESD, DCS	National
	Number and type of medium-scale agricultural machinery/processing equipment local fabricators	Number	Count and types of medium-scale local fabricators of agricultural machinery for land development, planting, harvesting, threshing, etc.	2019	130	260	Annually	GRATIS, AESD	National and Regional
	Level of mechanization in production	Number	Number (Count) of machines available for ploughing and harvesting (in rice producing areas)	2023	Tractors=2,859 Harvesters=268 Rice Threshers=90 Power Tillers=	4,509	Annually	AESD, SRID	National and Regional

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
					1,292				
	Number of major private sector participating in the marketing of agricultural machinery	Number	Count of major private sector actors participating in the marketing of agricultural machinery	2019	19	30	Annually	AESD, GIPC, Register General Department	National and Regional
	Number of AMSECs in rice-growing districts	Number	Count of AMSECs in rice-growing districts	2019	176	216	Annually	AESD, HRMD, Private Sector, MMDAs	National and Regional
	Number of anchor farmers providing mechanized services	Number	Count of anchor farmers providing mechanized services	2019	N/A	500	Quarterly and annually	AESD, MMDAs,	National and Regional
	Number of agricultural machinery operators trained, certified and licensed	Number	Count of male, PWD and female agricultural machinery operators trained, certified and licensed to provide mechanised services	2019	500	5,000	Annually	AESD, DVLA	National and Regional
	Number of mechanics, technicians, fabricators and operators trained in assembling, maintenance and repair of agricultural machinery	Number	Count of male, PWD and female mechanics, technicians, fabricators and operators trained in maintenance and repair of agricultural machinery	2019	250	2,500	Quarterly and annually	AESD, HRMD, GRATIS, MMDAs	National and Regional

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of major private sector dealing in agricultural machinery spare parts	Number	Count of major private sector dealers in spare parts	2019	10	50	Quarterly and annually	AESD, GIPC, Register General Department	National and Regional
Community Mobilization, Farmer Based Organizations and Credit Management Strategy	**Strategic Objective: Facilitate the formation of new FBOs and strengthen existing FBOs**								
	Number of existing FBOs	Number	Count of existing FBOs	2019	2,600	5,200	Quarterly and annually	PPMED, DCS, DAES, GIDA	National, Regional and District
	Number of functional FBOs	Number	Count of functional FBOs	2019	1,560	4,940	Quarterly and annually	PPMED, DCS, DAES, GIDA	National, Regional and District
	Number of new FBOs formed	Number	Count of new FBOs formed within the year	2019	780	520	Quarterly and annually	PPMED, DCS, DAES, GIDA	National, Regional and District
	Number of FBOs/actor associations trained in agricultural management practices (GAPs, agribusiness, etc.)	Number	Count of FBOs/actor associations trained in agricultural management practices	2019	2,600	5,200	Quarterly and annually	PPMED, DCS, DAES, GIDA	National, Regional and District
	Strategic Objective: To identify actors along the rice value chain								
	Number of rice producers	Number	Count of rice producers by gender	2019	71,000	104,000	Quarterly and annually	PPMED, DCS, DAES, GIDA, Farmers, Processors, Traders	National, Regional and District

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of rice aggregators/ offtakers	Number	Count of rice aggregators/offtakers by gender	2019	520	1,300	Quarterly and annually	PPMED, DCS, DAES, GIDA, Farmers, Processors, Traders	National, Regional and District
	Number of rice millers	Number	Count of rice millers by gender	2019	520	1,300	Quarterly and annually	PPMED, DCS, DAES, GIDA, Farmers, Processors, Traders	National, Regional and District
	Number of rice parboilers	Number	Count of rice parboilers by gender	2019	300	600	Annually		
	Number of rice marketers (milled rice)	Number	Count of rice marketers by gender	2019	2080	5,200	Quarterly and annually	PPMED, DCS, DAES, GIDA, Farmers, Processors, Traders	National, Regional and District
	Strategic Objective: To improve credit management								
	Number of FBOs trained in credit management and financial literacy	Number	Count of farmers trained on credit management and financial literacy by gender	2019	2,600	5,200	Quarterly and annually	DAES, FIs, GIRSAL	National, Regional and District
	Number of FBOs accessing credit	Number	Count of farmers accessing credit by gender	2019	2,600	5,200	Quarterly and annually	GIRSAL, FIs, SRID	National, Regional and District
	Strategic Objective: To strengthen value chain associations								

Thematic Areas	Indicators	Unit of Measurement	Definition of Indicators	Base Year	Baseline Value	Targets by 2030	Frequency of Data Collection	Data Source	Data Disaggregation
	Number of functional GRIB at the regional level	Number	Count of functional GRIB at the regional level	2019	10	16	Annually	DCS, GRIB	National and Regional
	Number of functional GRIB at the district level	Number	Count of functional GRIB at the district level	2019	156	260	Annually	DCS, GRIB	National, Regional and District
	Number of media engagements carried-out	Number	Count of media engagements conducted	2019	16	32	Quarterly and annually	DAES	National and Regional
	Number of interest groups mobilized	Number	Count of interest groups mobilized	2019	260	780	Quarterly and annually	DAES	National and Regional
N/A studies would have to be carried out to establish the baseline which will then inform the targets*									

7 CONCLUSION

The strategy recognizes the importance of developing and sustaining rice production along the value chain. In this document, bottlenecks militating against the development of the rice sub-sector were identified, and possible solutions were proffered. For ease of implementation, concept notes will be developed to stimulate investments by the Government, Private Sector and/or Development Partners.

Mainstreaming of the NRDS II document into the National Agricultural Investment Plan should be paramount to give greater confidence to invest in the developed concept notes. It must be noted that the bulk of the technical work as well as fund matching lies on the shoulders of the National Rice Coordinating Committee (NRCC), while the National Rice Liaison Desk (NRLD) is the information clearing house for all rice-related investments in Ghana. For proper guidance in the implementation of the concept notes derived from the NRDS II, these two bodies should receive maximum support from the Government.

These strategies and policies need the utmost attention to ensure the country's self-sufficiency in rice production and to help counter the effect of the global food crisis that may require medium to long-term interventions to address. It is envisaged that set targets and milestones when vigorously pursued and monitored would be achieved.

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9 ANNEXES

9.1 Annex I: NRDS Stakeholders and Responsibilities

Table 13: NRDS Stakeholders and Responsibilities

Stakeholders/Institutions	Description	Responsibility
1. Government	MoFA, MESTI, MoTI, MRH/DFR, MLGDRD, MoF/GIRSAL, MLNR, MoJAG, etc.	Coordination, policy direction, financing and technology testing and dissemination, M&E
2. NGO's	Identifiable local and international (e.g., Amasachina, CRS, TechnoServe)	Extension, group formation and development, micro-financing, marketing, M&E
3. Public Institutions	CSIR /Universities	technology development, testing and dissemination, M&E
4. Financial Institutions	Banks, Micro-finance Institutions.	Credit support (disbursement and recovery), M&E
5. Development Partners	Multilaterals/Bilateral	Technical assistance, funding, capacity building, M&E
6. Private Sector	Investors, service providers, Input dealers, FBOs etc.	Value chain development, investment/financing, consultant services and
7. International Institutions	Research Sub-Regional Organizations & Networks/Agencies	Technical back stopping, research information dissemination and technology sharing
8. On-going Rice Development Programmes	MoFA projects, Research projects, etc.	Coherence and linkages for harmonization

9.2 Annex II: Past and Current Rice Sector Projects

Table 14: Past and current projects in the rice sector

Code	Project	Start	End
GH1	Food Security and Rice Producers Organization Project	2003	2008
GH2	Special Programme for Food Security in Ghana	2002	2007
GH3	Project for Promotion of Farmers' Participation in Irrigation Management	2004	2006
GH4	The Study of the Promotion of Domestic Rice in the Republic of Ghana	2006	2008
GH5	Improvement of Drought Tolerance of Rice through Within-Species Gene Transfer	2007	2009
GH6	Nerica Rice Dissemination Project	2005	2010
GH7	Inland Valleys Rice Development Project	2004	2011
GH8	Small Scale Irrigation Development Project	2001	2009
GH9	Small Farms Irrigation Project	2003	2009
GH10	Rice Sector Support Project	2008	2016
GH11	Ghana Rice Inter-professional Body	2008	On-going
GH12	Rice Seed Production	2008	2010
GH13	Project for Sustainable Development of Rain-fed Lowland Rice Production (Phase I)	2009	2014
GH14	Development of low-input Rice Cultivation System in Wetland in Africa	2009	2015
GH15	Development of Rice Varieties with Enhanced Nitrogen-Use Efficiency and Salt Tolerance	2010	2015
GH16	Improving Yield, Quality and Adaptability of Upland and Rain fed Lowland Rice Varieties in Ghana to Reduce	2011	2014

	Dependency on Imported Rice (CRI-AGRA)		
GH17	GCSP/GHA/028/UNO – Dissemination of Improved Rice Production Systems with Emphasis on Nerica to Reduce Food Deficit and Improve Farmers Income in Ghana (UN-FAO/UNIDO-JAPAN GOVERNMENTT)	2004	2006
GH18	Expanded Rice Programme	2008	On
GH19	Kpong Irrigation Project	1998	2010
GH20	An Emergency Initiative to Boost Rice Production (USAID – SARI)	2008	2010
GH21	Improving Organic Matter content of soil for increased yield of NERICA	2006	2011
GH22	Japanese Grant Aid for Increased Food Production (2-KR)	2006	2014
GH23	Enhanced Access to Quality Rice Seed Initiative (WAAPP)	2014	2017
GH24	Northern Rural Growth Programme	2007	2016
GH25	Ghana Commercial Agriculture Project	2014	2021
GH26	West Africa Seed Programme	2013	2017
GH27	EDAIF Sponsored Rice Project	2014	2016
GH28	Study for the development of improved infrastructure and technologies for rice production in Ghana by JIRCAS	2008	2011
GH29	Study on Improvement of Micro Reservoir Technologies for Enhancement of Rice Production in Africa	2014	2018
GH30	Promoting Sustainable Increase in Rice Production and Productivity of Small and Medium Scale Farmers	2014	2017

	through a Public Private Partnership		
GH31	Planting for Food and Jobs Phase 1	2017	2022
GH32	Savannah Zone Agricultural Productivity Improvement Project	2018	2022
GH33	Market-based Agriculture by Smallholders and Private Sector Linkages (JICA)	2016	2021
GH34	Project for Sustainable Development of Rain-fed Lowland Rice Projection (Phase II)	2016	2021
GH35	Competitive African Rice Initiative I	2014	2017
GH36	Competitive African Rice Initiative II.	2018	2019
GH37	Ghana Agricultural Sector Investment Programme.	2014	2021
GH38	Public Private Partnership for Competitive & Inclusive Rice Value Chain Development Project	2018	2021
GH39	Green Innovation Centre for the Agriculture and Food Sector	2015	2022
GH40	The National Metrology Institute of Germany (PTB)	2011	2015
GH41	Improvement of Rice Value Chain in Central Region	2019	2023
GH42	Market Oriented Agriculture Programme in North West Ghana	2017	2023
GH43	Special Rice Initiative under Planting for Food and Jobs	2019	2020
GH44	Ghana COVID-19 Alleviation and Revitalization of Enterprises Support (CARES) “Obaatan pa” Programme	2021	2023
GH45	Financing of Processors	2020	Ongoing

GH46	Modernising Agriculture in Ghana: Distribution of 1,000 hand held harvesters	2021	2021
GH47	Ghana Rice Production Improvement Project	2022	2027
GH48	Ghana 4R Solution Project	2019	2024
GH49	Invest West Africa - Ghana Agribusiness Competitiveness Advisory Project	2018	2022
GH50	Savannah Agriculture Value Chain Development Project (SADEP)	2023	2027
GH51	West Africa Food System Resilience Project	2023	2028
GH52	Emergency Support to Rural Livelihoods and Food systems	2020	2024
GH53	Feed the Future Ghana Agricultural Development and Value Chain Enhancement Activity (Advance II)	2014	2020
GH54	Partnership for Inclusive Agriculture Transformation in Africa	2017	2023
GH55	Financing the Development of Agric Value Chain	2017	2018
GH56	Improving the Technology and Quality Control System for Higher Value Addition in the Post-harvest Processes of the Rice Value Chain (ITEQ-RICE)	2022	2025
GH57	Africa Field Innovation Centre for Agricultural Technology (AFICAT)	2022	2024
GH58	Africa Rice Promotion Support	2022	2025
GH59	The project to improve rice value chain in the Central Region of Ghana	2019	2024
GH60	Planting for Food and Jobs Phase II	2023	Ongoing

GH61	Market Oriented Value Chains for Jobs and Growth in the ECOWAS Region (MOVE)	2022	Ongoing
GH62	K-Ricebelt Project	2023	2028
GH63	Harnessing Agricultural Productivity and Prosperity for Youth (HAPPY) Programme	2023	2027

9.3 Annex III: Situation Analysis and Identification of Interventions

Table 15: Intervention Matrix

GHANA	Policy/ institutional	Infrastructure	Human resource capacity	Provision/support	Information/ knowledge	Unclassified
Seed - breeding - multiplication - distribution/use	GH18; GH20; GH23; GH26; GH6; GH27; GH38	GH32; GH41; GH42	GH15; GH16; GH18; GH41; GH42	GH6; GH12; GH13; GH15; GH16; GH17; GH18; GH20; GH31; GH39; GH41; GH42; GH43; GH44	GH5; GH10; GH14; GH15; GH16; GH18; GH32; GH41; GH42; GH48	
Fertilizer - production/importation - distribution/use	GH18; GH20	GH40	GH40	GH6; GH13; GH20; GH31; GH42; GH43;	GH20; GH21; GH39; GH40; GH42; GH48	

GHANA	Policy/ institutional	Infrastructure	Human resource capacity	Provision/support	Information/ knowledge	Unclassified
Irrigation/water management	GH25;	GH2; GH7; GH8; GH9; GH10; GH3; GH27; GH37; GH32; GH41; GH42	GH3; GH25; GH42; GH47	GH25; GH41; GH42	GH42; GH47	
On-farm technology transfer - Research and extension	GH4; GH18	GH42	GH2; GH6; GH10; GH13; GH16; GH18; GH20; GH31; GH42; GH48	GH8; GH9; GH15; GH16; GH17; GH18; GH35; GH42; GH48	GH2; GH4; GH6; GH7; GH10; GH13; GH14; GH5; GH41; GH16; GH18; GH19; GH20; GH21; GH35; GH34, GH42; GH47; GH48	
Mechanization		GH46	GH17; GH18;	GH15; GH6; GH18; GH19;	GH42	

GHANA	Policy/ institutional	Infrastructure	Human resource capacity	Provision/support	Information/ knowledge	Unclassified
			GH41; GH42	GH22; GH32; GH41; GH42; GH44; GH45; GH46		
Quality improvement - Processing/Storage	GH4; GH18; GH35	GH7; GH18; GH19; GH32; GH41	GH6; GH10; GH16; GH41; GH42	GH7; GH35; GH41; GH42; GH44; GH45 GH56	GH4; GH10; GH15; GH41; GH42	
Access to market - Promotion of local produce/branding	GH4; GH18	GH18	GH11; GH33; GH41; GH42	GH19; GH31; GH41; GH42; GH44; GH45	GH4; GH11; GH13; GH41; GH42; GH44; GH48	
Access to credit	GH10; GH17; GH49		GH17; GH49	GH7; GH10; GH18; GH19; GH35; GH42; GH44; GH45	GH39	
Overall policy tools	GH1; GH4; GH11; GH13; GH39; GH47; GH48		GH1; GH9; GH10; GH11; GH19; GH47; GH48	GH1;	GH4; GH13	

GHANA	Policy/ institutional	Infrastructure	Human resource capacity	Provision/support	Information/ knowledge	Unclassified
Unclassified		GH19	GH1; GH7; GH8; GH9	GH8; GH9;		

The needs and resource gap matrix establishes the facilitating factors as per the thematic areas for rice development committed by the Government, Development Partners and CSOs.

In doing so, the facilitating factors, which require attention, are matched to seven main thematic areas, which indicate the resources required. Further to that, projects and programmes are examined based on their component categories and the relative attention given to each thematic area.

When all projects/programmes are matched with the thematic areas in the matrix, the empty spaces represent the resource gaps. Additional gaps are identified when we can determine the scope and coverage of a particular project/programme. The GH1 to GH49 represent the project/programmes.

9.4 Annex IV: Sub-sector interventions

Table 16: Sub-sector interventions

GHANA	Policy/Institutional	Infrastructure	Human Resource Capacity
Seed - breeding - multiplication - distribution/use	***	**	**
Fertilizer - production/importation - distribution/use	**		
Irrigation/water Management		**	***
On-farm technology transfer - Research and extension			
Mechanization		**	
Quality improvement - Processing/Storage		**	
Access to market - Promotion of Ghana Rice/branding		**	
Access to Financial Services	**		
Overall policy tools			

Table 16 uses the colour picture to determine the extent to which a particular thematic area and strategy areas have been addressed within the rice value chain.
Green represents an area, which has received relatively higher attention and probably resources depending on the number of projects, which had components, which tackled that thematic area.
Yellow colour indicates areas and strategies that have received some attention but still requires a greater level of attention.
Red colour also suggests that very little has been done in respect to a particular thematic and strategic area.

Based on the extent of the gap, an intervention is proposed to address and promote areas needing more attention.

Table 17: NRDS 2 – Interventions

GHANA	Policy/ institutional	Infrastructure	Human resource capacity	Provision/ support	Information/ knowledge	Unclassified
Seed - breeding - multiplication - Certification & distribution/use	RS-1	RS-1	RS-1		RS-1	
Fertilizer - production/importation - distribution/use	RS-2		RS-2		RS-2	
Irrigation/water management	RS-4	RS-4	RS-4		RS-4	
On-farm technology transfer - Research and extension		RS-6	RS-6	RS-6	RS-6	
Mechanization	RS-5	RS-5	RS-5	RS-5	RS-5	
Quality improvement		RS-3	RS-3	RS-3	RS-3	

- Processing/Storage						
Access to market - Promotion of local produce/branding		RS-3	RS-3		RS-3	
Access to credit	RS-7		RS-7		RS-7	
Overall policy tools	RS-7*		RS-7			
Unclassified						

Table 17 inputs the suggested interventions based on gaps onto the matrix. The interventions therefore address the area with limited attention over the years and all value chain stages are addressed by a strategy. RS-1 to RS-7, suggests the seven (7) NRDS strategic areas of the document.

Table 18: NRDS 2 – Interventions

GHAHA	Policy/ institutional	Infrastructure	Human resource capacity	Provision/ support	Information/ knowledge	Unclassified
Seed - breeding - multiplication - Certification & distribution/use	RS-1	RS-1	RS-1	*Create demand for quality seed	RS-1	
Fertilizer - production/importation - distribution/use	RS-2		RS-2 quality standard assurance	*Create demand for fertilizer	RS-2 Site specific fertilizer recommendations	
Irrigation/water management	RS-4 valleys and rain-fed lowlands	RS-4 valleys and rain-fed lowlands, irrigation infrastructure	RS-4		RS-4	
On-farm technology transfer - Research and extension		RS-6	RS-6	RS-6	RS-6	

Mechanization	RS-5	RS-5 Mechanization Services	RS-5	RS-5 equipment support	RS-5	
Quality improvement - Processing/Storage		RS-3 warehousing, drying floors, milling machinery	RS-3	RS-3 quality improvement	RS-3	
Access to market - Promotion of local produce/branding		RS-3	RS-3		RS-3	
Access to credit	RS-7 Institutional arrangements		RS-7 debt collection		RS-7	
Overall policy tools	RS-7*		RS-7 Rice Based Organisation development			
Unclassified						

Table 18 gives a little bit of narrative indicating where the emphasis should be (prioritization).

Table 19: Priorities setting using Strategic Intervention Element Matrix (SIEM) and NRDS 2 matrix

GHANA	Policy/institutional	Infrastructure	Human resource capacity	Provision/support	Information knowledge/Research	Unclassified
Seed	RS-1	RS-1	RS-1- Capacity Building, breeders, private seed producers, extensionist,	*Create demand for quality seed	RS-1	
Fertilizer	RS-2 Quality assurance for fertilizers	RS-2	RS-2 quality standard assurance	*Create demand for fertilizer	RS-2 Variety and Site-specific fertilizer recommendations	
Irrigation/water management	RS-4 valleys and rain-fed lowlands	RS-4 valleys and rain-fed lowlands, irrigation infrastructure	RS-4		RS-4	
On-farm		RS-6	RS-6	RS-6 Extension	RS-6 Content	

technology dissemination			Capacity building	tools and materials	generation for E-extension	
Mechanization	RS-5	RS-5 Mechanization Services	RS-5	RS-5 equipment support	RS-5	
Quality improvement		RS-3 warehousing, drying floors, milling machinery	RS-3	RS-3 quality improvement	RS-3	
Access to market		RS-3 Aggregation centres, warehousing	RS-3 Capacity building (aggregators, processors, combine operators)		RS-3 Promotion and advocacy	
Access to financial services	RS-7 Institutional arrangements		RS-7 limited knowledge of creditors	RS-7 Access to credit/high interest rate	RS-7	

Overall policy tools	RS-7*		RS-7 Rice Based Organisation development			
Unclassified						

Table 19 sets the priority areas for which concept notes are prepared.

9.5 Annex V: Proposed Interventions

Potential areas for Concept Notes development

1. Production support and infrastructure development for improved quality of rice seeds.

Components

- Production support.
- Enhance seed use.
- Infrastructure support.
- Capacity building.

2. Develop Lowlands/Inland Valleys with Water Control Structures for Rice Cultivation.

Components:

- Identification and characterization of valleys/lowlands.
- Land acquisition, tenancy and compensation.
- Survey of selected valleys/lowlands, design of water control structures and land development.
- Community mobilization, capacity building for effective and efficient water and crop management.

3. Construct, rehabilitate and expand area under irrigation.

Components:

- Construct new irrigation infrastructure.
- Assessment of existing schemes.
- Rehabilitation and expansion.
- Capacity building.

4. Support for the transfer of Improved Rice Technologies.

Components:

- Research, technology development and transfer.
- Institutional Coordination.

- Financial support.
- Capacity Development.

5. Support Mechanization for rice production and processing.

Components:

- Access to Agricultural Mechanisation .
    - Enhance farmers' access to agricultural machinery services.
- Equipment Maintenance and management.
    - Empower machine operators/AMSECs and mechanics.
- Capacity Building and Farm Power R & D.
    - Establish a unit CSIR institutions dedicated to research and development of robust, user- friendly and affordable machinery adapted to the rice ecologies in Ghana.
- Artisanal Development and Fabrication of Machinery and Parts.

6. Infrastructure development and quality improvement for increased competitiveness of Ghana rice.

Components:

- Post-harvest Equipment Support.
- Storage facilities/warehousing development.
    - Drying patios construction.
- Branding and promotion.
- Commodity market development.
    - Market Information Systems.
- Financial Service Support System.
- Capacity Building.

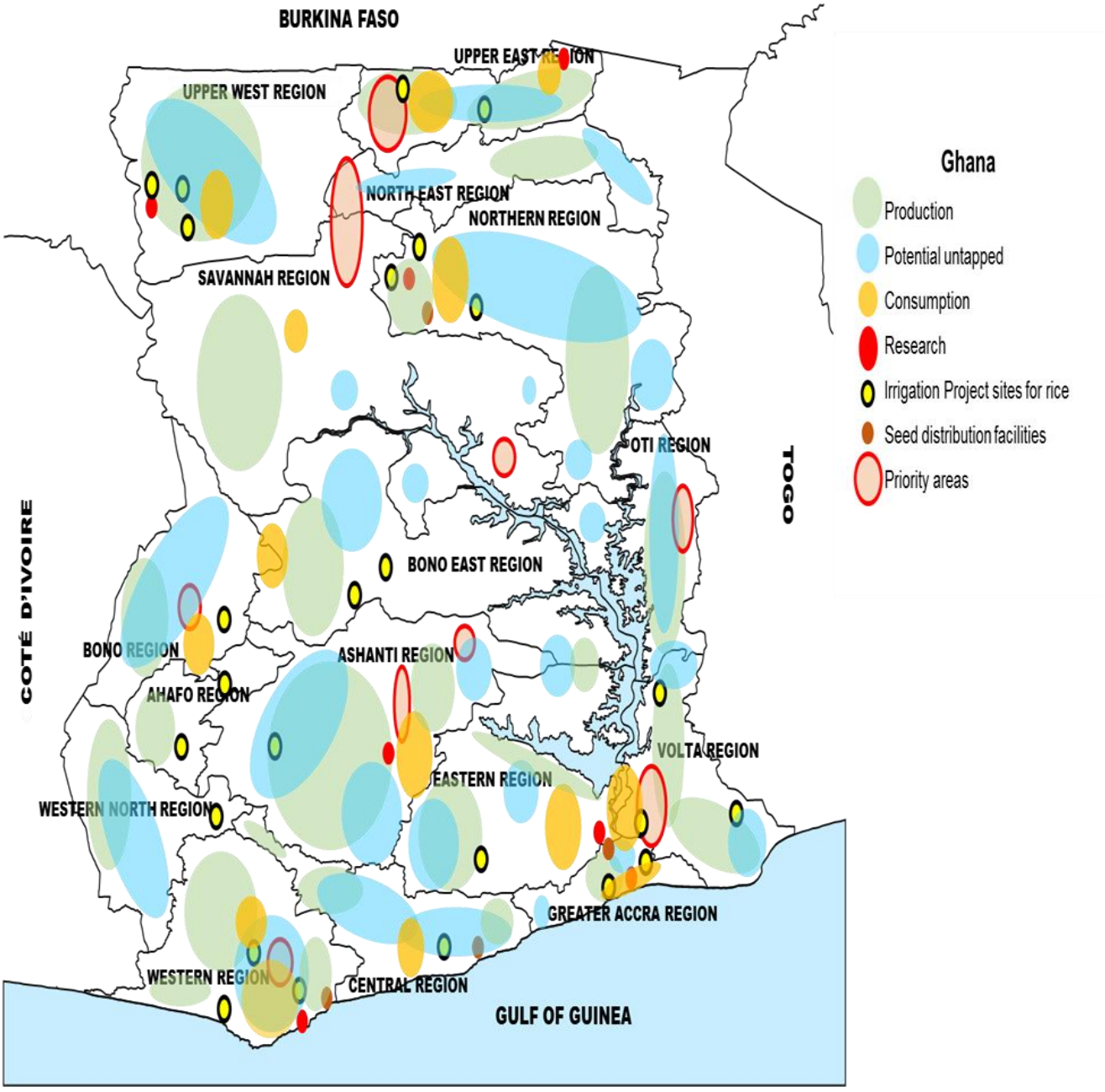
7. Strengthen Rice Value Chain Actors to enhance quality service delivery.

Components:

- Capacity strengthening.
    - At national, regional and district levels (GRIB).

- Service provision.
    - Access to finance.
    - Access to inputs.
- Policy and advocacy.

9.6 Annex VI: Geographic Prioritization



Source: MoFA, 2021

Figure 3: *Geographic Prioritization for Rice*

NOTE: The prioritization map illustrates the geographic potentials of resources available for rice production in-country. Currently, production is concentrated in spots marked light green across the country. This is an indication that all regions of Ghana have substantial number of smallholders who are quite conversant with rice-based cropping systems. Areas marked light blue have the potential for intensive rice production, but the resources in these localities are marginally or fully untapped. Hence, the importance of this strategy document is to propose interventions and target the technical improvement of practices employed at already known rice growing areas and as well as make room for judicious tapping of potentials of the unexplored areas.

Our ability to effectively use the areas with untapped resources depends much on Government and/or investors' willingness to invest in land development as most of the suitable areas can only be cropped under rain-fed conditions.

Table 20: Potential valleys/lowlands for rice production

No.	Region	Rice Growing Districts and Areas
1.	Upper East	Bolgatanga East, Bawku West, Bolgatanga Municipal, Kassena-Nankana Municipal, Bawku Municipal, Builsa North, Talensi, Tempane, Builsa South, Garu, Nabdam, Binduri, Bongo.
2.	Upper West	Wa West, Wa Municipal, Wa East, Sissala East Municipal, Sissala West, Nadowli, Lambussie, Jirapa, Daffiama-Bussie-Issa, Nandom, Lawra.
3.	Northern	Gushegu, Karaga, Kpandai, Kumbungu, Mion, Sang, Nanton, Nanumba North, Nanumba South, Saboba, Sagnarigu, Savelugu, Tamale, Tatale-Sanguli, Tolon, Yendi, Zabzugu.
4	North East	East Mamprusi Municipal, Bunkprugu/Nakpanduri, Chereponi, West Mamprusi, Yunyoo Nasuan, Mamprugu Moagduri.
5	Savannah	North East Gonja, East Gonja, Central Gonja, North Gonja.
6.	Bono	Tain, Jaman North, Jaman South, Banda, Dormaa Municipal, Dorman East, Dorman West, Berekum West, Wenchi, Sunyani East, Sunyani West,
7.	Bono East	Kintampo North, Pru East, Pru West, Atebubu-Amantin, Nkoranza South, Nkoranza North, Techiman North, Techiman South, Sene East
8.	Ahafo	Tano South, Tano North, Asutifi North, Asutifi South, Asunafo South, Asunafo

		North.
9.	Ashanti	Asante Akim North, Bosomtwe, Atwima Mponua, Atwima Nwabiagya Municipal, Afigya Kwabre South, Sekyere Central, Asante Akim South, Sekyere South, Afigya Kwabre North, Atwima Nwabiagya North, Obuasi Municipal, Adansi South, Mampong Municipal, Ahafo Ano South East, Bekwai Municipal, Offinso Municipal, Sekyere Kumawu, Ejura Sekyedumase, Bomome Freho, Sekyere Afram Plains, Atwima Kwanwoma, Amasie Central, Kwabre East, Offinso North, Ahafo Ano North, Sekyere East, Adansi Asokwa, Obuasi East, Ahafo Ano South West.
10.	Volta	South Dayi, Afadjato South, Ketu North, Ketu South, North Tongu, North Dayi, Hohoe, Agotime-Ziope.
11	Oti	Kadjebi, Nkwanta South, Nkwanta North, Krachi East, Krachi West, Krachi Nchumuru, Jasikan, Biakoye, Guan
12.	Eastern	Achiase, Akyemansa, Atiwa East, Birim Central, Birim North, Birim South, Denkyembour, Kwahu-Afram Plains South, Kwahu East, Kwahu South, Kwahu West, West Akim, Yilo Krobo, Kwaebibirem.
13.	Western	Tarkwa Nsuaem, Amenfi East, Sekondi Takoradi Metropolitan Assembly, Amenfi West, Wassa East, Ellembele.
14	Western North	Akontombra, Bia East, Bia West, Aowin, Bibiani, Bodi, Juaboso, Suaman, Sefwi Wiawso
15.	Central	Foso, Mfantseman, Asikuna Odoben Brakwa, Gomoa Central, Twifo Atti Morkwa, Upper Denkyira West, Ajumako Eyan Essiam, Gomoa West, Assin North, Effutu, Assin South, Twifo Hemang Lower Denkyira, Awutu Senya, Upper Denkyira East, Komenda-Edina-Eguafo-Abbrem, Agona East, Agona West.
16.	Greater Accra	Shai-Osudoku, Ada East, Ga South, Ada West.

9.7 Annex VII: Area and Quantity of Different Classes of Seed Required

Table 21: Area and quantity of the different classes of seed required

Year	Certified seed (MT)		Foundation seed (MT)		Breeder seed (MT)		Total Area (Ha)		Total Seed Quantity (MT)	
	Quantity (MT)	Area (Ha)	Quantity (MT)	Area (Ha)	Quantity (MT)	Area (Ha)	Total Area (Ha)	% Change	Total Quantity (MT)	% Change
2019	14,100.0*	4,700.0	282.0	112.8	7.1	3.6	4,816.4	8.5	14,389.1	8.5
2020	15,550.0*	5,183.3	311.0	124.4	7.8	3.9	5,311.6	10.3	15,868.8	10.3
2021	17,105.0	5,701.7	342.1	136.8	8.6	4.3	5,842.8	10.0	17,455.7	10.0
2022	19,670.8	6,556.9	393.4	157.4	9.8	4.9	6,719.2	15.0	20,074.0	15.0
2023	22,621.4	7,540.5	452.4	181.0	11.3	5.7	7,727.1	15.0	23,085.1	15.0
2024	24,883.5	8,294.5	497.7	199.1	12.4	6.2	8,499.8	10.0	25,393.6	10.0
2025	26,127.7	8,709.2	522.6	209.0	13.1	6.6	8,924.8	5.0	26,663.4	5.0
2026	27,434.1	9,144.7	548.7	219.5	13.7	6.9	9,371.0	5.0	27,996.5	5.0
2027	28,805.8	9,601.9	576.1	230.4	14.4	7.2	9,839.6	5.0	29,396.3	5.0
2028	30,246.0	10,082.0	604.9	242.0	15.1	7.6	10,331.5	5.0	30,866.0	5.0
2029	31,758.4	10,586.1	635.2	254.1	15.9	8.0	10,848.2	5.0	32,409.5	5.0
2030	33,346.3	11,115.4	666.9	266.8	16.7	8.4	11,390.5	5.0	34,029.9	5.0

Yield (MT/Ha): Certified seeds – 3 MT/Ha; Foundation seed – 2.5 MT/Ha; and Breeder seed – 2 MT/Ha

**These figures consist of the total quantities of seeds (both certified and uncertified) utilized in 2019 and 2020*

9.8 Annex VIII: Members of NRDS 2 Revision Team

Table 22: NRDS 2 Revision Team

No.	Name	Institution
1.	Charlotte Oduro-Yeboah	CSIR-FRI *(Taskforce member)*
2.	Bright K. Atsyor	GIDA *(Taskforce member)*
3.	Michael Owusu	DCS-MoFA *(Taskforce member)*
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With support from:		
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33.	JICA Ghana	
34.	CARD Secretariat	
35.	Mastercard Foundation in partnership with Agri Impact Limited	

9.9 Annex IX: Linkages between NRDS 2 and other relevant Strategic Policies

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Table 23: NRDS 2 Linkages to other relevant strategic policies

CAADP	NRDS	GPRS	FASDEP (II)	SDGs
CP-I: Increase food supply by reducing hunger across the region by increasing smallholder productivity and improve response to food emergencies.	N1: Seed System Develop efficient rice seed system within the remits of the overall input needs of the rice sector	G 1: Re-examine existing variations in access and control over land in different communities to ensure equity. Improve the system of land registration to protect the interest of smallholders	F1: Introduce high-yielding and short-duration (crop) rice varieties. F2: Establish contingency plans and strategic stocks (of rice) to support national emergency preparedness	SDG 2.5: by 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from utilisation of genetic resources and associated traditional knowledge, as internationally agreed. SDG 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

				SDG 13.2: Integrate climate change measures into national policies, strategies and planning.
CP-I: Increase food supply by reducing hunger across the region by increasing smallholder productivity and improve response to food emergencies.	N2: Community Mobilization, FBOs and Credit Management Strategy Important key actors (smallholders, processors, traders) mobilized and animated into cohesive and well-functioning groups. Effective management of credit system put in place.	G 2: Access to Credit and Inputs for Agriculture Initiate special interventions to improve access to affordable credit by farmers (special emphasis on increasing the proportion of women to gain access to credit.	F1: Introduce high-yielding and short-duration (crop) rice varieties. F2: Establish contingency plans and strategic stocks (of rice) to support national emergency preparedness.	SDG 2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality. SDG 13.2: Integrate climate change measures into national policies, strategies and planning.
CP-I: Increase food	N2: Community Mobilization, FBOs	Promote and support the	F1: Introduce high-yielding	SDG 2.3: By 2030, double agricultural productivity and incomes of small-

supply by reducing hunger across the region by increasing smallholder productivity and improve response to food emergencies.	and Credit Management Strategy	establishment of FBOs to enhance access to group credit and other inputs and significantly to domestic food security.	and short-duration (crop) rice varieties. F2: Establish contingency plans and strategic stocks (of rice) to support national emergency preparedness	scale producers, in particular women, family farmers, fishers among others including secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment. SDG 8.2: Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high value added and labour-intensive sectors. SDG 8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial

				services. SDG 8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. SDG 8.10: Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all. SDG 13.2: Integrate climate change measures into national policies, strategies and planning.
CP-II: Extend the area under sustainable land management and reliable	N3: Irrigation and Water Control Investment Strategy-Expand rice production under	G4: Agriculture Mechanization Promoting increased mechanism in	F3: Develop appropriate irrigation schemes for different	SDG 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and

water control systems which includes soil fertility management and conservation agricultural water management, agricultural water use and irrigation land policy and administration	irrigation, (existing schemes rehabilitated and new gravity-controlled schemes build). Low-cost water control structure developed for rain fed lowland systems. N4: Fertilizer Use Enhance fertilizer use through efficient distribution, access and affordability by smallholders. Ecology-specific organic fertilizer use system will be encouraged	large agriculture, with emphasis on the development and use of small-scale technologies, targeting smallholder farmers (tillage, storage and processing). G5: Access to Extension Services. Expand the coverage and effectiveness of extension services G-6: Accelerating the	ecologies of farmers to ensure production throughout the year.	substantially reduce the number of people suffering from water scarcity. SDG 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate. SDG 6.a: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies. SDG 6.b: Support and strengthen the participation of local communities in improving water and sanitation management

		Provision of Irrigation Infrastructure. Small-scale interventions such as dug-outs, hand pump systems, valley bottom schemes etc. Rehabilitation, expansion and promotion of the use of the existing irrigation facilities and infrastructure. G7: Restoration of Degraded Environment. Minimize the impact of		SDG 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. SDG 13.2: Integrate climate change measures into national policies, strategies and planning.

		environmental degradation (restoring degraded natural resources).		
CP-III: Market Increase market access through improved rural infrastructure and other trade related interventions which includes supply chain development, quality control and management system	N5: Post-Harvest/Marketing Strategy Paddy to be processed into acceptable national minimum standards by providing appropriate harvesting, threshing and milling facilities. N5(b) Marketing Branding and promotion, packaging retailing/food bazaars. N6: Equipment		F13: Develop effective post-harvest management strategies, particularly storage facilities at community level. F4: Improve accessibility and facilitate distribution of crops.	SDG 2.c: Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, to help limit extreme food price volatility. SDG 9.2: Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

development, export infrastructure and global trade policies and agreements.	Access and Maintenance Easy and timely access to improved agricultural equipment/machinery			SDG 9.3: Increase the access of small-scale industrial and other enterprises, in particular developing countries, to financial services, including affordable credit, and their integration into value chains and markets. SDG 13.2: Integrate climate change measures into national policies, strategies and planning.
CP-IV: Research Improve agricultural research and systems to disseminate appropriate new technologies and increasing the support	N7: Research, Technology Development and Transfer Need to enhance technology development and dissemination along the rice value chain			SDG 2.a.: Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks to enhance agricultural productive capacity in developing countries, in particular least developed countries.

given to help farmers adopt them which includes building research capacity and training.				SDG 9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending. SDG 9.b: Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities. SDG 12.a: Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of

				consumption and production. SDG 13.2: Integrate climate change measures into national policies, strategies and planning.

- NRDS (Ghana) tried to respond to CAAPD Pillars, GPRS, FASDEP (II) and SDGs
- NRDS (Ghana) responded to MOFA Strategic Plan through FASDEP (II) and GPRS
- NRDS (Ghana) will achieve its targets if all actors and resources are adequately provided

9.10 AnnexX: Anchor Approach: Public Private Partnership Act, 2020 1 Act 1039

AN ACT to provide for the development, implementation and regulation of public private partnership arrangements between contracting authorities and private parties for the provision of infrastructure and services, to establish institutional arrangements for the regulation of public private partnerships, and to provide for related matters.

Objects of the Act

1. The objects of this Act are to;
   a. regulate public private partnership arrangements; and
   b. promote the use of private sector resources for the provision of infrastructure and services through public private partnerships.

2. For subsection (1), the objects shall encompass the
   a. creation of an environment and framework to enable private parties to participate in partnership projects and through the Public Private Partnership Act, 2020 1 Act 1039 offer value for money to the public sector and users of the partnership projects;
   b. delivery of efficient infrastructure and services with assured quality;
   c. establishment of efficient institutional arrangements for the identification, structuring, procurement, implementation and monitoring of partnership projects;
   d. leverage of public assets to encourage private sector investment in the provision of infrastructure and services;
   e. protection of the interests of public and private sector stakeholders and end users;
   f. establishment of a framework for optimal risk sharing in partnership projects;
   g. promotion of local participation in partnership projects;
   h. establishment of a regulatory framework for contracting authorities for the purpose of partnership arrangements; and
   i. establishment of a framework for the management of financial commitments in respect of partnership arrangements.

Public Private Partnership Arrangements

The following Public Private Partnership arrangements with their variations and combinations may be entered into by the Contracting Authority for undertaking any Public Private Partnership Project. The arrangements enumerated in this Schedule are indicative in nature and the contracting authority may evolve and arrive at such agreement or arrangement incorporating any of the arrangements enumerated hereinafter or any other arrangements as are necessary or expedient for any specific project subject to the extent of financial and technical involvement and risk taken by the private party and upon approval of the Minister.

1. Build Own Operate (BOO):

A contractual agreement that authorises a private party to finance, build, manage, operate as well as maintain the infrastructure facility and provide services for a defined period of time. Private party remuneration is either through user charges, government budgets, or a combination of both. The transfer of the project to the government or the contracting authority is not envisaged in this structure.

2. Build, Own, Operate and Transfer (BOOT):

A contractual agreement in which the private party designs, finances, builds, operates and maintains an infrastructure facility for a specified period, after which the private party transfers the facility to the contracting authority. During the term of the contract the private party holds the legal and economic rights to the asset. The private party recoups their investment either through user charges, government budgets, or a combination of both.

3. Build, Operate and Transfer (BOT):

A contractual arrangement where the private party finances, constructs, operates and maintains an infrastructure facility and transfers the facility to the contracting authority at the end of a specified term. Legal ownership of the asset shall remain Public Private Partnership Act, 2020 1 Act 1039 with the government or contracting authority for the duration of the contract agreement. The private party recoups their investment either through user charges, government budgets, or a combination of both.

4. Build, Transfer and Operate (BTO):

A contractual arrangement where the private party constructs an infrastructure facility and assumes the costs and risks associated with the construction of the building and upon completion, transfers ownership of the facility, both legally and economically to the contracting authority. Operation of the facility is done on behalf of the contracting authority. Remuneration of the private party is either through user charges, government budgets, or a combination of both.

5. Concession:

Where a contracting authority issues a contractual licence to the private party to operate, maintain, rehabilitate or upgrade an infrastructure facility and to charge a user fee while paying a concession fee to the contracting authority.

6. Design, Build, Finance, Operate and Maintain (DBFOM):

A contractual agreement which enables the private party to design, build, finance, operate and maintain an infrastructure facility for a specified period, after which the facility is transferred to the contracting authority. Legal ownership of the asset for the duration of the contract agreement remains with the government or contracting authority. The private party recoups their investment either through user charges, government budgets, or a combination of both.

7. Develop, Operate and Transfer (DOT):

A contractual arrangement where favourable conditions external to a proposed infrastructure project by a private party are integrated into the arrangement by giving that private party the right to develop adjoining property and enjoy the benefits the investment creates as the parties agree on condition that the private party transfers the infrastructure facility to the contracting authority within a specified period and the developed property remain the property of the private party in perpetuity.

8. Operation and Maintenance (O&M):

A contractual agreement in which the private party is responsible for the operation, maintenance and management of an infrastructure facility for a specified period and the

contracting authority retains ownership of the facility and capital assets. Under the public private partnership, they are typically performance-based, long-term, and require substantial private capital investment.

9. Rehabilitate, Operate and Transfer (ROT):

A contractual agreement where the private party refurbishes, operates and maintains for a specified period, an existing facility at the expiry of which the private party transfers the facility to the contracting authority.

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