REPUBLIC OF KENYA

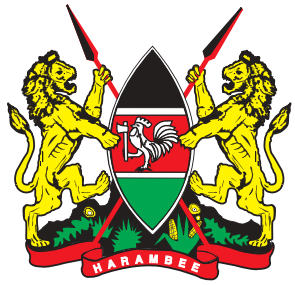
MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES AND COOPERATIVES

STATE DEPARTMENT FOR CROP DEVELOPMENT AND AGRICULTURAL RESEARCH

NATIONAL RICE DEVELOPMENT STRATEGY-2 (2019–2030)




2020



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FOREWORD

Agriculture continues to be the bedrock of the development of our nation and the key to creating equitable and sustainable growth for our people. This has been emphasized in Kenya through Vision 2030, the Medium-Term Plan III and the President's Big Four priority agenda for 2017-2022 and the Agricultural Sector Growth and Transformation Strategy (ASTGS).

The ASTGS has identified nine flagships that serve as the core of the 10-year agriculture strategy where the flagships draw on the status of our agriculture today through a rigorous and thorough review of data, lessons from global best practice, and our local realities. The actions inherent in these flagships are bold and ambitious. The implementation of the flagships will help to transform our agriculture sector in Kenya, drive 100% food and nutrition security, and ensure food is available and affordable for all Kenyans.

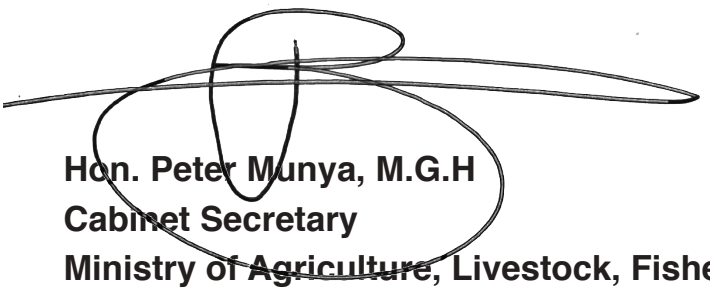
The role of the Ministry of Agriculture, Livestock, Fisheries and Cooperatives (MoALF&C) is to ensure food and nutrition security for all Kenyans as stipulated in the constitution. The Ministry being conscious of the importance of the agriculture sector to national and counties' economy; and the livelihood of the Kenyan people, has set to make the sector vibrant, innovative, transformed and modernized. This entails the use of technologies and diversification and commercialisation in crops, livestock production and fisheries activities.

Rice is the third most important staple crop in Kenya after maize and wheat and is grown in 23 Counties in the country. This subsector has received enormous support internationally and regionally through various initiatives with development partners. The Coalition for Africa Rice Development (CARD) initiative spearheaded by JICA and AGRA was launched during the Fourth Tokyo International Conference on African Development (TICAD IV) held in Japan in May, 2008 to promote rice production in Africa. Through this initiative the National Rice Development Strategy (NRDS) Phase 1 (2008-2018) was developed in the country with the objective of doubling rice production. This was achieved where paddy rice production tripled from 52,000-150,000 metric tonnes (MT) in 2016.

In the second Phase of CARD the objective is further doubling rice production in Africa; whereas in Kenya the objective is towards self-sufficiency and increase paddy rice production from 156,000 in 2018 to 1,301,000 MT by 2030. This strategy envisages a structure that will focus on core functions in commercialization of rice production, processing, value addition and market-driven approaches by public-private sector partnerships and all stakeholders.

This strategy sets the vision, mission, objectives and strategies that the ministry will pursue in implementation with the aim of facilitating growth and development of the rice subsector. It will form the basis of which work plans will be formulated at national and counties' and functional units.

The NRDS Phase 2 will be an instrument of value proposition for development partners, private sector investors, and national and county governments.



Hon. Peter Munya, M.G.H
Cabinet Secretary
Ministry of Agriculture, Livestock, Fisheries and Cooperatives

PREFACE

Agricultural transformation is critical to the growth of Kenya's economy. This involves modernization of on-farm production and value addition thus increasing farmer incomes and reducing the cost of food, alleviating poverty and therefore delivering 100% food and nutrition security.

The Agriculture Sector Stakeholders have developed the Agricultural Sector Growth and Transformation Strategy (ASTGS) to guide the sector towards the envisaged transformation. ASTGS is based on the belief that food security requires a vibrant, commercial and modern agricultural sector that supports Kenya's economic development sustainably and its commitment to regional and global growth. ASTGS prioritizes three anchors with nine flagships to drive the 10-year transformation. This includes increase in farmer incomes; increase in agricultural output and value addition; and increase in household food resilience.

The importance of rice as a staple food crop has continued to grow over the years. This has led to rising demand and consumption of the commodity compared to other cereals. Rice was classified as a food security crop from 2008 leading to development of NRDS Phase 1 to promote its production. The Ministry has endeavoured to develop a comprehensive, practical and all-inclusive National Rice Development Strategy (NRDS Phase 2) for the period 2019-2030. The strategy focuses on what the actors intend to accomplish and how resources will be directed towards realizing the desired goals within the given time frame.

In this regard cognizance has been taken of the new organizational structure bearing in mind the two levels of government and is designed to meet the challenges of expanding rice production for food and nutrition security and increased incomes. The process of preparing the strategy has involved consultations between the National Government, County Government, Development Partners and other stakeholders in the rice subsector. Account has been taken of the past policies on rice and various government strategies aimed at the development of the agricultural sector and the economy besides food and nutrition security as a whole.

We wish to recognize the support of the government and Cabinet Secretary for Agriculture, Livestock Fisheries and Cooperatives Hon Peter Munya, not only in the process of developing this NRDS Phase 2 but also the support accorded to the Rice Promotion Programme and rice farmers.

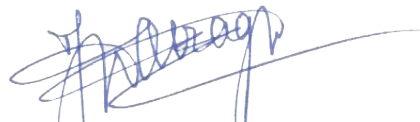
The Government has also planned to provide local market through purchase of rice for the Strategic Food Reserve and local consumption through the Kenya National Trading Corporation. We are also grateful for the technical support and guidance given to the taskforce by the outgoing director Crop Resources, Agribusiness and Market Development Dr. Johnson W. Irungu.

It is our sincere hope that this strategy will meet the expectations of the National and County Governments, Development Partners, the Private sector, but more importantly, the needs of the farming community, producers, processors and others in the rice subsector who wholeheartedly participated in National Rice Stakeholders consultative meetings.

Prof. Hamadi Iddi Boga, PhD.
Principal Secretary

State Department for Crop Development and Agricultural Research

Ministry of Agriculture, Livestock, Fisheries and Cooperatives



Joseph Irungu, CBS
Principal Secretary

State Department for Water, Sanitation and Irrigation

Ministry of Water, Sanitation and Irrigation

ACKNOWLEDGEMENT

The National Rice Technical Committee (NRTC) is grateful to the Cabinet Secretary for Agriculture, Livestock Fisheries and Cooperatives Hon. Peter Munya, for the facilitation accorded to the team during the strategy development process. In addition, NRTC appreciates the technical support and guidance by Dr. Johnson W. Irungu, Director Crop Resources, Agribusiness and Market Development.

Special thanks go to the Coalition for African Rice Development (CARD) for their financial support and guidance throughout the development of the strategy. Specifically, the NRTC acknowledges the CARD secretariat led by Dr. Haneishi Yusuke and formerly by Mr. Satoyama Takanori as well as the Consultant Dr. Arumugam Kathiresan.

The NRTC further acknowledges JICA-Kenya Office; Former agriculture sector Kenya advisor Dr. Masahiko Murakami and Ms Ai Wakamiya, for their financial and technical support towards the preparation of the strategy. We also extend our gratitude to all County Governments in the rice producing regions for their participation and contributions during the entire strategy development process.

In addition, the NRTC extends its sincere gratitude to all those who participated in the stakeholders validation workshop including: AATF, IRRI, AFA, KEPHIS, MRGM, NIA, JASSCM, NCPB, LBDC, AfricaHarvest, NAAIAP, Ministry of Water and Irrigation, Kisumu Rice Stakeholders Forum, County Governments, and participants from the planning, policy, mechanization & agri-business units of the MoALF&C for their invaluable and insightful contributions and feedback.

Much appreciation goes to the Rice Promotion Programme (RiPP) team and the able officers from partner institutions for their hard work and commitment during the preparation of the strategy. Specifically, the NRTC wishes to acknowledge its Chairman Prof. John C. Onyango, together

with other members; Prof. Christopher L. Kanali, the Late Eng. John K. Kibe, Eng. Fredrick K. Muga, Mrs. Marion Gathumbi, Dr. Mary M. Mutembei, Mr. Raphael Kitonyi, Mr. Godwin G. Kuria, Ms. Lydiah M. Atiti, Dr. Raphael Wanjogu, Mr. Vincent K. Koskei, Dr. John M. Kimani, Mr. Washington O. Kouko, Mrs.Winnie Kore, Dr. Wilson A. Oyange, Mr. Kennedy Wekulo, Mr. Phanuel Webi, Mr Jacob Cheptaiwa, Mr. Joseph Maina (MRGM), Ms. Jane Njeru for design and layout of the document and finally Mrs. Emma Bosire and Mrs. Susan Warutere for their invaluable support services.

Finally, the NRTC is looking forward towards the successful collaboration during the implementation period.

Jane K. Ndungu
Head Rice Promotion Programme
State Department for Crop Development and Agricultural Research

ABBREVIATIONS

AATF	African Agricultural Technology Foundation
ADG	Agribusiness Development Group
AFA	Agriculture and Food Authority
AFC	Agricultural Finance Corporation
Afritech	Afritech Seed Company
AGRA	Alliance for a Green Revolution in Africa
ASAL	Arid and Semi-Arid Lands
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASTGS	Agriculture Sector Transformation and Growth Strategy
AU	African Union
CAADP	Comprehensive African Agricultural Development Program
CaDPERP	Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes
CARD	Coalition for African Rice Development
CBOs	Community Based Organizations
CET	Common External Tariff
CGA	Cereal Growers Association
COG	Council of Governors
COMESA	Common Market for Eastern and Southern Africa
CRSF	County Rice Stakeholder Forum
DAP	Di-Ammonium Phosphate
EA	East Africa
EAC	East African Community
ECAAT	Eastern and Central Africa Agricultural Transformation Project
ECARRN	Eastern and Central Africa Rice Research Network
FAO	Food and Agriculture Organization
FARA	Forum for Agricultural Research in Africa

GAPs	Good Agricultural Practices
GDP	Gross Domestic Product
GoK	Government of Kenya
ICREA	International Centre for Research and Education in Agriculture
ICT	Information Communication Technology
IFAD	International Fund for Agricultural Development
IRRI	International Rice Research Institute
IWUAs	Irrigation Water Users Associations
JASCCM	Joint Agriculture Sector Consultation and Cooperation Mechanism
JICA	Japan International Cooperation Authority
JIRCAS	Japan International Research Centre for Agricultural Sciences
KAFACI	Korea-Africa Food and Agriculture Cooperative Initiative
KALRO	Kenya Agricultural and Livestock Research Organization
KEBs	Kenya Bureau of Standards
KENAF	Kenya National Farmers Federation
KEPHIS	Kenya Plant Health Inspectorate Services
KMD	Kenya Meteorological Department
KNTC	Kenya National Trading Cooperation
KNCCI	Kenya National Chamber of Commerce and Industry
KRRF	Kenya Rice Researchers Forum
KSCo	Kenya Seed Company
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
MFI	Microfinance Institution
MIAD	Mwea Irrigation Agricultural Development Centre
MoALF&C	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
MoT&ED	Ministry of Trade and Enterprise Development
MoTIH&UD	Ministry of Transport, Infrastructure, Housing and Urban Development

MoWS&I	Ministry of Water, Sanitation and Irrigation
MoU	Memorandum of Understanding
MRGM	Mwea Rice Growers Multipurpose Co-operative Society
MTEF	Medium Term Expenditure Framework
MWSI	Ministry of Water, Sanitation and Irrigation
NAAIAP	National Accelerated Agricultural Inputs Access Programme
NAIP	National Agriculture Imagery Program
NCPB	National Cereals and Produce Board
NEMA	National Environment Management Authority
NEPAD	New Partnership for Africa's Development
NFNSP	National Food and Nutrition Security Policy
NGOs	Non-Governmental Organization
NIA	National Irrigation Authority
NLC	National Land Commission
NRDS	National Rice Development Strategy
NRSF	National Rice Stakeholders Forum
NRTC	National Rice Technical Committee
NWHSA	National Water Harvesting and Storage Authority
PARDA	Partnerships for Sustainable Rice Systems Development in Sub-Saharan Africa
PPP	Private Public Partnership
R&D	Research and Development
RDA	Research Data Alliance
RiceMAPP	Rice-based and Market-oriented Agriculture Promotion Project
RIPP	Rice Promotion Programme
SDCD	State Department for Crop Development and Agricultural Research
SFR	Strategic Food Reserve
SMAEs	Small and Medium Agricultural Enterprises
SRI	System of Rice Intensification

STAK	Seed Trade Association of Kenya
TARDA	Tana and Athi Rivers Development Authority
TF	Task Force
TICAD	Tokyo International Conference on African Development
UDR	Urea Deep Placement
UNCED	United Nations Conference on Environment and Development
WARDA	West Africa Rice Development Association (Now AfricaRice Centre)
WB	World Bank
WFP	World Food Programme
WSRC	Water Saving Rice Culture

EXECUTIVE SUMMARY

Rice is currently the third important staple crop after maize and wheat in Kenya. It can be considered as an alternative cereal to supplement maize as it is preferred by households in ASAL regions (WB 2011).

Despite the achievements in the last decade of NRDS Phase 1 (2008-2018) in doubling rice production, the consumption has continued to rise thus creating a deficit which is met through imports causing a high import bill. The increase in demand is attributable to the changing eating habits coupled with a growing population with high consumption by the youth. To meet this demand and reduce the import bill, calls for hard work among all stakeholders towards increasing production for self-sufficiency. This is achievable through expansion of area under rice production as well as increased productivity based on the identified interventions therein.

During the NRDS Phase 2 implementation the actual irrigated area is targeted to increase from 32,988 - 171,676 Ha (table 5) while rainfed production area is targeted to increase from 10,631 - 42,000 Ha by 2030. Paddy rice productivity under irrigation is targeted to increase from the current average of 4.0 to 7.5 t/Ha, rainfed upland from 1.5 to 2.5 t/Ha and rainfed lowlands from 2.0 to 3.5 t/Ha.

This NRDS targets to address various challenges faced by the stakeholders in the rice value chain and offers various opportunities for increased production and productivity. These challenges include high costs of production (seed, fertilizers, chemicals, machinery, labour); lack or access to these inputs; lack of credit facilities; erratic weather and water supply; high harvest and post-harvest losses; poor infrastructure in irrigated ecologies; poor market and market infrastructure; paddy flight to neighbouring countries and low rice value addition; among others.

The interventions include development and dissemination of improved production technologies, introduction of high yielding rice varieties, efficient irrigation water management, up scaling of mechanization along the value chain, improved knowledge and skills on harvest and postharvest handling and value addition in rice and rice by-products. Research and extension will play a key role in ensuring that this objective is met. To address nutrition issues, deliberate efforts will be made to ensure production and consumption of nutritious rice meals. It is with this in mind that the NRDS Phase 2 (2019-2030) has been developed.

The NRDS Phase 2 will build on achievements made in phase 1 which included use of hybrid seeds, development of the Water Saving Rice Culture, improved mechanization along the rice value chain, development and release of improved varieties, development of rice seed distribution system, capacity building for staff and farmers, construction of two rice research laboratories and improved networking among others.

It is notable that about 80% of rice in Kenya is mainly grown in irrigation schemes by small scale farmers while the rest is produced under rain-fed conditions. The producers are highly fragmented which poses a challenge in meeting quality and quantity requirements for development of an efficient marketing system. The Mwea Rice Growers Multipurpose Cooperative Society (MRGM) based in Mwea Irrigation Scheme is a good example of how farmers can benefit from organized rice farming.

Currently, as part of the gazette notice of the Public Finance Management (Strategic Food Reserve Trust Fund) Regulations 2015, the strategic food reserve includes maize, beans, rice, fish, powdered milk and canned beef. However, since 2015, the majority of the purchases have been for maize (>95%) with the rest of the purchases consisting of beans and powdered milk. The Government through a presidential directive through Kenya National Trading Corporation (KNTC) in the Ministry of Trade and Enterprise Development will be purchasing rice with a revolving fund of six hundred and sixty million in the major rice growing areas of West Kano and Mwea for purchase by local institutions in the country. This implies there will market for locally produced rice.

The NRDS proposes formation of a Rice Council of Kenya that will increase private sector involvement in the rice value chain and mobilise funding to address the challenges. Mobilisation of a Rice Millers Association of Kenya will be done and the forum created to coordinate issues of mechanisation in the value chain. It is also expected that this increase will create 100 new enterprises along the rice value chain and 3 new producer marketing organization formed thus creation of employment and increase in the country's gross domestic product. Value addition in rice and rice by-products will also be promoted so as to have at least three new value added products developed.

The achievement of rice self-sufficiency as envisaged in this strategy will require cooperation of all rice stakeholders. The strategy encourages private sector participation along the value chain to unlock key areas.

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1. INTRODUCTION

Rice (*Oryza sativa* L.) domestication is thought to have occurred in China before spreading to other parts of Asia, Europe and Latin America (Vaughan et al, 2008). There are two main cultivated species, *Oryza sativa* L. and *Oryza glaberrima* L. where *Oryza sativa* L. is the most commonly cultivated (MOA and JICA, 2011). Globally, the crop occupies about 158 million hectares producing 470 million tons of milled rice mainly in Asia where China and India are the leading producers (IRRI, Africa Rice, and C.I.A.T, 2010). It is a major staple food crop for almost half of the world population mainly living in developing world (FAO, 2008). The demand for rice is expected to continue increasing based on changing food preferences and rising urban population. In sub-Saharan Africa, rice is produced in five main ecosystems, namely rain-fed uplands, rain-fed lowlands, inland swamps, irrigated ecosystem and mangrove swamps (Norman and Otoo, 2003).

Rice is grown by small and medium scale farmers as a cash crop in East and Southern Africa and for subsistence in Western Africa (ARC, 2006; Keya et al., 2008). The crop was introduced in Kenya in 1907 from Asia. About 80% of rice grown in Kenya is from irrigated ecologies established by the Government and communities, while the rest is produced under rain-fed conditions. The crop is ranked as the third most important cereal after maize and wheat (GOK-NRDS, 2008).

Rice per capita consumption in Kenya from 2008-2018 increased from 12.7 to 20.6 kg due to increase in population and change in eating habits. Rice imports accounts for 90% of this consumption valued at Kshs 26 billion (Economic Survey, 2019).

Various efforts have been made to reduce the gap in local rice production but there exists challenges facing the subsector which affects the achievements. Some of these challenges include; unfavourable weather, inadequate water for irrigation, inadequate credit facilities, limited access to mechanization, limited improved varieties, poor irrigation infrastructure, unorganized marketing systems, high postharvest losses, low productivity, weak farmer organizations, high cost of inputs, inadequate policy framework, among others. On average rice farm sizes range from 0.25-4.0 acres (0.1-1.6 Ha). These farmers are not well organized with low rice value addition at the farm level.

2. REVIEW OF THE NATIONAL RICE SUBSECTOR

The government prioritizes food and nutrition security as a policy agenda that is articulated in the Kenya Vision 2030, the "Big Four Agenda (2018-2022)" and the Third Medium Term Plan (2018-2022) through modernization of agriculture sector. The policy agenda is anchored in the Kenyan devolved government structure, the United Nations' Sustainable Development Goals and Comprehensive Africa Agriculture Development Programme (CAADP) towards agriculture growth and transformation. Part of the envisaged 10% economic growth in Kenya Vision 2030 is expected to come from the agriculture sector through transformation from subsistence smallholder agriculture to an innovative commercially oriented modern sector.

In line with this, rice has been identified as one of the priority value chains in the National Agriculture Investment Plan (NAIP 2018-2028), which seeks to accelerate Kenya's agricultural transformation towards a commercial and modern sector that sustainably supports the country's food and nutrition security and socio-economic development.

This is also emphasized in the Agriculture Sector Transformation and Growth Strategy (ASTGS 2019-2029) in which rice has been identified as an important value chain among the staples for transforming agriculture beyond food production. Furthermore, Article 43 of the Constitution of Kenya (2010) states that "Every person has the right to be free from hunger, and to have adequate food of acceptable quality". Providing food and nutrition security to all Kenyans is therefore a national mandate. Rice is expected to play a key role in meeting this objective.

In the first Phase of NRDS (2008-2018), various milestones were achieved in production, productivity, mechanization, seed system, technology development and adoption of new varieties. The overall objective was to double rice production from 52,000 MT in 2008, but by 2016 it had been tripled to 150,000 MT (NRDS Evaluation Report, 2018). However, consumption of rice rose steadily thus widening the gap between supply and demand.

There were notable achievements during NRDS Phase 1 which include;

1. Modification of the System of Rice Intensification (SRI) to Water

Saving Rice Culture (WSRC) with remarkable improvement in yield by 13% compared to the conventional system of cultivation

2. Urea Deep Placement (UDR) resulting in yield increase by 18% and reduction in fertilizer use by a third
3. Improved mechanization in rice farming through introduction of weeders, threshers, and combine harvesters. This has improved the efficiency and reduced losses during harvesting and post harvesting by 2.4%
4. Two (2) state of the art rice research laboratories were constructed at KALRO Mwea and KALRO Kibos
5. Development and release of improved rice varieties as presented in Appendix 1
6. Development of a certified seed production and distribution system
7. Capacity building for researchers, extension staff and farmers both locally and internationally
8. Improved stakeholder networks; one national rice farmers' apex association was formed, with 23 similar representations in the 23 rice producing counties. However, this network is weak and needs to be strengthened
9. Frequency of monitoring and evaluation increased by 50%
10. Collaboration with development partners in research and mechanization
11. Rehabilitation and expansion of irrigation infrastructures
12. Access to credit was improved by 6.6% and 1.3% in irrigated and rainfed ecologies, respectively
13. Sharing of rice research findings and progress through platforms such as Kenya Rice Researchers Forum (KRRF), and CARD regional meetings: an average of one (1) meeting was held every two years
14. Access to quality extension service improved by 21% and 25% in irrigated and rain-fed ecologies respectively

2.1 Typology and number of rice farmers, processors and traders

In Kenya, rice is mainly produced under irrigation by small-scale farmers in counties that include: Kirinyaga (Mwea), Busia (Bunyala), Tana River (Tana Delta, Bura), Kwale (Vanga cluster), Kisumu (Ahero, West Kano, South West Kano, smallholder irrigation schemes within Kano Plains), Migori (Lower Kuja), Homa Bay (Maugo, Oluch Kimira), Siaya (Anyiko), and Taita Taveta (Kimorigho, Buluma).

Rice is also grown under rain-fed conditions in Busia, Bungoma, Kakamega, Kwale, Kilifi, Meru, Isiolo, Migori, Baringo and Murang'a and about 300,000 rice farmers provide labour and also earn their livelihood out of the crop's production (NRDS 1).

For rice milling and processing, there are various rice mills spread across the country with varying capacities between 1 and 3.5 tons/hour. Majority of these mills are located within the Mwea Irrigation Scheme where most of them are privately owned with fewer that are publicly owned.

The Mwea Rice Growers Multipurpose Cooperative Society (MRGM) is the largest farmer- run cooperative within the Mwea Irrigation scheme in Kirinyaga County. The other large mills include: government-owned Mwea Rice Mills (MRM) and National Cereals Produce Board (NCPB) in Kirinyaga County, TARDA in Tana River as well as Western Rice Mills and Lake Basin Development Company in Kisumu. There are eight large private mills in Kirinyaga and one in Kiambu (Capwell Industries). In addition, there are several small privately owned mills spread across the major rice growing Counties.

The major outlets for the milled rice are supermarkets, institutions and individual consumers. The retail marketing of the milled rice in the local market is dominated by women traders. Women also take part in planting and transplanting activities, the youth are usually involved in mechanized farming as opposed to men who engage in manual work (i.e., transport, produce loading/offloading and hiring of mechanization services (PARDA project baseline survey report, 2018).

2.2 Consumer preferences and demand projections

Kenyan consumers prefer aromatic rice varieties which have a niche market especially amongst households with improved incomes. However,

the retail price of these varieties are prohibitive. Though imported rice is of superior quality in terms of purity and percentage of broken grains compared to the local non-aromatic, it is usually cheaper. Nonetheless, preference for the locally produced non-aromatic rice is higher, especially in Kirinyaga County. It is assumed that this preference is due to satiating qualities of the BW variety grown in Mwea for local consumption.

The per capita consumption of milled rice has risen from 12.7 kg in 2016 to 20.6 kg in 2018 which has increased rice consumption to 949,000 MT (Economic Survey 2019). The expected consumption in 2030 is over 1,292,000 MT. This demand is anticipated to be met through local production unlike the current situation where the difference is achieved through imports. This achievement is projected to have a positive impact on household incomes, increased employment, and increased contribution to the national economic growth.

2.3 Rice Productivity Trends by ecosystems in Kenya

During the NRDS 1 implementation, total rice paddy production tripled in 10 years (NRDS 1 evaluation report). Figure 2.1 shows rice production trends for three ecosystems (i.e., rain-fed upland, rain-fed lowland and irrigated) in Kenya between 2008 and 2016). In general, productivity increased steadily within this period for the three ecosystems.

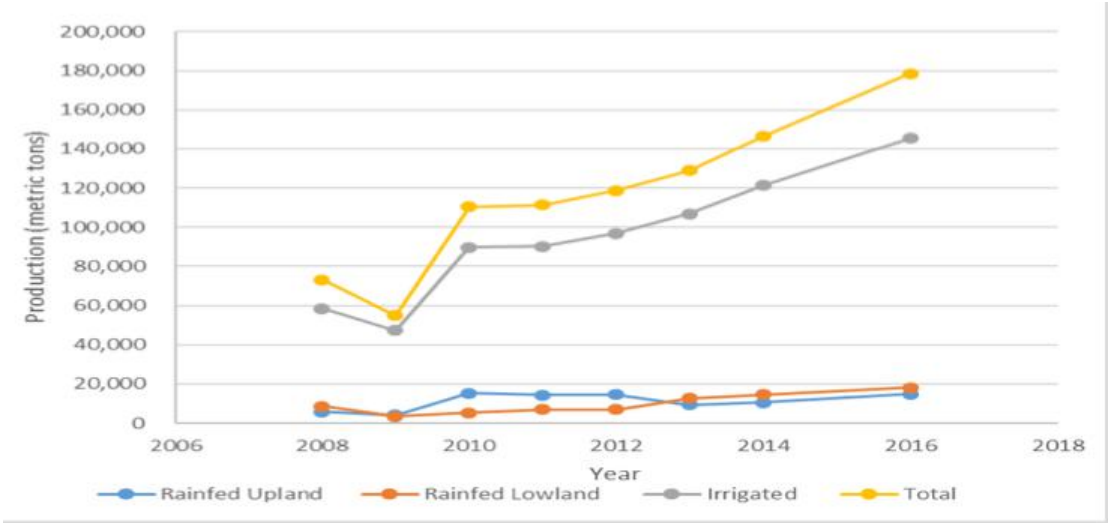

Figure 2.1: Rice production trends by ecosystems in Kenya

(Source: NRDS 2008-2018 evaluation report)

In addition, increased yield per unit area was achieved through promotion of improved varieties, distribution of high quality seed, water management techniques and integrated disease, insect pest and weed management as well as a strong extension services system among others (Figure 2.2).

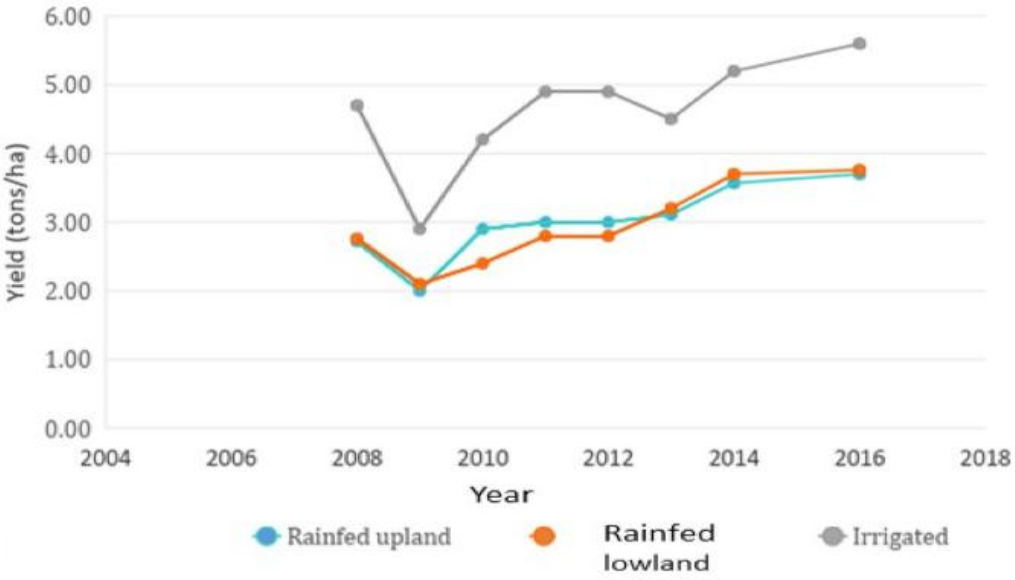

Figure 2.2: Rice yield trends by ecosystems in Kenya.

(NRDS 2008-2018 evaluation report)

3. VISION AND SCOPE OF NRDS PHASE 2

3.1 Goal

To enhance national food and nutrition security through increase in rice production, value addition and marketing.

3.2 Vision

A dynamic rice industry for improved economic growth and sustainable livelihoods.

3.3 Mission

To increase rice production and market competitiveness through increased productivity and area under cultivation, in collaboration with stakeholders.

3.4 Specific objectives

The overall objective is to increase domestic milled rice production by 7-fold from 128,000 MT in 2019 to 846,000 MT by 2030 through:

1. Expansion of physical area under rice cultivation from 43,619 Ha in 2018 to 174,000 Ha in 2030 (areas under irrigation from 32,988-132,000 Ha, rain-fed lowland from 6,400-35,000 Ha and rain-fed upland from 4,231-7,000 Ha)
2. Increased on-farm productivity of rice cultivated under irrigation from 4.0 to 7.5 t/Ha, rain-fed lowland from 2.0 to 3.5 t/Ha, rain-fed upland from 1.4 to 2.5 t/Ha
3. Reduction of the import bill by reducing importation of milled rice from 625,000 MT in 2018 to negligible by 2030 through increased production and market competitiveness of locally produced rice
4. Promotion of private sector participation in agribusinesses by adding at least 100 micro, small and medium enterprises in the rice value chain, at least 3 new value-added rice products and at least 3 new producer-marketing organizations

4. CHALLENGES FACING THE RICE SUBSECTOR AND EXISTING OPPORTUNITIES

4.1 Overview

Kenya imports 90% of its rice demand (KNBS-Economic Survey, 2019), implying that the country is a net importer to meet its annual demand and ready domestic market. There is a huge potential to produce enough rice and even export if the right production practices and policies are put in place and implemented. To attain the above, there is need to promote the use of: recommended agronomic management practices, high yielding rice varieties with desirable consumer-preferred traits, improved mechanization, reduced post-harvest losses and intensified rice production in all ecologies. In addition, it is necessary to put in place functional seed system, enable farmers have access to credit facilities and organize farmer groups. Finally, provision of organized storage, milling and marketing structures with supporting policies is paramount.

4.2 Specific challenges and interventions

Despite the above mentioned huge economic potential, the rice sub sector faces a lot of challenges and corresponding opportunities/interventions as indicated in Table 4.1.

Table 4.1: Challenges, opportunities and interventions in the rice value chain

S/No.	Issue	Challenge	Opportunity/Interventions
1.	Inadequate policy and institutional legal framework	Inadequate, uncoordinated and fragmented policies and institutional legal framework in the rice subsector	Develop participatory policies and legal frameworks to address gaps in the rice value chain
			Harmonization and periodic review of policies and institutional legal framework
		Weak funding for implementation of NRDS	Mainstream and develop project proposal for funding of NRDS state entities (RIPP)
2.	High cost of inputs and labour during production	Limited government input subsidy quota	Review of legislation governing agriculture sector subsidy program and favourable tax regime for agricultural inputs
		Low level of mechanization in rice sector	Encourage use of machineries through favourable tax regime
3.	Poor market efficiencies	Disorganized marketing systems	Use of early market-based warning systems to guide policy makers
			Enhanced border controls
			Group formation (farmers, processors, etc.) and strengthening of the existing ones
4.	Low competitiveness of locally produced rice	High price of locally produced rice compared to imported rice	Enforcement of rice quality standards
		Adulteration of local aromatic rice	Improve efficiency along the rice value chain
		Poor quality of local rice	
5.	Low adoption of mechanization across the value chain	Limited access to machinery	Facilitate access to appropriate affordable machinery across the value chain

S/No.	Issue	Challenge	Opportunity/Interventions
6.	Unfavourable weather conditions	Due to climate change and variability, weather patterns are becoming unpredictable with shifts in the onset of rains, prolonged dry periods, and extreme cold weather for rice production in traditional rice growing regions. This also influences the pest and disease dynamics, as well as other emerging issues like salinity, flooding and weeds	Development and promotion of climate resilient technologies and mitigation of climate change effects
			Avail timely weather advisory services and early warning systems
			Development of rice suitability atlas
			Introduce and implement rice crop insurance
			Capacity building and promotion of newly improved released varieties
7.	Inadequate water for irrigation	Limited amount and unreliable irrigation water	Upscaling water harvesting structures (dams, reservoirs) and water saving technologies; Convert pump irrigation to gravity fed irrigation system.
8.	Slow adoption of new improved varieties	Inadequate promotion of newly released varieties	Capacity building and promotion of newly improved released varieties
			Enhanced seed availability
		Lack of consumer-preferred traits in these varieties	Breeding for consumer-desired traits to replace the old varieties through product profiling
		High cost of seed and maintenance of the hybrid crop	Capacity building on the benefits of hybrid rice production.
9.	Low and declining land productivity	Continuous cropping has led to a decline in soil nutrient fertility	Provision of inorganic fertilizer through government subsidy program based on soil analyses results
			Capacity building and enhanced awareness on best soil management practices

S/No.	Issue	Challenge	Opportunity/Interventions
10.	Poor infrastructure	Poor and limited access roads	Create a conducive platform to upgrade all infrastructures in rice growing ecologies through public private partnerships
		Loss of irrigation water through seepage	
		Difficulties in usage of machinery in boggy paddy fields	
11.	Transboundary/ regional issues	Movement of quarantine pests and diseases	Enforcement of existing trans boundary regulations
		Unorganized internal rice market leading to paddy flight to neighbouring countries	Capacity building farmers on market and market organization
			Regulation of rice flow in regional markets (e.g., COMESA)
12.	Low human and institutional capacities for rain-fed rice systems	Rice production is new in most rain-fed ecologies	Capacity building of the value chain actors
13.	Harvest and post-harvest losses	High grain loss during harvesting and post-harvest handling	Promote appropriate and efficient harvesting and post-harvesting technologies
14.	Low milling capacities	Non availability of milling plants in most rice-growing ecologies	Encourage private sector investment
			Provision of subsidized milling plants/machines through public private partnerships
			Proper stakeholder involvement in policy development process
15.	Limited access to affordable credit facilities	Farming credit facilities are expensive due to high interest rates	Forming producer business groups and strengthening of existing farmer cooperative societies and groups
		Lack of collateral	Rice value chain financing through a commodities fund
		Lack of awareness	Creating awareness on sources of credits

S/No.	Issue	Challenge	Opportunity/Interventions
16.	Low number of SMAEs and Limited value-added products in rice	Low product range and choice	Develop a wide range of rice products and by-products
			Capacity build entrepreneurs
			Rice branding
			Agribusiness promotion along rice value chain
			At least 100 new enterprises in rice value chain
			At least 3 new value-added rice products and
			At least 3 new producer-marketing organizations based on rice production clusters/regions
17.	Farmer organization	Weak/ lack of farmer organizations	Capacity build farmers to create vibrant groups that are able to access all the services along the value chain
18.	Low funding	Limited Implementation of planned activities and interventions	Improved funding from government and public- private partnerships
		Inadequate research	Broaden the participation of development partners
19.	Health care services and environmental concerns	Lack of sanitation facilities	Collaboration with health service providers
		Lack of awareness on disease prevention	Creation of awareness on disease prevention
			Provision of sanitation facilities in the irrigation schemes
20.	Vertebrate pests: Quelea quelea, rats	Damage and rice grain losses	Well-coordinated early warning systems by counties
			Improved facilitation for the Counties and National crop protection unit
21.	Lack of reliable data	Lack of baseline data	Conduct a rice value chain analysis
		Poor data collection and reporting mechanisms	Develop a data collection and reporting mechanism

S/No.	Issue	Challenge	Opportunity/Interventions
22.	Dissemination of technologies	Poor infrastructure on technology dissemination	Develop packages on rice technologies for dissemination using various platforms
			Strengthen the extension framework in the counties
			Stakeholder networking for sharing of information

4.3 Lessons Learnt in NRDS Phase 1

The lessons learnt in Phase 1 implementation include:

- Farmers responded positively by increasing rice production despite challenges in marketing and other value chains segments especially with high production costs
- Where production was substantial, the private sector played a big role in processing, marketing and in other value chain services
- Mechanization of the rice value chain, especially, the use of combine harvesters was upscaled in Mwea Irrigation Scheme under RiceMAPP (2012-2017) that resulted to reduction in harvest losses, and enhanced yields with better returns to investment
- Investment by private sector in rice milling and transport increased
- Farmer organization and marketing continue to be key challenges
- Financial access and support along the rice value chain remains low
- Access to inputs and markets are key to increased farmer incomes

5. PRIORITY AREAS AND APPROACHES

Kenya has expansive rice cultivation areas under irrigated, rain-fed lowland and upland rain-fed ecologies. There are 23 Counties with suitable agro-climatic conditions and potential for increased rice production that include; Kirinyaga, Kisumu, Busia, Migori, Homa Bay, Bungoma, Siaya, Kilifi, Kwale, Taita-Taveta, Lamu, Tana River, Embu, Murang'a, Isiolo, Elgeyo-Marakwet, West Pokot, Turkana, Baringo, Kakamega, Meru, Tharaka- Nithi and Garissa with varied rice priority ecologies. However, there is high untapped potential that need further expansion in these counties like Taita-Taveta, Tana River, Kisumu, Migori, Siaya, Homa Bay among others although additional counties with restrictions on weather conditions can be brought into rice cultivation through introduction of new technologies like cold and salinity tolerant varieties.

5.2 Opportunities in prioritized ecologies

To increase rice production and productivity in order to attain domestic milled rice target of 7-fold by 2030, this strategy has identified priority areas of focus in the different rice ecologies.

The highest cultivation potential and priority areas for increased and sustainable rice productivity, profitability and on-farm job creation do exist under irrigation schemes. However, due to capital investment challenges, rice production in rain-fed areas will be encouraged for expansion to meet its ever-increasing demand.

The Government through the National Irrigation Authority (NIA) has initiated development of several new large-scale irrigation schemes and dams in the country. Community based irrigation schemes also augment rice production in the country. There is also need to rehabilitate and maintain existing infrastructure. As a long-term measure, this will not only improve productivity, profitability and climate resilience but also allow crop intensification and achieve food and nutrition security. Irrigation schemes will be expanded and/or newly developed by 99,012 Ha in areas where soil and other agro-climatic conditions favour rice production.

Under irrigated ecosystem, opportunities exist in growing other crops such as grain legumes and vegetables using residual moisture. This will enable rice farmers to raise their farm income, enhance family nutrition, and enable incorporation of aquaculture production systems.

There is need to increase production under rain-fed areas through expansion of area, promotion of certified seeds, on farm water harvesting for supplementary irrigation, improved harvest and post-harvest handling, and promotion of mechanization along the value chain. In addition, intercropping can be introduced in upland rain-fed ecologies.

The target total area under rain-fed rice production by 2030 is 35,000 Ha for rain-fed lowland and 7,000 Ha for rain-fed upland. However, there exists opportunity in rice production which is more profitable than other arable crops, especially under waterlogged conditions. Rice also offers comparably higher number of on-farm and off-farm job opportunities especially for women and youth due to the many management operations there are compared to other cereal crops like maize and wheat hence holds wider scope for poverty reduction in rural areas.

There are vast lowland areas in Bungoma, Busia, Siaya, Kisumu, Kakamega, Kilifi, Kwale, Meru, Isiolo, Migori, Homa Bay, Embu, Elgeyo-Marakwet and Lamu. These areas are suitable for growing rainfed rice that can ratoon and even double cropped. Provisions for individual and/or community-based water storage and rivers can be used for supplementary irrigation.

Capacity building of extension agents and farmer organizations on rice production technologies like use of high yielding certified seeds, stress tolerant and market-oriented varieties, processing, value addition and value-added products with linkages to the markets will also be addressed. There are also problems of low soil fertility, diseases (especially blast and rice yellow mottle virus), insect and vertebrate pests (white stem borer, stalk eyed fly; Quelea quelea birds, rodents) will be addressed. Use of fertilizers and agro-chemicals in irrigated and rain-fed ecologies will also be encouraged through public/private investments (production, agro-dealerships).

In both ecologies, the key focus areas will be to expand area under rice cultivation, raise on-farm productivity, increase local rice competitiveness and promote agribusiness along rice value chain (Table 5.1).

Table 5.1: Priority objectives and approaches

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
1. Expansion of area under rice cultivation	Irrigation infrastructures (Rehabilitation of existing and development of new schemes)	Irrigated: expansion from 32,988 Ha to 171,676,000 Ha	• Rice yields (and hence the profitability) are higher under irrigation • Irrigation allows crop intensification and thus achievement of food and nutrition security and income • Strengthens climate resilience • There are opportunities to use the residual moisture for growing other crops which can enhance food and nutrition security and farm income	Irrigation schemes will be expanded and/or newly developed in areas where the soil and other agro-climatic conditions favour rice production. Planned areas for expansion are as follows (***current area is in brackets)***. • Mwea (Kirinyaga) - 5,500 (10,000) Ha • Lower Nzoia (Busia and Siaya) - 9,570 (900) Ha • Lower Sio (Busia) - 6,600 (0) Ha • Yala swamp (Siaya) - 2,940 (4,600) Ha • Anyiko (Siaya) - 200 (50) Ha • Kano plain: Magwagwa dam (Kisumu) - 15,000 (0) Ha • Gem Rae - 90 (85) Ha • Nyachoda, Kopudo etc. - 0 (2000) Ha • Nyando (Kisumu) - 6,361 (4000) Ha • Chiga (Kisumu) - 180 (50) Ha • Kericho (Koru) - 6000 (0) Ha • Muhoroni (Kisumu) - 690 (500) Ha • Lower Kuja Phase 2 - Katieno dam (Migori) - 32,700 (0) Ha • Lower Kuja Phase 1 (Migori) - 7,800 (1000) Ha • Oluch Kimira (Homa Bay) - 600 (1400) Ha • Maugo (Homa Bay) - 400 (110) Ha • Perkerra (Baringo) - 4000 (1,338) Ha

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
				• Tana delta (Tana River) - 9045 (2,955) Ha • Bura (Tana River) - 3000 (2,500) Ha • Kora dam irrigation (Tana River) - 25000 (0) Ha • Kimorigo (TaitaTaveta) - 1500 (500) Ha • Buluma (TaitaTaveta) - 500 (200) Ha • Vanga cluster (Kwale) - 4000 (600) Ha • Jarajara and Rahole (Garissa) - 2,000 (200) Ha • Bura East (Garissa) - 28,000 (0) Ha **Total = 171,676 (32,988) Ha**
	Rain-fed areas	Rain fed-low land and upland: expansion from 10,631 to 42,000 Ha	• Rice is more profitable than other crops such as maize and tubers • Waterlogged areas can be better utilized through rice cultivation • Relatively higher number of on-farm and off-farm jobs can be created through rice cultivation (especially for women and youth) enabling poverty reduction in rural areas	Potential areas for expansion are as follows in the following counties with community based water storage and supplementary irrigation. • Bungoma • Busia (Teso North, Teso South and Nambale) • Kakamega • Kilifi (Kaloleni and Malindi • Kwale (Matuga, Msambweni and Lungalunga) • Meru (Tigania West and Tigania East) • Isiolo • Migori (Uriri and Awendo) • Homabay • Siaya • Embu • Elgeyo-Marakwet (Marakwet East and Marakwet West)

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
				• Lamu • West pokot (Sigor and Ortum) • TharakaNithi • Murang'a (Kiharu)
2. Raise on-farm rice productivity	Quality inputs and improved technologies	Irrigated from 4.0 to 7.5 t/Ha Rain-fed lowland from 2.0 to 3.5 t/Ha Rain-fed upland from 1.5 to 2.5 t/Ha	• Rice is more profitable than other crops such as maize and tubers • Waterlogged areas can be better utilized through rice cultivation • Relatively higher number of on-farm and off-farm jobs can be created through rice cultivation (especially for women and youth) enabling poverty reduction in rural areas	• Double cropping and ratooning • Capacity building of extension agents on rice production, processing and marketing • Provision of subsidies and seasonal credit • Promote of high-yielding, stress tolerant, market-oriented varieties • Increase the 'uptake' of certified seeds and hybrids, fertilizers and agro-chemicals in irrigated and rain-fed • Facilitate management of migratory pests • Facilitation of private investments in production and agro-dealerships (SMAEs)
	Appropriate mechanization			• Appropriation of cost-efficient machineries for sowing, weeding, transplanting, harvesting, drying and milling • Promote private investments and participation of youth in provision of hiring services, sales and after-sales services (SMAEs)

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
	Minimizing harvest and postharvest losses			• Promotion of use and maintenance of efficient machineries • Increase adoption of improved harvest and postharvest handling practices • Training on postharvest handling technologies such as parboiling (SMAEs)
	Soil and water management			• Organize soil testing in rice growing areas for appropriation of fertilizer usage • Upscale adoption of proven water saving technologies
3. Increase the competitiveness of locally produced rice	Reducing the cost of production	Reduce from Kshs. 56,585 to 40,000 per acre		• Increase on-farm mechanization • Optimization of application of farm-inputs • Organization of Agribusiness Development Groups for bulk procurements (SMAEs) • Promote local sourcing/manufacturing of inputs such as fertilizers, machineries, other resources/utilities
	Improving the quality of locally produced rice			• Promotion of good harvesting and postharvest handling practices (harvesting, drying, cleaning, milling, grading and packaging) [SMAEs] • Increased and organized private investments in trading, processing and marketing of paddy and milled rice (SMAEs)

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
	Promote efficient rice marketing and trading			• Increase the accessibility and availability of rice to consumers • Promoting linkages between farmers, farmer-based organizations, millers and markets • Facilitation of procurement towards National Strategic Food Reserve
4. Agribusiness promotion along rice value chain	Promote agribusiness environment and market channels, linkages	At least 100 new enterprises in rice value chain At least 3 new value-added rice products and At least 3 new producer-marketing organizations	Expansion of rice area to 112,000 Ha and productivity creates an opportunity for private sector investment along the value chain	• Provide an enabling environment for private sector investment along the rice value chain • Capacity build farmer organizations in rice value chain • Create an enabling environment (standards, regulations, infrastructure (roads, electricity)

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
	Input supply		• Govt. is promoting the uptake of inputs through subsidy (Flagship Project 2 in the ASTGS) – targeting 'high needs farmers' • Demand for inputs by rice farmers is rising (widening the scopes for marketing) • Scope for expansion of area under rice cultivation (and hence the market)	• Creating more demand for inputs through demonstrations and other extension services • Capacity building (training and trade fairs) for farmers, agro-dealers
	Hiring/service provision (machineries), Support services		• Availability of machineries is low in rice growing regions • Higher capital costs for the machineries which hinders the adoption of machineries	• Promotion of setting up of 'machinery hiring hubs' in rice growing areas • Facilitating finance (low interest schemes) for investments, especially by youth • Promotion of rice crop insurance • Increased technical back-stopping • Capacity building for operators, artisans and technicians

Strategic/ Specific Objective	Major Expectations	Targets (by 2030)	Rationale	Approaches
	Value Addition (rice products, by-products, packaging, branding)		• Allows increment in rice farm revenues (profitability of rice farming) • Creates job for women and youth • Reduces the losses/ wastages of grain and other by-products	• Capacity building of stakeholders • Promote entrepreneurships, especially youth & women, e.g., baling of straws for animal feeds • Technology support towards innovative products • Improve rural infrastructure such as electricity and roads
	Farmer based organizations		• Promotes efficient sharing of natural resources • Increases the connectivity between the farmers and markets (input, output) • Enhances the pace of technology adoption • Provides a platform for policy advocacies • Creates opportunity for aggregation of rice such as warehouse system	• Strengthen existing cooperatives and creation of Agribusiness Development Groups • Mobilize farmers and rural leadership committees • Facilitate linkages (including contractual agreements) with input suppliers, service providers (machineries, millers) • Capacity building (training workshops) on business and organizational skills • Promote warehouse receipting system in major rice producing regions
	Large scale (>1,000 Ha) private rice farms		• Provides the advantage of economies of scale • Faster deployment and efficient use of available natural resources (water, land) • Faster contribution to food and nutrition security (NRDS target)	• Provide enabling environment (guarantee/protected land ownership) • Provide amenities (road, power, water)

Based on the objectives and approaches highlighted in Table 5.1, the timeline for priority areas for interventions are summarized in Table 5.2. The short-term interventions are aligned and can be actualized within the time frame of the Big Four Agenda.

Table 5.2: Prioritized areas or intervention

Major Expectations	Importance		
	Short-term (2019-2022)	Medium (2019-2024)	Long (2019-2030)
1. Expansion of area under rice cultivation			
Irrigation infrastructures (rehabilitation)	XXX		
Irrigation infrastructures (new establishment)		XX	
Rain-fed areas	XXX		
2. Raise on-farm productivity			
Inputs, technologies	XXX		
Appropriate mechanization	XXX		
Minimizing harvest, postharvest losses	XXX		
Soil and water management		X	
3. Increase local rice competitiveness			
Reducing the cost of production	XXX		
Improving the quality of locally produced rice	XXX		
Promote efficient marketing/trading	XXX		
4. Agribusiness promotion along rice value chain			
Input supply	XX		
Hiring/Service provision (machineries), Support services	XX		
Value Addition (packaging, branding, by-products)		XXX	
Farmer based organizations	XX		
Large scale (>1,000 Ha) private rice farms		XX	

*KEY: **X** Important, **XX** Very important and **XXX** Extremely important*

5.2 Policies and Institutional Opportunities

Rice has been identified as a key strategic crop for food and nutrition security and income generation. Besides the existing policy documents on food and nutrition security, such as Vision 2030, ASTGS and NFNSP, the government developed NRDS to guide the promotion of rice subsector. Consumption outstrips production hence the need to focus on policies

and strategies that will enhance production in order to achieve self-sufficiency and import substitution. There are opportunities for harnessing the available water resources and expanding rice production areas. The government is committed to increasing food production as stipulated in its current development policies and has embraced Private-Public-Partnerships to encourage private sector participation and investment in business development services.

5.2.1 Technical Issues

The technical issues include: inadequate capacity building activities for researchers, extension staff and farmers on modern rice production techniques and utilization within the existing institutional systems. This creates opportunities for the following:

- Training institutions to undertake capacity building in rice competence-based courses
- Support and strengthen rice research and development institutions
- Hold Kenya Rice Researchers Forum once in every two years for information sharing
- Recruitment and retention of rice-trained extension officers in rice growing areas
- Institutions involved in quality assurance such as KEBS and KEPHIS to strengthen inspection and enforcement
- Formation of rice based lobby organisations to lobby for funds and support (Rice Council of Kenya and Rice Millers Association of Kenya)

5.2.2 Farm inputs, agricultural machinery and equipment

To render higher on-farm productivity and profitability through rice farming, there is a strong need:

- To increase accessibility to affordable farm inputs, agricultural machinery and equipment
- To introduce, test and develop appropriate agricultural machinery and equipment to improve efficiency in production

- For the National Government to continue to play a key role in rice variety development, maintenance and seed production in partnerships with county governments and other stakeholders
- To facilitate farmers to form groups to enjoy economies of scale in farm input and machinery acquisition
- To encourage private sector partnerships in farm inputs, machinery and equipment supply and maintenance

5.2.3 Credit support

Farmers and other actors along the rice value chain including input suppliers, agro-dealers, millers and traders need to be facilitated with adequate finance for their operations. In addition, financial management capacities and organizational management capacities need to be built so as to form Agribusiness Development Groups, cooperatives and produce based organizations that are linked to financial institutions to access credit and/or grants.

5.2.4 Infrastructural development

To enable a sustainable rice sub sector development, the following infrastructure interventions need be considered, amongst others:

- Improvement and development of research facilities in KALRO and other rice related institutions such as Universities, NIA, and Regional Development Authorities
- Improvement of feeder roads, transport facilities and access to electricity in rice growing areas
- Enhancement of irrigation infrastructures, operation, maintenance and scheme management
- Provision and strengthening of health services in rice growing areas to curb waterborne diseases
- Promotion of public private sector partnerships in value addition of rice
- Environmental impact assessment and auditing for large scale rice investments

5.2.5 Marketing structure improvement

Marketing plays a key role in offtake of farm produce. For further sustenance of the sector the following areas need to be focused on:

- Promotion and enhancement of private sector participation in rice marketing
- Procurement of rice as part of the Strategic Food Reserve
- Strengthening of farmer organizations and Agribusiness Development Groups in rice marketing to offer services to its members
- Awareness creation on warehouse receipt system to rice farmers
- Enabling fair competition from imported rice by enforcing rice grain standards through KEBS
- Facilitation of ICT market/price oriented technologies for speedy and timely market information
- Identification and exploitation of value addition opportunities

6. TARGETED RICE PRODUCTION

Table 6.1 details the production targets in different rice ecologies towards achieving the targets in the above specific objectives.

Table 6.1: Rice production targets

Year	Irrigated Rice				Rain-Fed Lowland Rice			Rain-Fed Upland Rice			Total Cropped Area	Total Paddy Production
	Area (Ha)	Annual Total Ha (Main, Second and ratoon crop)	Yields (t/ha)	Production (Paddy) (MT)	Area (Ha)	Yield (t/ha)	Paddy Production (MT)	Area (Ha)	Yield (t/ha)	Paddy Production (MT)	Area (Ha)	Paddy Production (MT)
2018 (Baseline)	23,600	40,120	4.2	146,886	6,400	2.1	13,120	4,231	1.4	6,092	50,751	166,099
Projected												
2019	28,775	51,795	4.6	201,281	7,800	2.1	16,380	4,462	1.5	6,603	64,057	224,264
2020	36,020	68,438	5.0	280,524	9,200	2.2	19,780	4,692	1.5	7,132	82,330	307,436
2021	50,510	101,020	5.3	434,538	10,600	2.2	23,320	4,923	1.6	7,680	116,543	465,538

Year	Irrigated Rice				Rain-Fed Lowland Rice			Rain-Fed Upland Rice			Total Cropped Area	Total Paddy Production
	Area (Ha)	Annual Total Ha (Main, Second and ratoon crop)	Yields (t/ha)	Production (Paddy) (MT)	Area (Ha)	Yield (t/ha)	Paddy Production (MT)	Area (Ha)	Yield (t/ha)	Paddy Production (MT)	Area (Ha)	Paddy Production (MT)
2022	65,000	130,000	5.7	594,100	12,000	2.3	27,000	5,154	1.6	8,246	147,154	629,346
2023	68,125	136,250	5.9	654,085	14,875	2.4	35,793	5,385	1.7	9,221	156,510	699,099
2024	71,250	142,500	6.2	717,131	17,750	2.6	45,484	5,615	1.8	10248	165,865	772,864
2025	74,375	148,750	6.4	783,262	20,625	2.7	56,074	5,846	1.9	11327	175,221	850,663
2026	77,500	155,000	6.6	852,500	23,500	2.9	67,563	6,077	2.1	12458	184,577	932,520
2027	80,625	161,250	6.8	924,870	26,375	3.0	79,949	6,308	2.2	13640	193,933	1,018,459
2028	83,750	167,500	7.1	1,000,394	29,250	3.2	93,234	6,538	2.3	14875	203,288	1,108,503
2029	86,875	173,750	7.3	1,079,096	32,125	3.3	107,418	6,769	2.4	16162	212,644	1,202,676
2030	90,000	180,000	7.5	1,161,000	35,000	3.5	122,500	7,000	2.5	17500	222,000	1,301,000

NOTE: 1.Total area includes area for the first season crop in irrigated, rain-fed lowland and rain-fed upland ecologies; Annual total area for irrigated includes season 1, 2 and ratoon crop in irrigated ecologies; the yield is for the first season crop. The second season and ratoon crops have lower yields.

2. Data has been projected from an excel sheet with many variables

Figure 6.1 shows the projected area in ha for rice production for various ecologies for the period 2017 to 2030 while Figure 6.2 presents the targeted rice paddy production for the same period.

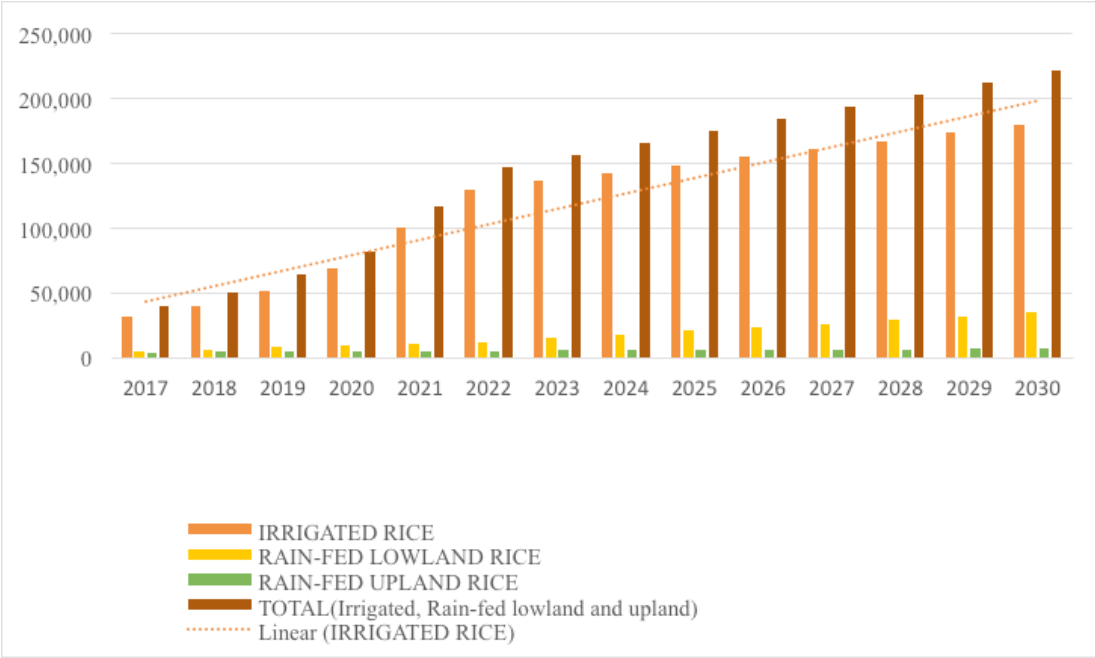

Figure 6.1: Projected area of rice production for various ecologies from 2017 to 2030

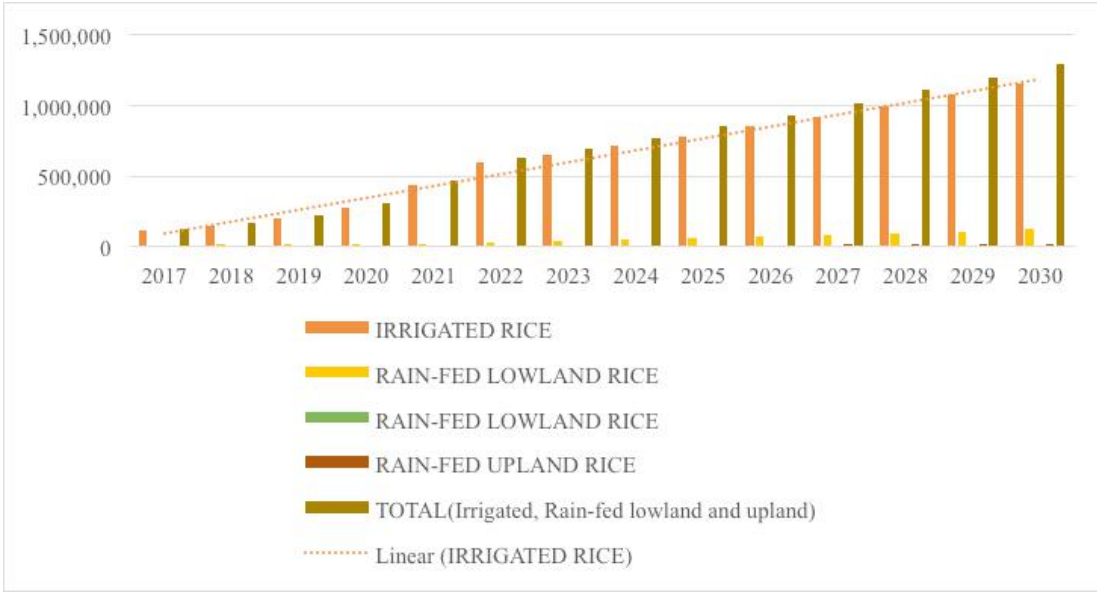

Figure 6.2: Targeted rice paddy production for the period 2017 to 2030

Table 6.2 shows the road map of projected rice production and consumption to achieve rice self- sufficiency by 2030.

Table 6.2: Rice consumption targets during the NRDS Phase 2 implementation

Year	Paddy Production MT	Milled rice MT	Projected total milled rice consumption based on per capita (20.6)	Expected deficit (milled rice)
2018	180,000	115,000	949,000	834,000
2019	214,000	139,000	974,000	835,000
2020	298,000	194,000	999,000	805,000
2021	461,000	299,000	1,025,000	726,000
2022	629,000	409,000	1,052,000	643,000
2023	699,000	454,000	1,079,000	625,000
2024	773,000	502,000	1,108,000	606,000
2025	851,000	553,000	1,136,000	583,000
2026	933,000	606,000	1,166,000	560,000
2027	1,018,000	662,000	1,196,000	534,000
2028	1,109,000	721,000	1,227,000	506,000
2029	1,203,000	782,000	1,259,000	477,000
2030	1,301,000	846,000	1,292,000	446,000

NOTE: Conversion ratio for milled rice (MT) is 65%.

Figure 6.3 presents the projected rice consumption targets during NRDS Phase 2 implementation.

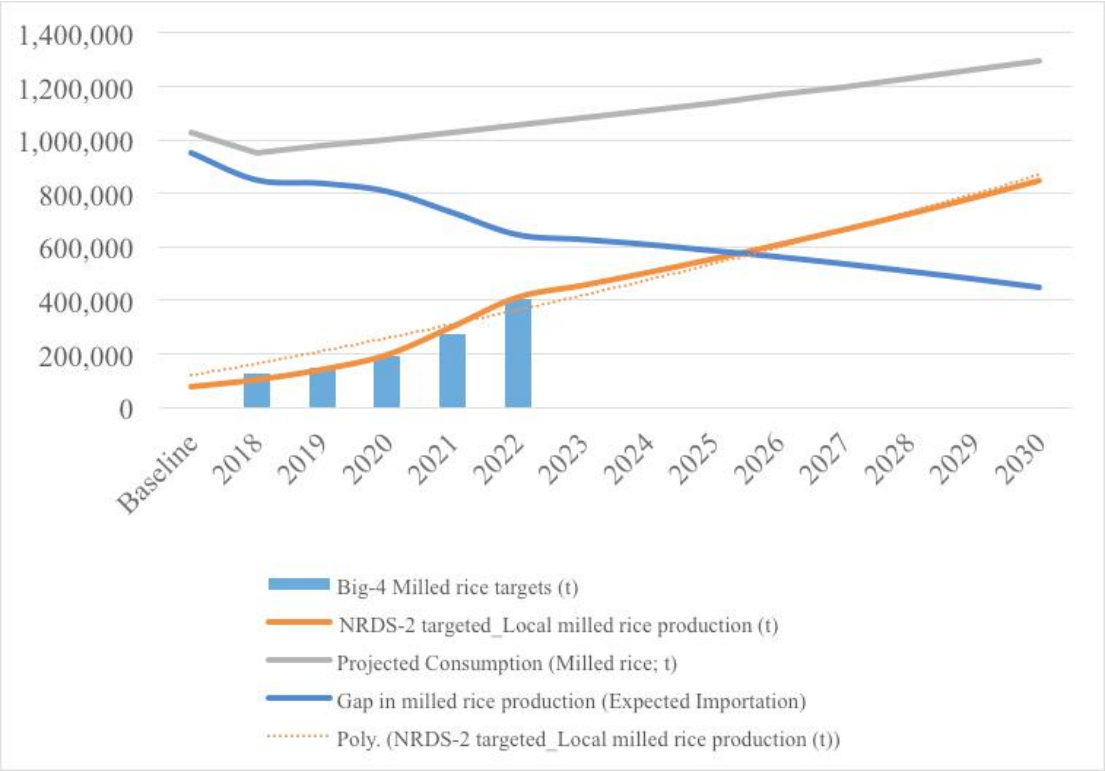

Figure 6.3: Projected rice need requirement in Kenya

7. CAPACITY BUILDING

Capacity building entails much more than training and encompasses development of the human, scientific, technological, and organizational and resource capabilities for institutions (UNCED, 1992). Capacity building in the rice subsector will therefore involve the following components:

- Human resource development aimed at equipping stakeholders with the required knowledge on rice technologies, production, processing, marketing skills and adequate access to information
- Strengthening of the Rice Promotion Programme, the National Rice Technical Committee, county technical staff, other rice stakeholder management structures, processes and procedures
- There is need for continued private sector engagement and capacity building in the rice subsector for the development of the value chain. This is expected to raise the local rice competitiveness. Rice producers and traders need to be trained on appropriate technologies and skills for increasing rice production and quality for improved incomes
- Encourage retention of trained personnel within the rice value chain.

Table 7.1: Training needs

a) Long courses

S/No	Technical	Number of MSc	Number of PhD	Deployment
1.	Nutritional Analysis - (Grains and Plant Tissue)	6	3	Research
2.	Value addition in rice and rice by-products	4	3	Research
3.	Soil Nutritional Analysis	2	1	Research
4.	Breeding	3	1	Research
5.	Molecular breeding	2	2	Research
6.	Social Economics	2	1	Research
7.	Water quality and management	2	1	Research

S/No	Technical	Number of MSc	Number of PhD	Deployment
8.	Plant Health (pathology, entomology, virology, weed scientist)	2	1	Research
9.	Plant breeding and biotechnology	4	2	Seed inspection
10.	Seed science and plant pathology	4	2	Seed inspection
11.	Rice agronomy and extension	26	0	County officers
12.	Rice agronomy in research	10	8	Research
13.	Postharvest handling, processing and value addition	5	3	Research
	Total	**72**	**28**	

b) Short courses

S/No	Technical	Number
1.	Rice seed production and quality	20
2.	Rice seed maintenance and certification	20
3.	Rice post-harvest handling and processing	20
4.	Irrigation water use and scheme management	40
5.	Sustainable rice production techniques	20
6.	Rice agribusiness	20
7.	Mechanization in rice production	20
8.	Data collection and analysis	30
9.	Monitoring and Evaluation	30
10.	Rice quality standards	20
11.	Rice value addition and marketing	20
12.	Nutrition sensitive rice value chain	20
13.	Rice agronomy and extension	100
	Total	**380**

8. GOVERNANCE STRUCTURE OF NRDS PHASE 2

The governance and implementation of NRDS Phase 2 will involve all the stakeholders in the rice sub sector spearheaded by the NRTC. This will include National Government, County Governments, Development Partners, the private sector for mobilization of resources, and farmers through their common interest groups for production. NRDS Phase 2 aims at providing adequate institutional framework to mobilize sufficient resources to achieve its objectives in rice production.

The two levels of government will be committed to provide human resource for the NRDS Phase 2 implementation, monitoring and evaluation. County governments will facilitate collection of relevant rice data and share the same with the national government for nationwide dissemination. Development of rice policies will be done involving all stakeholders.

Roles and responsibilities of stakeholders in rice value chain will be specific and well defined as per in the organogram (see Figure 8.1) as described in this section.

8.1 NRDS Phase 2 organizational structure

To enhance proper implementation of the NRDS Phase 2, there is a need to have an organizational structure coordinated by the Principal Secretary, State Department for Crop Development and Agricultural Research, Ministry of Agriculture, Livestock Fisheries and Cooperatives (MoALF&C); the Principal Secretary, State Department responsible for Irrigation, Ministry of Water, Sanitation and Irrigation (MoWS&I) and the County Governments (through CASSCOM) who will be the lead implementers of the NRDS Phase 2 together with other government agencies and private sector. RIPP and the NRTC will coordinate the implementation at the national level.

8.2 National Rice Technical Committee

The National Rice Technical Committee (NRTC) and the Secretariat members are drawn from MoALF&C, MWSI and related state agencies, County Governments, KALRO, Universities, NIA, JASSCM, STAK, and the private sector. The NRTC members will meet on a quarterly basis and

will provide consultations on the effective and efficient implementation of the NRDS Phase 2 and will consider recommendations of CARD and other national and regional stakeholders. The main tasks of the NRTC include:

- Providing technical and administrative guidance
- Developing appropriate review mechanism for identifying priorities under the NRDS Phase 2 and the implementation plan for NRDS Phase 2
- Resource mobilization for the implementation of NRDS Phase 2
- Provide technical backstopping and feedback to the stakeholders at the county and national levels
- Undertake monitoring and evaluation of NRDS Phase 2 activities

8.3 Organizational Structure

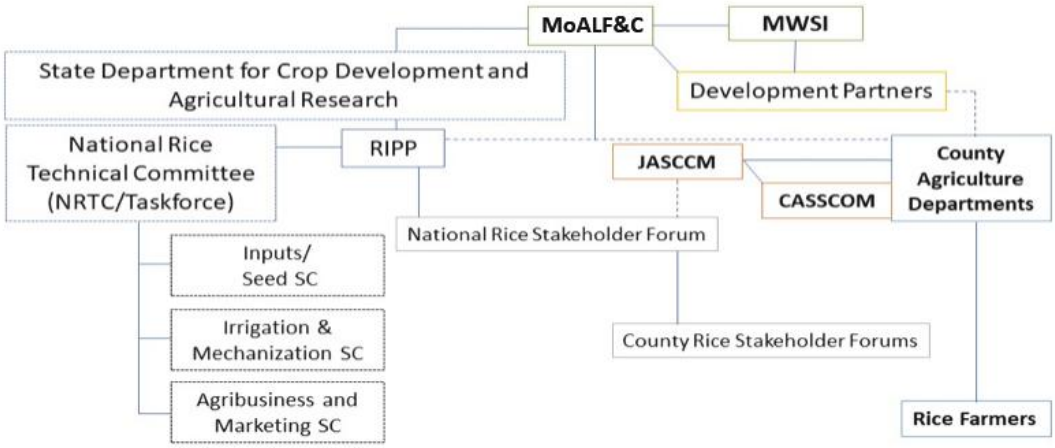

Figure 8.1: Organizational structure for NRDS Phase 2 implementation

8.4 National Rice Stakeholders' Forum

There is a National Rice Stakeholders' Forum (NRSF) that is not active. The NRSF will normally hold its meetings twice per year. The forum will be instrumental in priority setting and implementation of interventions identified in NRDS Phase 2. NRSF will endeavour to coordinate county level rice stakeholders' forum (CRSF). The NRSF will collaborate with county administrations; regional and international rice stakeholders and partners. It will also participate in the counties, regional and international rice development initiatives such as the Regional Rice Centre of Excellence. The stakeholders' forum will be composed of, but not limited to the following:

- MoALF&C - Secretariat
- Researchers - KALRO, Universities, NIA and others
- Institutions dealing with rice, e.g., Afritec, Bayer, AATF, etc.
- Other state agencies - Regional development Authorities, NIA, NWHSA
- Farmer organizations
- Policy makers
- Relevant Agriculture sector ministries/State Departments like Water and Irrigation, Regional Development Authorities, County Governments, Cooperatives and Marketing and Trade
- Regulatory bodies - KEBS, KEPHIS
- Agro-processors
- Service providers - stockists, mechanization and seed producers
- Rice traders and merchants
- NGOs and CBOs
- Financial service providers - AFC, Banks, Commodities Fund and MFIs
- Consumer organization (apex organization)

The NRSF will endeavour to encourage the formation of a National Rice Millers Association with representation of all rice growing counties through private-public-participation.

8.5 Terms of reference for the National Rice Stakeholders' Forum

- Periodical review of NRDS Phase 2 within the framework of Government policies
- Set and periodically review extension, research and capacity building agenda
- Prioritize programs and activities of NRDS Phase 2
- Form specialized committees as need arises
- Monitor and evaluate implementation of NRDS Phase 2
- Co-opt other members as need arises
- Perform any other related responsibilities

8.5.1 County Rice Stakeholders' Forum (CRSF)

CRSF membership will be drawn from all rice growing sub counties and they will participate in advocating on rice matters at the county and sub-county.

8.5.2 Joint Agriculture Sector Consultation and Cooperation Mechanism (JASCCM)

JASCCM will provide linkages with the various players/stakeholders and development partners during the implementation of the NRDS Phase 2. It will facilitate collaboration and building of public/private sector partnerships. There will be a county agricultural sector steering committee that will oversee the implementation of rice projects in the counties through the leadership of the County Executive Committee Member (CEC) in charge of agriculture.

9. IMPLEMENTATION STRATEGY

Effective implementation of NRDS Phase 2 will depend on the active, integrated and holistic involvement of all the rice stakeholders. The implementation of NRDS Phase 2 will be based on a RICE approach; whereby Resilience, Industrialization, Competitiveness and Empowerment (RICE) will be emphasized during the implementation.

- Through the Resilience (R) approach, stability in rice production will be asserted in the face of climate change and the rising population growth
- Industrialization (I) approaches will help engage rural and urban enterprises (micro, small, medium and macro) in production, processing, value addition and marketing of the locally produced rice
- The quality and value of the locally produced rice will be enhanced through approaches that will sharpen the Competitiveness (C) of the locally produced rice over the imported rice
- Empowerment (E) of all the relevant stakeholders (including women and youth) in harnessing the socio-economic rewards of rice farming will be reinforced during the implementation
- The following strategies for the subsectors/value chain segments interventions are discussed further under section 9 of this NRDS Phase 2
- Overall policy, institutional framework and coordination mechanisms for rice development
- Research, technology dissemination and capacity building
- Development and management of rice production infrastructure and resources
- Seed system development (breeder, pre-basic, basic and certified seed, and improved informal seeds such as quality declared seeds (QDS), as appropriate)
- Fertilizer supply and usage
- Post-harvest and rice marketing (National and Regional trade)
- Access to and maintenance of agricultural machinery and equipment
- Monitoring and Evaluation

9.1 Strategies for Subsectors/Value Chain Segments

9.1.1 Overall policy, institutional framework and coordination mechanisms for rice development

The National and County Governments will be expected to provide an enabling environment for rice production and fair trade with stakeholder involvement.

9.1.2 Trading policy (export and/or import)

Kenya is a member of both the East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA) regional trading blocs. It is therefore bound by the common tariffs that apply to the member states of these trading blocs. However, there is a lot of informal cross-border trade with neighbouring countries. There is also rice seed movement across the borders which may not have undergone formal certification processes that could be detrimental to rice subsector development. However, the blocs present major opportunities for trade and sharing of germplasm. There is therefore need to have harmonized trade tariffs, and seed industry rules and regulations by the partner states.

Generally rice trade is in favour of Kenya's trading partners. Joint action at the EAC level is required in terms of treatment of rice as a sensitive product and harmonization of CET rates applicable to rice. It should also be noted that poor market organization in the region has led to market dominance by cartels and adulteration of rice.

9.1.3 Private sector promotion

Public Private Partnerships are necessary considering that no single institution can achieve the task of improving farmers' livelihoods; thus both the Government and the Private Sector will play complementary roles in the rice industry.

Representation of private sector issues in consultative fora with the Government will be enhanced through national, county and sub-county level stakeholder fora. There is a need to encourage increased private investment in the rice subsector, e.g., in seed multiplication, inputs supply, mechanization services, irrigation/water management and extension services.

9.1.4 Land and water use

Land tenure system in the rice growing schemes is unfavourable to farmers due to land ownership issues. For sustainable rice production the land tenure system should be addressed to provide for ownership and to allow more access of women and youth to land, as they are key players in rice production.

Strengthening of Irrigation Water Users Associations (IWUA) should be enhanced for proper water apportionment. There is also need to promote water saving technologies, such as Water Saving Rice Culture (WSRC) where watering is done intermittently in rice paddies.

9.1.5 Strategy for financing rice sub sector

There is poor access to credit by rice farmers. The strategies for improving the financing for rice growers include the following:

- Extend agricultural crop insurance to rice
- Promote contract farming in rice production
- Strengthen existing farmer based SACCOS to increase access to credit
- Create awareness of available credit sources
- Establish clear pricing mechanisms for inputs including subsidized fertilizers
- Encourage alternate approaches for financing rice sub sector such as warehouse receipt system

9.1.6 Rice producers associations

Historically there have been associations to drive the rice sub sector in the country. These associations exist at the counties and national levels. However, they are weak and have leadership constraints. There is need to empower and mobilize more members and increase their advocacy and financial base. Kenya National Farmers Federation (KENAFF) should play a key role in this endeavour.

9.1.7 Rice private business associations

Rice private business association such as Cereal Growers Association (CGA), proposed Rice Millers Association and Kenya National Chamber of Commerce and Industry (KNCCI) will form important stake holding in the sub sector; and their participation in decision making will be encouraged. Incentives to engage in rice business will be explored, e.g., favourable tax regimes for agricultural machinery and inputs.

9.1.8 Coordination mechanism among stakeholders

The following actions are foreseen for the improvement of coordination of stakeholders:

- The NRTC will be supported by the various sub-technical consultative committees in providing technical consultations on the various segments of the rice value chain
- There is need to strengthen the National Rice Stakeholders' Forum, and establish similar functional fora in the counties and sub-counties
- It is necessary to increase funding to RIPP and have its own budget. Projects in the Ministry and DPs can support rice promotion, e.g., NAAIAP, ECAAT, JICA, FAO and CARD
- A monitoring and evaluation plan will be established to monitor periodical progress of implementation of the NRDS
- Rice information management capacity will be enhanced

9.1.9 Fertilizer supply, usage and other soil amendments

- Conduct soil analysis and replenish nutrients with appropriate fertilizers
- Enhance timely access to fertilizers to rice farmers, in the right quantities and types by MoALF&C fertilizer unit
- Avail the Rice Technologies Handbook for dissemination on efficient use of fertilizers
- Encourage investments in manufacturing and blending of rice site specific fertilizers and other soil amendments

The required annual volumes of nutrients for the rice sector under the NRDS Phase 2 for the various years are shown in Figure 9.1.

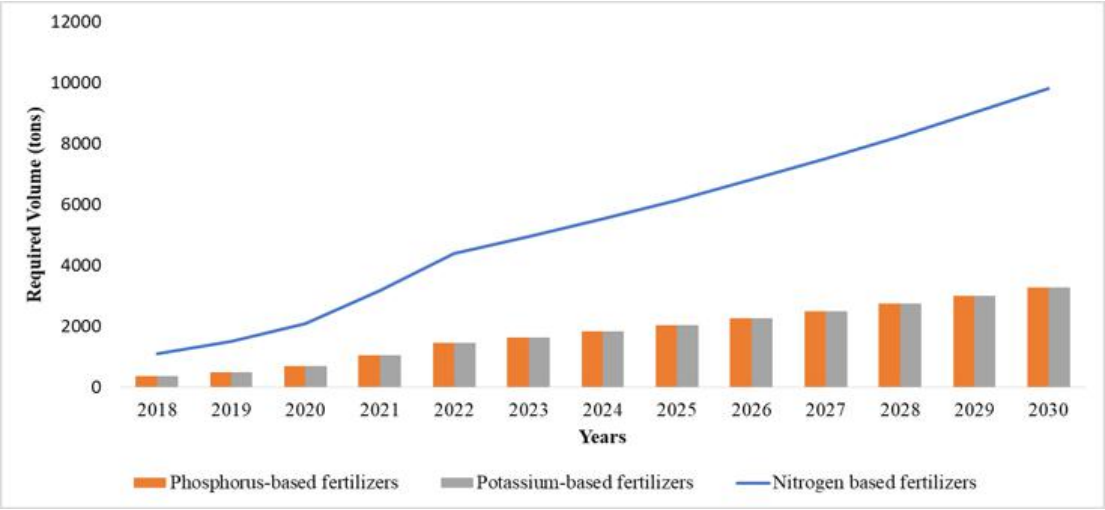

Figure 9.1: Projected soil nutrients requirements as per crop hectarage

9.2 Research, technology dissemination and capacity building

Research develops innovations that can be used to positively move the rice sub sector forward. Technology dissemination assists in adoption while capacity building helps farmers acquire technical knowledge.

9.2.1 Genetic resources conservation and use

Rice genetic resource provides a basis of improvement and breeding of new varieties. They should be collected, efficiently conserved and optimally utilized. Collection can be in the form of ex situ seed banks, field gene banks or botanic gardens. These will be achieved through:

Facilitating research institutions; KALRO, MIAD and Universities to undertake ex-situ conservation of genetic materials in the form of seed banks, field gene banks or botanic gardens. This is to avoid eminent threat of genetic erosion due to both environmental and socio-economic factors.

Maintaining wild species in botanical gardens through ex-situ conservation method which has the advantage of allowing the natural process of evolution to continue.

Facilitating research institutions to use molecular DNA sequencing technologies in the identification and characterization of these genetic resources.

9.3.3 Development, promotion /adoption of new varieties

An improved variety is an important tool for increasing rice productivity and production. To improve the varieties, the following will be undertaken;

- Develop and promote new, high yielding, cold tolerant, market oriented varieties; hybrids, aromatic and short- duration varieties that will promote double cropping in irrigated schemes of Kenya
- Extension service providers to promote adoption of new varieties by setting demonstration in farmers' fields, farmer to farmer extension, to enhance adoption
- The Government to enhance the capacity of research institutions; KALRO, MIAD, and Universities through enhanced funding for research on new varieties and facilitation for storing and conserving genetic resource materials in order to enable production and maintenance of existing varieties
- Strengthen collaboration amongst local research institutions in rice and international organizations and other stakeholders to ease access to the current best rice varieties from all over the world

9.2.3 Agronomy in rice production

The average rice grain yield in Kenya is below the world average of 3.4 t/Ha. This is partly contributed by low production technologies.

There is need to;

- Promote adoption of good agronomic packages, e.g., timely planting, pest control, fertilizer regimes, etc., through training and farm demonstrations
- Upscale adoption of proven water saving technologies for higher productivity, such as WSRC

- Minimize harvest and post-harvest losses by promoting good harvesting and postharvest handling practices
- Improve research and extension services; provision of infrastructure; and accessibility to inputs
- Promote uptake of certified seeds by rice farmers
- Provide rice technologies handbook and brochures to extension agents and farmers

9.2.4 Soil health/soil fertility management

Soil fertility management is important to ensure that the applied plant nutrients are in available forms and in adequate amounts for normal plant growth. There is need to;

- Organize periodic soil testing in rice growing areas for appropriation of fertilizer usage
- Develop site specific fertilizers formulations to meet specific area demands
- Train rice farmers in various regions on soil nutrition
- Develop, sensitize and update guidelines on rice fertilizer use

9.2.5 Irrigation water use and scheme management

With improved irrigation water resource utilization and management, the current irrigation potential can be up scaled. The strategy envisages to;

- Ensure improved management and optimization of the utilization of irrigation water
- Undertake extension of the length of the lined canals
- Undertake regular desilting of unlined canals
- Encourage adoption of climate smart technologies in rice value chain
- Mainstream rice aquaculture and related complimentary enterprises

9.2.6 Upscale the adoption of proven water saving technologies

Water for paddy irrigation is inadequate in most irrigation schemes due to adverse effects of climate change and variations.

- Adopt production systems that ensure sustainable use of water by increasing productivity while reducing on water usage such as WSRC developed by RiceMAPP

9.2.7 Agricultural mechanization

Mechanization in rice production reduces labour requirement, increases productivity, reduces cost of production and drudgery; and hence is a key driver for change in the rice subsector. There is need to;

- Facilitate relevant institutions to upscale research and technology development in the rice subsector based on quality standards and guidelines
- Encourage local production of efficient machinery and equipment for rice production and milling (SMAEs) based on quality standards and guidelines
- Sensitize, train and promote mechanized rice land preparation (to include laser levelling, minimum tillage), planting (including direct seeding, wet seeding, and mechanized transplanting), weeding, harvesting, threshing, drying and milling
- Promote rice mechanization technologies that are user-friendly to both youth and women

9.2.8 Pest control

Insect pests and disease infestations are the primary constraints in rice production systems. Farmers consequently loose an estimated average of 37% (http://www.knowledgebank.irri.org) of their rice crop to pests and diseases every year. Under changing environmental conditions and indiscriminate chemical application to the rice crop, pests have developed resistance. This will be achieved through;

- Research institutions to partner with agrochemical companies for continued research on pest control products
- Enhance funding to the national plant protection sub division, to enable it link and appropriately implement timely control measures

- Undertake monitoring and regulation of disease and pest control products
- Provide continuous/periodic update to farmers on good agricultural practices pertaining to pesticides

9.2.9 Harvest and post-harvest handling

In Kenya, most farmers, processors and other end users of agricultural mechanization do not use enough technologies for their farming and processing operations. Kenyan rice value chain is therefore labour intensive and uncompetitive. There is need to;

- Empower R&D centres to handle research in harvest and postharvest handling
- Encourage private sector collaboration with scientists in public institutions in R&D in harvest and postharvest handling
- Involve stakeholder collaboration in R&D in harvest and postharvest handling
- Adopt and promote R&D technologies on harvest and postharvest handling in collaboration with extension agents

9.2.10 Policy, trading and market research

Policy on rice is an important enabler to rice production and marketing in Kenya. The sector lacks a coherent and comprehensive policy. Strengthening research and development through provision of adequate funds to conduct research and training will help to address some of the challenges. There is need to:

- Develop evidence based policies that restrict flight of paddy to neighbouring countries
- Promote micro-, small-, medium- and large scale private enterprises in agribusiness activities along the entire rice value chain

9.2.11 Human Resource Development

Continuous capacity building of researchers, extension officers, training of trainers and farmers in the rice value chain sector will be undertaken. During the NRDS Phase 2 implementation, it is expected that 28 PhDs,

72 MSc and 380 staff for short courses and 100 farmer groups will be trained.

9.2.12 Strategies/vision for advisory services and capacity building

Extension service delivery in Kenya is currently inadequate, partly due to low staff: farmer ratio (1:1000, ASTGS). Various interventions need to be put in place;

- Enhance implementation of farmer-to-farmer approaches like Farmer Field Schools, core farmer approach, NGOs/CBOs and ADGs in extension service provision
- Embrace alternative suitable extension methods for technology dissemination/ capacity building (e.g., ICT)
- Engage private service providers in extending the adoption of rice-related technologies and Good Agricultural Practices (GAPs)
- County Governments should recruit and train new extension agents to achieve the ratio1:600 (ASTGS)

9.2.13 Producer organizations

Producer organizations assist individual rice farmers to access credit, organize production inputs and enhance their production and marketing capacity. Many existing farmers' organizations are generally weak. There is need to;

- Strengthen existing farmer groups and create new ones
- Mobilize farmers and rural leadership committees
- Facilitate linkages (including contractual agreements) with input suppliers, service providers (machineries, millers, etc.)
- Capacity build group leaders on entrepreneurship and organizational skills for better management of farmer groups
- Encourage groups to invest financially in rice value chain, for better income to the farmer groups

9.2.14 Development and management of rice production infrastructure and resources

Irrigation infrastructure development and maintenance is expensive but key in rice production. However, the current level of investment is low. There is need for more investments for expansion of the infrastructure and management of the resources for sustainability.

Strategies

- Develop and manage irrigation infrastructure in line with the Water Master Plan 2030
- Develop new irrigation schemes to cover up to 99,012 Ha of irrigated area
- Expand the area under lowland rain-fed ecology to cover 35,000 Ha and 7,000 Ha for upland rain-fed ecology
- Develop water harvesting structures for supplementary irrigation for rain-fed rice ecologies
- Rehabilitate and upgrade irrigation and drainage facilities of the existing schemes (32,988 Ha)
- Develop water harvesting and storage infrastructure as captured in the Water Master Plan 2030 in order to increase the water availability for irrigation and other uses
- Install gravity irrigation systems in all existing and upcoming rice schemes in line with the Water Master Plan 2030 to reduce on the cost of pumping water
- Promote water saving technologies for rice cultivation (e.g., WSRC)
- Improve water transmission efficiencies by canal lining and adequate water management including operation and maintenance of all flow control and measurements structures
- Develop well planned road infrastructure to serve on farms as well as from the farms to allow easy access of machinery and transportation in rice production areas
- Capacity build officers and IWUAs to sustainably and effectively operate, manage and maintain irrigation infrastructure and water resources

- Provide affordable power sources in the rice growing areas to facilitate processing and value addition
- Capacity build communities on the conservation of the watershed for sustainable water supply

9.3 Seed system development

It is envisaged that a vibrant rice seed industry that is able to satisfy the farmer and compliment national food security will be developed.

Strategies

The rice seed development strategy developed under the NRDS Phase 1 sets the vision, mission and objectives of achieving a working seed system in the country. It also forms the basis on which steps will be undertaken to achieve the goal of a vibrant rice seed sub sector.

- In the next twelve years the rice seed system shall be all inclusive where stakeholders play a pivotal role to ensure certified seed is readily and timely availed in the market
- Develop rice varieties with aromatic traits
- Develop rice varieties with disease and pest resistance
- Develop rice varieties with tolerance to drought, cold, salinity and low soil fertility

9.3.1 Harmonization of national seed system with regional

Efforts are at an advanced stage of harmonizing the national seed systems with the regional one, e.g., EAC regulations, COMESA Seed Regulations. This has been spearheaded by KEPHIS in conjunction with the "parent" Ministry of Agriculture in Kenya. Therefore, there is need to;

- Harmonize national and regional seed regulations
- Facilitate the movement of certified seed within/ outside the borders for enhanced seed production and trade

9.3.3 Rice seed production and supply/marketing system

A vibrant inter-regional seed trade for enhanced productivity to address the food and nutrition security in the individual countries and the region is envisaged.

Strategies

The country will work very closely with the other regional bodies. This is expected to;

- Establish a regional seed subsector for enhanced trade and commercialization
- Promote sharing of seed technologies among the EAC and COMESA countries and thus speed up the productivity
- Strengthen the Rice Seed consultative subcommittee of NRTC to coordinate development, promotion and supply of improved rice seeds among stakeholders

9.3.3 Seed maintenance system

Location and quantity of breeder/ pre-basic/ basic/ certified seed/ informal seeds (e.g., QDS) production, in accordance with the geographical distribution of rice production ecologies.

Table 9.1 shows projections for rice seed roadmap for the period up to 2030.

Table 9.1: Rice seed production and projections based on cultivated area and yield

Ecology	Cultivated area and yield	Year		
		2018	2024	2030
Rain-fed upland	Area, Ha	15.8	28.7	52.5
	Yield, t/Ha	1.5	2.5	2.5
	Production, MT	23.8	71.8	131.3
Rain-fed lowland	Area, Ha	5.3	45.5	245
	Yield, t/Ha	2.5	3.5	3.5
	Production, MT	13	159	856
Irrigated	Area, Ha	154	895	1631
	Yield, t/Ha	3.5	4	4
	Production, MT	540	3580	6524
Total	**Area, Ha**	**175**	**969**	**1929**
	Production, MT	**576**	**3811**	**7513**

9.3.4 Planning and coordination of seed production, supply and marketing

- Involve stakeholders such as NIA, KALRO, MRGM, KSCo, AfriTech, Bayer (EA), FreshCo, IRRI, farmers and universities in seed production under the supervision of KEPHIS
- MoU among stakeholders will facilitate supply of breeders' seed.
- Review policy to fasten development and release of new rice varieties
- Adopt participatory variety selection and release

9.3.5 Seed value chain development and integration

The seed value chain will involve;

- Stakeholders with given mandate and specialty to handle certain seed classes under the supervision of KEPHIS
- Public-Private-Partnership guided by MoUs to share roles along the seed value chain

9.3.6 Seed supply, marketing and promotion of improved seeds

- Allow forces of demand and supply to govern seed marketing
- Enhance and promote adoption of new rice varieties
- Encourage PPP to play a key role in seed production and marketing, especially in the marginal areas

9.4 Postharvest handling and rice marketing

9.4.1 Postharvest handling practices

Technologies will be employed for postharvest handling practices through appropriation and promotion of cost-efficient machineries and facilities for harvesting, threshing, drying, cleaning, milling, packaging and storage. This will enhance resilience, industrialization, competitiveness and empowerment (RICE Approach) in the rice subsector.

Strategies

- Promote use of small combine harvesters and motorized threshers by rice farmers
- Develop and promote small scale hand and motorized winnowers
- Identify, develop and promote simple improved drying technologies, machinery and equipment
- Encourage County governments and private entrepreneurs in rice growing regions to invest in driers for paddy rice
- Promote investment and use of rice by-products for examples rice husk briquettes and pellets, rice husk ash, carbonized rice husk, rice bran, straw, among others
- Encourage farmers associations and private investors to invest and install improved rice mills
- Construct more rice storage facilities and expand on the existing ones
- Promote packaging of milled rice in appropriate materials as stipulated by rice standards
- Promote public and private sector investments (small, medium-scale and large-scale) in all post-harvest rice processes and facilities

- Enforce adherence to quality standards to deter rice adulteration and create competitiveness in the industry
- Promote warehouse-receipt system for rice farmers and community-based storage facilities
- Encourage participation of youth entrepreneurship in mechanization as service providers along the rice value chain
- Promote rice mechanization technologies that are user-friendly to both youth and women

9.4.2 Rice Marketing

Rice marketing is not currently well structured for efficient operation. To address this, the following will be applied;

Strategies

- Put in place a seamless structure for rice value chain actors for effective and efficient interaction in rice marketing
- Promote access for ICT to link farmers to markets
- Promote the use of grading equipment for milled rice to enhance quality differentiation and market competitiveness
- Improve branding through capacity building for stakeholders
- Promote entrepreneurships (especially youth and women) on rice products and by-products
- Provide technology support towards innovative products
- Create an enabling environment for entrepreneurs to invest in value addition initiatives
- Capacity build and create awareness on existing standards at national and regional levels and variety preferences for quality assurance
- Enforce adherence to set standards for quality assurance
- Encourage organized private investments in trading, processing and marketing of paddy and milled rice
- Enhance business linkages along the entire rice value chain
- Reduce the cost of production through increased on-farm mechanization, optimization of application of farm-inputs

- Capacity build farmers on book keeping techniques including gross-margin analysis
- Promote efficient marketing/trading through increased accessibility and availability of rice to consumers and promotion of linkages between farmers, farmer-based organizations, millers and markets.
- Provide linkages with grain reserve and/or other public food programs through facilitation of procurement of rice towards National Strategic Food Reserve
- Formulate regulatory framework to discourage 'paddy flight' to other regions
- Strengthen liaison between the National and County Governments in order to address marketing constraints that distort rice supply and demand
- Analyse the socio-economic aspects of the farming community to help them develop an efficient market system

9.5 Access to and maintenance of agricultural machinery and equipment

It is envisaged that an accessible and well serviced mechanization system for farmers will be put in place to address drudgery and improve efficiency in rice production.

Strategies

The NRDS Phase 2 proposes the following approaches to improve mechanization along the rice value chain.

- Put in place a seamless mechanization value chain structure in which various components in it support one another effectively and efficiently to enhance the efficiency and profitability of rice production and market competitiveness
- Create an enabling environment such as suitable taxation regimes for importation and supply of quality agricultural machinery and equipment
- Promote local sourcing/manufacturing of agricultural machinery and equipment
- Promote public and private investments
- Facilitate access to low interest financial schemes for investments,

especially for women and youth

- Formulate regulatory framework to ensure quality of agricultural machinery, equipment and services
- Promote setting up of 'machinery hiring hubs' in rice growing areas and participation of youth in provision of hiring services
- Formulate regulatory framework to ensure provision of after sales service and spare parts supply
- Enhance the skills and operational capacities of the operators, artisans and technicians through continuous technical backstopping
- Empower R&D centre's handling research in agricultural mechanization
- Encourage private sector collaboration with scientists in public institutions in design, fabrication and repair of agricultural machinery and equipment

9.6 Nutrition enrichment through rice consumption

To promote consumption of nutritionally-enhanced rice recipes and rice-based foods, the following strategies will be applied;

Strategies

- Promote production and consumption of nutrient dense vegetables through sequential and/or inter and/ or fallow cropping
- Promote production and consumption of nutritionally-enhanced rice varieties
- Promote intercropping of rain-fed upland rice with legumes for improved soil fertility and availability of pulses
- Create awareness of the nutritive value of rice through demonstrations and campaigns
- Enhance availability and consumption of brown and parboiled rice through demonstrations and training
- Create awareness and promote adoption of available local and regional standards in storage, drying, milling, packaging and sale of paddy and milled rice
- Promote rice aquaculture in rice growing regions to enhance protein availability

10. IMPLEMENTATION FRAMEWORK

10.1 Introduction

There exists enormous potential in the rice sub-sector in enhancing food and nutrition security and livelihoods for the majority of urban and rural population in Kenya. Rice has been prioritized as one of the crops to address food security challenges in Kenya. Strategies have been put in place to promote the rice sub-sector development towards the achievement of national food and nutrition security. During the NRDS Phase 1 implementation period (2008-2018), numerous milestones were achieved in production, productivity, mechanization, seed system, technology development, and adoption of new varieties. Further, networking among rice subsector players, credit access, monitoring and evaluation have been enhanced.

Limitations in access to extension services, high cost of inputs, poor marketing efficiency, low competitiveness of locally produced rice, and inadequate infrastructure among others will be addressed during NRDS Phase 2. These limitations continue to slow the growth of the rice subsector. The envisaged results in this strategy will be guided through the Implementation Framework (2019-2030) that details the roadmap to be followed. The framework has been prepared to encourage investment by all stakeholders in the development of the rice subsector.

The goal, vision, mission and objectives are as stated in Chapter 3 and the implementation framework is presented in Tables 10.1 and 10.2. The period of strategy implementation is from 2019-2030. Focus areas are: Lake Region: (Kisumu, Migori, Homa Bay, Siaya); Western Kenya (Kakamega, Busia, Bungoma); Rift Valley (Baringo, Elgeyo Marakwet, West Pokot), Central/Eastern Kenya (Kirinyaga, Murang'a, Embu, Meru, Isiolo); Coastal area: (Kwale, Tana River, Lamu, Kilifi, Taita Taveta), North Eastern (Garissa). Other potential areas are: Lake Region: (Nyamira, Kisii); Rift Valley (Turkana), Central/Eastern Kenya: (Marsabit, Tharaka Nithi); Coastal area: (Mombasa), North Eastern (Mandera).

Table 10.1: Intervention logic for implementation framework

Intervention Logic	Objectively Verifiable Indicator(s)	Means of Verification	Assumptions
Goal To enhance national food and nutrition security through 7 fold increase in rice production; value addition and marketing	Increase milled rice production from 128,000 MT in 2019 to 846,000 MT milled rice	National and County rice development baseline surveys Periodic institutional reports Midterm review End of project evaluation Production Survey data from MoALF, FAOSTAT	Both the National and County governments formulate policies that will be favourable to the development of the rice sub-sector to the levels proposed in NRDS 2 Collaboration between the Government and Development partners will be enhanced The agro climatic conditions will remain favourable Political stability will prevail
Strategic Objectives			
1. Expansion of physical area under rice cultivation from 43,619 to 174,000 Ha by 2030	Area under irrigated ecosystem increases from 32,988 physical to 132,000 Ha Area with ratoon and second crop from 47,944 to 222,000 Ha Rain-fed lowland from 6,400 to 35,000 Ha Rain-fed upland from 4,231 to 7,000 Ha	Periodic institutional reports Production Survey data from MoALF, FAOSTAT National and County rice development baseline surveys	Both the National and County governments formulate policies that will be favourable to the development of the rice sub-sector to the levels proposed in NRDS 2 Collaboration between the Government and Development partners will be enhanced The agro climatic conditions will remain favourable Political stability will prevail

Intervention Logic	Objectively Verifiable Indicator(s)	Means of Verification	Assumptions
2. Increased on-farm productivity of rice	Average on-farm yield levels under the irrigated ecosystem increases from 4.0 t/Ha to 7.5 t/Ha Rain-fed lowland from 2.0 t/Ha to 3.5 t/Ha Rain-fed upland from 1.4 t/Ha to 2.5 t/Ha	Periodic institutional reports National and County rice development baseline surveys	
3. Reduction of the import bill by increasing production and market competitiveness of locally produced rice	Reduction of imported milled rice from 848,000 MT in 2018 to 446,000 MT in 2030 Increase milled rice production from 112,000 MT in 2018 to 846,000 MT in 2030	Periodic institutional reports Importation data from Kenya Customs and Kenya Revenue Authority Production Survey data from MoALF, FAOSTAT	
4. Promotion of private sector participation in agribusinesses	Promote at least 100 SMAEs in the rice value chain Develop and promote at least 3 new value-added rice products Establish and promote at least 3 new producer-marketing organizations	Periodic institutional reports	

Table 10.2: Activity-based implementation framework

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
STRATEGIC OBJECTIVE 1: EXPANSION OF AREA UNDER RICE CULTIVATION				
1.1 Rehabilitation of existing and development of new irrigation infrastructure				
a) Rehabilitate and upgrade irrigation and drainage facilities of the existing schemes	32,988 Ha	MoWS&I, NIA, Counties, MoALF&C, Regional Authorities, NLC, Development Partners, NEMA	Number of hectares newly rehabilitated	2019-2030
b) Improve water transmission efficiencies by canal lining and adequate water management including operation and maintenance of all flow control and measurements structures	For at least 7 existing schemes		Number of schemes with improved water management	2019-2030
c) Install gravity intake irrigation systems in existing rice schemes	For at least 3 existing schemes		Number of new schemes with gravitational irrigation	2019-2030
d) Develop new irrigation schemes with gravity intake irrigation systems in line with the Water Master Plan 2030 (MoWS&I) to reduce on the cost of pumping water	99,012 Ha		Number of hectares with gravitational irrigation	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
1.2 Expansion of rain-fed rice production area				
a) Expand the area under lowland rain-fed and upland rain-fed ecology	Targeted 35,000 Ha for lowland and 7,000 Ha for upland rice	MoALF&C, NIA, Counties, Regional Authorities, Development Partners, Private Sector	Number of hectares newly deployed	2019-2030
b) Develop and promote water harvesting structures for supplementary irrigation for rain-fed rice ecologies	At least 3 types of water harvesting structures developed and promoted	MoALF&C, NIA, Counties, Regional Authorities, Development Partners, Private Sector, Research Institutions, NEMA	Types of water harvesting structures developed/promoted	2019-2030
c) Promote in situ water management technologies	At least 3 technologies promoted	MoALF&C, NIA, Counties, Regional Authorities, Development Partners, Private Sector, Research Institutions, KMD	Number of new water management technologies adopted	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
STRATEGIC OBJECTIVE 2: RAISE ON-FARM RICE PRODUCTIVITY				
2.1 Adoption of quality inputs and improved technologies				
a) Promotion of double cropping and ratooning	2 full cropping seasons or ratooning established in major scheme (Mwea, Ahero, West Kano, South West Kano, Bunyala, Lower Kuja, Maugo, Yala Swamp)	County extension staff, MOALF&C, Service providers, Farmer organizations, NIA, MoWS&I, Development Partners	Number of farmers who have adopted double cropping Increased productivity and production	2019-2030
b) Provide subsidies and improve access to affordable credit	At least 5 counties provided with subsidies and have access to affordable credit	County Government, Financial institutions	Number of counties reached	2019-2030
c) Develop and promote high-yielding, stress tolerant, market-oriented varieties	At least new 5 varieties developed At least 18 varieties promoted	Breeders, Universities, Seed companies, KEPHIS, KALRO, Farmers	Number of high yielding varieties released	2019-2030
d) Facilitate and create linkages to private investments in production and agro-dealerships (SMAEs)	100 SMAEs facilitated and linked	MoALF&C, MoWS&I, MTI&C, NGOs, Farmer organizations, County Governments	Number of SMAEs with strong linkages	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
e) Increase the 'uptake' of certified seeds and hybrids, fertilizers and agro-chemicals in irrigated and rain-fed ecologies	20% increased uptake in irrigated and 10% in rain-fed ecologies	Breeders, Universities, Seed companies, KEPHIS, KALRO, Farmers	Percentage increase of the uptake of quality seeds	2019-2030
f) Facilitate management of migratory pests	Target outbreaks in at least 3 major growing counties per year	MoALF&C (Plant protection subdivision), Farmers, Ministry of Interior	Number of counties that have controlled migratory pest incidences	2019-2030
2.2 Promotion of appropriation of mechanization				
a) Appropriate cost-efficient machineries for sowing, transplanting, weeding, harvesting, drying and milling	At least 5 counties reached	Research institutions, MoALF&C, Service providers, Farmer organizations, County Governments, Development Partners	Number of counties reached	2019-2030
b) Promote private investments and participation of youth and women in provision of hiring services, sales and after-sales services (SMAEs)	50 SMAEs facilitated to commercialization	Research institutions, MoALF&C, County Governments, Service providers, Farmer organizations, Development Partners	Number of youth and women-led SMAEs participating in provision of hiring services, sales and after-sales services	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
c) Promote use of efficient machinery in harvest and postharvest activities	20 demonstrations At least 3 more schemes	Research institutions, MoALF&C, County Governments, Private sector, Farmer organizations, Development Partners	Number of demonstrations Number of schemes covered	2019-2030
d) Increase adoption of improved harvest and postharvest handling practices	At least 3 new technologies adopted At least 50% increase in level of adoption	Research institutions, MoALF&C, County Governments, Private sector, Farmer organizations, Development Partner	Number of technologies adopted Level of adoption	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
e) Train on emerging technologies in mechanization	At least 3 types of technologies	MoALF&C, Farmer organizations, County Governments, MTI&C, Development Partners, Private sector	Number of types of mechanization technologies Number of trainees	2019-2030
2.3 Promotion of efficient and sustainable natural resource management practices				
a) Organize soil testing in rice growing counties for appropriate fertilizer usage	At least 4 irrigated rice schemes and 5 rain-fed rice growing counties	MoALF&C, Farmers, County Governments, Development Partners, Soil testing laboratories	Number of counties covered and soil tests cycles done	2019-2030
b) Customize and upscale adoption of proven water saving technologies	At least 30% of farmers in at least 5 schemes	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, Research institutions, Private sector	Percentage of farmers adopting customized water saving technologies Number of schemes covered	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
c) Develop and promote climate resilient technologies and mitigation of climate change effects	At least 3 new technologies developed and promoted At least 3 platforms for specific timely weather advisory services and early warning system created	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, KMD, Research institutions, Private sector	Number of climate resilience technologies developed and their adoption rates Number of platforms Number of early warning systems developed	2019-2030
d) Develop a rice suitability atlas	1 rice suitability atlas developed	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, KMD, Researcher Institutions, Private sector, Survey of Kenya, Regional Mapping Centre	Number of rice atlases developed	2019-2024

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
STRATEGIC OBJECTIVE 3: INCREASE THE COMPETITIVENESS OF LOCALLY PRODUCED RICE				
3.1 Reduction of the Cost of Production				
a) Increase on-farm mechanization	Increase on-farm mechanization by at least 20% in 7 major irrigated schemes	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, Research institutions, Private sector, NIA, RDA	Percentage increase in adoption of mechanization	2019-2030
b) Promote use of recommended guidelines for optimal application of farm-inputs	At least 50% of rice farmers following recommended guidelines	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, Research institutions, Private sector, NIA, RDA	Percentage increase in use of recommended guidelines	2019-2030
c) Organize agribusiness development groups for bulk procurements (SMAEs)	At least 10 SMAEs undertaking bulk procurement	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, Research institutions, Private sector, NIA, RDA	Number of agribusiness groups organized	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
d) Promote private sector investment in local sourcing/ manufacturing of inputs	At least 5 private sector investment undertaking local sourcing and manufacture of local inputs	MoALF&C, MoWS&I, NGOs, Farmer organizations, County Governments, Research institutions, Private sector, NIA, RDA	Number of new private sector undertakings	2019-2030
3.2 Improvement on quality of locally produced rice				
a) Promote good harvesting and postharvest handling practices (harvesting, drying, cleaning, milling, grading and packaging) [SMAEs]	30% increase of farmers who have adopted the practices	Research institutions, MoALF&C, NIA, NGOs, KEBS, CBOs	Percentage increase in farmers using the practices	2019-2030
b) Increase and organize private sector investment in trading, processing and marketing of paddy and milled rice (SMAEs)	At least 5 SMAEs investment in trading, processing and marketing of paddy and milled rice	KALRO, KIRDI, ATDC, MoALF&C, NIA, MoWS&I, RDA Universities, NGOs CBOs, County governments	Number of new SMAE registrations in rice growing areas	2019-2030
3.3 Promotion of efficient rice marketing and trading				
a) Increase accessibility, availability and preference of local rice to consumers	60% increase of consumers accessing local rice	MoALF&C, NIA, RDA, NGOs, CBOs, County governments, Private sector, KRA, KEBs, KNBS	Percentage increase of consumers accessing local rice	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
b) Promote linkages between farmers, farmer-based organizations, millers and markets	At least 5 new linkages created	MoALF&C, NIA, RDA, NGOs, CBOs, County governments, Private sector, Development Partners	Number of new linkages created	2019-2030
c) Facilitate procurement towards National Strategic Food Reserve	Targeted 25,000 bags of 50 kg annually	SFR, MoALF&C, Farmers, NIA, NCPB	Number of bags of rice under the reserve	2019-2022
STRATEGIC OBJECTIVE 4: AGRIBUSINESS PROMOTION ALONG RICE VALUE CHAIN				
4.1 Creation of enabling agribusiness environment; and streamlining marketing channels and linkages				
a) Provide an enabling environment for private sector investment along the rice value chain	At least 1 policy on marketing developed	MoALF&C, MoWS&I NIA, RDA, NGOs, CBOs, County governments, Private sector, AFA, MoTI&C, National Treasury, Development Partners	Number of new policies on rice marketing	2019-2022

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
b) Formulate regulatory framework to streamline marketing	At least 1 regulatory framework on marketing developed	MoALF&C, MoWS&I NIA, RDA, NGOs, CBOs, County governments, Private sector, AFA, MoTI&C, National Treasury, Development Partners	Number of new regulatory frameworks	2019-2024
c) Create awareness and enforce adherence to existing regional and domestic standards	5 workshops	MoALF&C, MoWS&I NIA, RDA, NGOs, CBOs, County governments, Private sector, AFA, MoTI&C, Development Partners, KEPHIS,KEBS	Number of sensitization workshops, trainees, Number of entities adopting the standards	2019-2030
d) Capacity build farmer organizations in the rice value chain agribusiness opportunities	5 farmer organizations capacity built	MoALF&C, NIA, RDA, NGOs, CBOs, County governments, Private sector, Development Partners	Number of farmer organizations trained	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
e) Create an enabling environment for support infrastructure development in the rice regions (road network in the farms, electricity tariffs, ICT)	At least 3 counties	MoALF&C, Counties, Research institutions, Development partners, MoEnergy, MoTI-HUD&PW	Length of roads improved Connectivity and electricity tariff reduction	2019-2030
4.2 Enhancement of input supply and use				
a) Capacity build farmers and agro-dealers (training, field days and trade fairs)	10 trainings Participate in 10 trade fairs 10 Field days	MoALF&C, Counties, NIA, KEPHIS, Research institutions, Development partners, Farmers, Agro dealers, private sector	Number of trainings, trade fairs and field days	2019-2030
b) Create more demand for inputs through demonstrations and other extension services	10 on farm demonstrations	MoALF&C, Counties, NIA, KEPHIS, Research institutions, Development partners, Farmers, Agro dealers, private sector	Number of demonstrations	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
4.3 Machinery hiring/service provision and support services				
a) Promote setting up of 'machinery hiring hubs' in rice growing areas	At least 3 machine hiring hubs	MoALF&C, Private sector, NIA, ATDC	Number of machine hiring hubs in rice production areas	2019-2030
b) Facilitate access to finance (low interest schemes) for investments, especially by youth and women	At least 3 low interest schemes	MoALF&C, Private sector, Financial institution	Number of low interest schemes established	2019-2030
c) Promote rice crop insurance	At least in 3 counties	MoALF&C, Private sector, Financial institution	Number of subscribers with rice insurance	2019-2030
d) Build technical capacities of operators, artisans and technicians	At least 10 trainings	MoALF&C, Private sector, Research institutions, Development partners,	Number of trainings organized	2019-2030
4.4 Promoting and upscaling value addition (rice products, by-products, packaging, branding and nutrition security)				
a) Build capacities of stakeholders and technology support towards innovative products	At least 10 trainings At least 3 products added in the market	MoALF&C, Private sector, Research institutions, Development partners, Financial institutions, MoTI&C	Number of trainings conducted	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
b) Promote and upscale entrepreneurships (especially youth, women) e.g. baling of straws for animal feeds	At least 5 enterprises promoted and upscaled	MoALF&C, Private sector, Research institutions, Development partners, Financial institutions, MoTI&C, MoEnergy	Number of enterprises promoted and upscaled by youth and women	2019-2030
c) Promote diversification of rice diets for nutrition security	20 demonstrations At least 3 new enhanced rice recipes developed At least 3 rice intercrop and enterprise mixes promoted	MoALF&C, MoH, Private sector, Research institutions, Development partners	Number of demonstrations Number enhance rice recipes Number of intercrop and enterprise mixes	2019-2030
4.5 Strengthening farmer based organizations				
a) Strengthen existing cooperatives, creation of Agribusiness Development Groups (ADGs) and mobilize farmers leadership committees	At least 5 cooperatives strengthened At least 3 ADGs developed	MoALF&C, MoTI&C, County Governments, Development partners, Financial institutions, KENAFF	Number of existing cooperatives strengthened Number of new ADGs created	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
b) Facilitate linkages (including contractual agreements) with input suppliers, service providers (machineries, millers)	At least 5 new linkages created	MoALF&C, NIA, RDA, NGOs, CBOs, County governments, Private sector, Development Partners	Number of new linkages created	2019-2030
c) Promote warehouse receipting system in major rice producing regions	At least 2 counties	MoALF&C, SFR, NIA, Private sector, County Governments	Number of counties using warehouse receipt system	2019-2030
d) Encourage investment in large scale rice farming	At least 2 large scale rice farms established	MoALF&C, Private sector, County Governments	Number of large scale rice farms	2019-2030
STRATEGIC OBJECTIVE 5: HUMAN RESOURCE DEVELOPMENT, COORDINATION, AND MONITORING & EVALUATION				
a) Build capacities of research institutions, policy makers and extension agents and other rice value chain actors on technical areas	28 PhD 72 MSc 380 Short courses	National government, County Governments, Research Institutes and Universities, Private sector, Development Partners	Number of people trained at various levels	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Expected output	Responsible/ collaborators	Performance indicators	Time frame
b) Build capacities of extension staff and actors on alternate online rice knowledge platforms	At least 10 trainings	National government, County Governments, Development Partners, Research institutions	Number of trainings conducted	2019-2030
c) Establish a Rice Research and Training Institute (RRTI)	1 RRTI established	National government, County Governments, Development Partners	Operationalization of RRTI	2019-2024
d) Equip Rice Research labs in KALRO Kibos and Mwea	2 rice research labs equipped	MoALF&C, National Treasury, KALRO, Development Partners	Number of labs equipped	2019-2024
e) Organize/participate in local and international rice research fora	At least 5 local At least 3 international	National government, County Governments, Development Partners	Number of rice research fora	2019-2030
f) Support to Rice Promotion Programme/NRTC, Technical consultative meetings	10 NRTC meetings 60 technical consultative meeting 5 stakeholder meetings	National government, County Governments, Development Partners	Number of meetings conducted	2019-2030
g) Monitoring, evaluation and reporting	10 NRTC M&E 20 periodic M&E 1 mid-term M&E 1 end-term M&E	National government, County Governments, Development Partners	M&E reports	2019-2030

11. FINANCING

The National Government, County Governments, Development Partners, other public institutions and private stakeholders of the rice value chain will commit financial resources in order to meet the goals of NRDS Phase 2. Budgetary allocations will also give attention to Monitoring and Evaluation mechanisms to ensure efficient and effective implementation of the strategy.

Concept notes will be developed for consideration for fund mobilization from the Government, Development Partners. CARD will play a major role in fund matching. Private sector participation will be encouraged. The proposed budget estimates are as indicated in Table 11.1.

Table 11.1: Proposed budget estimates for interventions

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
STRATEGIC OBJECTIVE 1: EXPANSION OF AREA UNDER RICE CULTIVATION			
1.1 Rehabilitation of existing and development of new irrigation infrastructure			
a) Rehabilitate and upgrade irrigation and drainage facilities of the existing schemes	7.00	National government, County Government, Development partners	2019-2030
b) Improve water transmission efficiencies by canal lining and adequate water management including operation and maintenance of all flow control and measurements structures	3.50		2019-2030
c) Install gravity intake irrigation systems in existing rice schemes	3.50		2019-2030
d) Develop new irrigation schemes with gravity intake irrigation systems in line with the Water Master Plan 2030 (MoWS&I) to reduce on the cost of pumping water	50.00		2019-2030
1.2 Expansion of rain-fed rice production area			
a) Expand the area under lowland rain-fed and upland rain-fed ecology	7.50	National government, County Government, Development partners, farmers and farmer organizations, NGOs	2019-2030
b) Develop and promote water harvesting structures for supplementary irrigation for rain-fed rice ecologies	7.50	National government, County Government, Development partners, farmers and farmer organizations, NGOs,	2019-2030
c) Promote in situ water management technologies	1.00	National government, County Government, Development partners, farmers and farmer organizations, NGOs	2019-2030
Sub-Total 1	**80.00**		

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
STRATEGIC OBJECTIVE 2: RAISE ON-FARM RICE PRODUCTIVITY			
2.1 Adoption of quality inputs and improved technologies			
a) Promotion of double cropping and ratooning	0.01	National government, County Government, farmers, farmer organizations, NGOs, Financial institutions	2019-2030
b) Provide subsidies and improve access to affordable credit	5.00	National government, County Government, farmers, farmer organizations, NGOs, Financial institutions	2019-2030
c) Develop and promote high-yielding, stress tolerant, market-oriented varieties	5.00	National government, County Government, Development partners, farmer organizations, NGOs, Financial institutions, Private sector, Research institutions, KEPHIS, Farmers	2019-2030
d) Facilitate and create linkages to private investments in production and agro-dealerships (SMAEs)	2.00	National government, County Government, Development partners, farmer organizations, NGOs, Financial institutions, Private sector, Research institutions, KEPHIS, Farmers	2019-2030
e) Increase the 'uptake' of certified seeds and hybrids, fertilizers and agro-chemicals in irrigated and rain-fed ecologies	1.00	National government, County Government, farmer organizations, NGOs, Financial institutions, Private sector, Research institutions, KEPHIS, Farmers	2019-2030
f) Facilitate management of migratory pests	1.00	National government, County Government, farmer organizations, NGOs, Financial institutions, Private sector, Farmers	2019-2030
2.2 Promotion of appropriation of mechanization			
α) Appropriate cost-efficient machineries for sowing, transplanting, weeding, harvest and postharvest handling	5.00	National government, County Government, Development partners, farmer organizations, NGOs, Financial institutions, Private sector, Research institutions, Farmers	2019-2030
β) Promote private investments and participation of youth and women in provision of hiring services, sales and after-sales services (SMAEs)	0.50	National Government, County Governments, Private sector Farmer organizations, Development Partners, RDA Research institutions	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
χ) Promote use of efficient machineries in harvest and postharvest activities	0.10	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
δ) Increase adoption of improved harvest and postharvest handling practices	0.10	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
ε) Train on emerging technologies in mechanization	0.50	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
2.3 Promotion of efficient and sustainable natural resource management practices			
a) Organize soil testing in rice growing areas for appropriate fertilizer usage	0.50	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
b) Customize and upscale adoption of proven water saving technologies	0.50	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
c) Develop and promote climate resilient technologies and mitigation of climate change effects	0.01	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2024
d) Develop a rice suitability atlas	0.01	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2024
Sub-Total 2	**21.23**		

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
STRATEGIC OBJECTIVE 3. INCREASE THE COMPETITIVENESS OF LOCALLY PRODUCED RICE			
3.1 Reduction of the cost of production			
a) Increase on-farm mechanization	0.50	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
b) Promote use of recommended guidelines for optimal application of farm-inputs	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
c) Organize agribusiness development groups for bulk procurements (SMAEs)	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
d) Promote private sector investment in local sourcing/ manufacturing of inputs	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
3.2 Improvement of the quality of locally produced rice			
a) Promote good production, harvesting and postharvest handling practices (harvesting, drying, cleaning, milling, grading and packaging) [SMAEs]	0.50	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
b) Increase and organize private sector investment in trading, processing and marketing of paddy and milled rice (SMAEs)	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
3.3 Promotion of efficient rice marketing and trading			
a) Increase accessibility, availability and preference of local rice to consumers	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
a) Promote linkages between farmers, farmer-based organizations, millers and markets	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2030
b) Facilitate procurement towards National Strategic Food Reserve	3.00	National Government, County Governments, Farmer organizations, RDA	2019-2022
c) Promote rice crop insurance	0.05	National Government, County Governments, Private sector, farmers and Farmer organizations, RDA	2019-2030
Sub-Total 3	**4.35**		
STRATEGIC OBJECTIVE 4: AGRIBUSINESS PROMOTION ALONG RICE VALUE CHAIN			
4.1 Creation of enabling agribusiness environment; and streamlining marketing channels and linkages			
a) Provide an enabling environment for private sector investment along the rice value chain	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2022
b) Formulate regulatory framework to streamline marketing	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	2019-2024 2019-2030
c) Create awareness of existing regional and domestic standards	0.03	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions	
d) Capacity build farmer organizations in the rice value chain agribusiness opportunities	0.05	National Government, County Governments, Development Partners, Private sector, Farmer organizations, RDA, Research institutions, NGOs	2019-2030
e) Create an enabling environment to support infrastructure development in the rice regions (e.g., road network, electricity tariffs)	3.00	National Government, County Governments, Development Partners, Private sector, RDA, NGOs, farmers	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
a) Form Rice Council of Kenya	0.005	National Government, County Governments, Development Partners, Private sector, RDA, NGOs, farmers	2019-2030
b) Form Rice Millers Association of Kenya	0.005	National Government, County Governments, Development Partners, Private sector, RDA, NGOs, farmers	2019-2030
4.2 Enhancement of input supply and use			
a) Capacity build farmers and agro-dealers (training, field days and trade fairs)	0.05	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
b) Create more demand for inputs through demonstrations and other extension services	0.01	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
4.3 Machinery hiring/service provision and support services			
a) Promote setting up of 'machinery hiring hubs' in rice growing areas	1.50	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
b) Facilitate access to finance (low interest schemes) for investments, especially by youth and women	0.50	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
c) Capacity build operators, artisans and technicians	0.05	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
4.4 Promoting and upscaling value addition (rice products, by-products, packaging, branding and nutrition security)			
a) Capacity build stakeholders on technology towards innovative products	0.05	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
b) Promote and upscale entrepreneurships (especially youth, women) e.g. baling of straws for animal feeds	0.05	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
c) Promote diversification of rice diets for nutrition security	0.01	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
4.5 Strengthening farmer based organizations			
a) Strengthen existing cooperatives, creation of Agribusiness Development Groups (ADGs) and mobilize farmers leadership committees	0.05	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030
b) Facilitate linkages (including contractual agreements) with input suppliers, service providers (machineries, millers)	0.05	National Government, County Governments, Development Partners, Private sector, RDA, NGOs	2019-2030

Result areas of interventions and their respective outputs, intervention strategies and activities	Required resources (Kshs. Billions)	Source of funding	Time frame
a) Promote warehouse receipting system in major rice producing regions	0.01	National Government, County Governments, Private sector, RDA, NGOs	2019-2030
b) Encourage investment in large scale rice farming	0.01	National Government, County Governments, Development Partners, Private sector, RDA, NGOs, Farmer organizations	2019-2030
Sub-Total 4	**5.52**		
STRATEGIC OBJECTIVE 5: HUMAN RESOURCE DEVELOPMENT, COORDINATION, AND MONITORING & EVALUATION			
a) Capacity build research institutions, policy makers and extension agents and other rice value chain actors on technical areas	0.50	National government, County Governments, Research Institutes and Universities, Private sector, Development Partners	2019-2030
b) Capacity build extension staff and actors on alternate online rice knowledge platforms	0.02	National government, County Governments, Research Institutes and Universities, Private sector, Development Partners	2019-2030
c) Establish a Rice Research and Training Institute (RRTI)	2.00	National government, County Governments, Development Partners	2019-2024
d) Equip Rice Research labs in KALRO Kibos and Mwea	1.00	National government, County Governments, Development Partners	2019-2024
e) Organize/ participate in local and international rice research fora	0.02	National government, County Governments, Development Partners	2019- 2030
f) Support to Rice Promotion Programme/ NRTC, Technical consultative meetings	0.20	National government, County Governments, Development Partners	2019-2030
g) Monitoring, evaluation and reporting	0.06	National government, County Governments, Development Partners	2019-2030
Sub-Total 5	**3.80**		
Grand-Total	**114.91**		

12. MONITORING, EVALUATION AND REPORTING

There is need for a suitable monitoring and evaluation (M&E) system/ mechanism to track the implementation of NRDS Phase 2 activities. The governance structure explained in section 6 of the document details the activities and responsibilities of the monitoring and evaluation process. This includes the use of results/logical frameworks, work plans, field visits and surveys, baseline survey, quarterly and annual reports, mid-term review and evaluation, and end term evaluation. The government will seek assistance on M&E from national and international partners to support efforts of promoting rice production in Kenya. A baseline survey will be carried out at the initial stages of NRDS implementation.

The M and E framework will be used to monitor:

- Expansion of area under rice cultivation
- Increase in rice productivity
- Increase in rice production and market competitiveness
- Agribusiness promotion along the rice value chain

The above broad output areas will contribute to the specific target outcomes of the three Anchors envisaged in the ASTGS namely:

- Increase in small scale farmer incomes
- Increase in agricultural output and value addition
- Boost household food resilience

A sample monitoring, evaluation and reporting tool is presented in Table 12.1.

Table 12.1: Sample monitoring, evaluation and reporting framework tool

	Indicator	Baseline	Target	Data Source	Frequency	Responsible	Reporting
Goal							
Outcome/ impact							
Output							

13. RESOURCE MOBILIZATION

Considering that increased production and productivity will be mainly achieved through irrigation development, which requires high capital investment, the government and development partners are called upon to prioritize investment in this area to ensure successful implementation of NRDS Phase 2. Smallholder farmers will be mobilized at county level to increase rice production under rain-fed cultures. Stakeholders will be encouraged to develop competitive proposals for soliciting support and grants.

The NRTC, in association with sub-technical committee members will identify priority areas from amongst the various proposed strategic interventions in this document. Based on such critical areas of interventions, the NRTC members will develop project concept notes, the execution of which shall lead to concrete implementation of the NRDS. The project concept notes will be shared with the various public and private stakeholders for further consultations and evoking interest in partnering the implementation. The NRTC members will further lobby for funds for the project concepts from the national and county governments, development partners, regional and international rice research and development organizations, the private sector and non-government organizations.

14. LINKAGES, COLLABORATION AND PARTNERSHIPS

International and regional linkages; National, County collaboration and partnerships in research (such as ASARECA, WARDA, IRRI, KAFACI, AfricaRice and JIRCAS) and development partners (such as FAO, JICA, AGRA, RDA, FARA, IFAD, NEPAD, The World Bank, WFP, etc.) will be encouraged to enhance achievements of NRDS Phase 2 goals and objectives.

REFERENCES

1. ACET, 2016. African Transformation Report. Transforming Africa's Agriculture.
2. African Union 2003. Maputo Declaration on Agriculture and Food Security Agribusiness Information Portal 2013. Rice Value Chain.
3. Alila, P. O. and Atieno, M., 2006.Agricultural Policy in Kenya: Issues and Processes. A paper for Anonymous, 2017. Personal Communication. Ministry of Water and Irrigation, Nairobi, Kenya.
4. Asanuma, S. and Y. Yamane 2015. Environment Conservation and Local Cultural in the Region Suffering from Soil Erosion in Western Kenya (April 2008 – March 2014).
5. CARD Working week and stakeholders' Report 2013.
6. Dietz, T., Dick Foeken, Sebastiaan Soeters & Wijnand K laver, 2013. Agricultural dynamics and food security trends in Kenya EUCORD 2012. Rice Sector Development in East Africa.
7. Economic survey 2018.
8. Economic survey 2019.
9. Evaluation of the National Rice Development Strategy (2008-2018) Charles Bett 2018.
10. FAO 2016. Crop prospects and Food Situation. No. 4 December 2016.
11. FAO 2016. Global Information and Early Warning System on Food and Agriculture (GIEWS) Country Brief, Kenya.
12. FAO 2016. Kenya Country Briefs.
13. FAO 2016. Rice Market Monitors. Vol. XIX (4):1-31.
14. FAOSTAT 2016. Kenya Country Briefs.
15. FAO 2017. Cereal Supply and Demand Brief.
16. FAO 2017. Food Price Index.
17. FAO 2017. Rice Price Update, Trade and Markets Global Agricultural Service 2016. Kenya Corn, Wheat and Rice Report. Grain and Feed Annual Report. USDA Foreign Agricultural Service. Ed. Kate Snipes and Kennedy Gitonga.

18. Government of Kenya 1966. Irrigation Act, Cap 347, Laws of Kenya.

19. Government of Kenya 2006. Strategic Plan 2006-2010. Ministry of Agriculture, Nairobi.

20. Government of Kenya Kenyan 2008. Kenya Vision 2030: Mainstreaming the Kenyan Diaspora Community in the Development Agenda.

21. Government of Kenya Kenyan 2009. National Rice Development Strategic Plan (2014-2018). Ministry of Agriculture, Livestock and Fisheries.

22. Government of Kenya 2010. Agricultural Sector Development Strategy 2010–2020.

23. Government of Kenya 2011. National Food and Nutrition Security Policy.

24. Government of Kenya, 2011. Rice Value Chain Study Report for Kenya. Agricultural Information Resource Centre (AIRC).

25. Government of Kenya Kenyan 2013. Economic Review of Agriculture. Ministry of Agriculture, Livestock and Fisheries.

26. Government of Kenya 2014. Kenya Agricultural Data Collection and Management Guideline. State Department of Agriculture Kenya, Kilimo House.

27. Government of Kenya 2015. Economic Review of Agriculture [ERA], 2015. Ministry of Agriculture, Livestock and Fisheries.

28. Government of Kenya 2015. The irrigation Bill.

29. Government of Kenya 2015. National Irrigation Policy.

30. Government of Kenya 2016. The Water Act. Kenya Gazette Supplement.

31. Grain storage, Private-Public partnerships, World Bank, 2011.

32. Huggins, C. 2000. Water Policy and Law in a Water-Scarce Country: Implications for Smallholder Irrigation in Kenya. African Centre for Technology Studies.

33. http://www.knowledgebank.irri.org

34. Irrigation Act 2019.

35. Jayne, T. and D. Ameyaw 2016. Africa Agriculture Status Report: Progress towards Agricultural Transformation in Africa.

36. Mabiso, A. K. Pauw and S. Benin 2012. Agricultural Growth And Poverty Reduction In Kenya: Technical Analysis For Agricultural Sector Development Strategy (ASDS) – Medium Term Investment Plan (MTIP).

37. Macauley, H. 2015. Cereal Crops: Rice, Maize, Millet, Sorghum, Wheat. Feeding Africa, An action Plan for African Agricultural Transformation.

38. MAFAP 2012. Analysis of Incentives and Disincentives for Rice in Kenya.

39. Kenya National Bureau of Statistics 2016. Economic Survey 2016.

40. KEPHIS website (https://www.kephis.org/images/Uploads/updated%20national%20variety_list-edited%20oct%202019.pdf.

41. Kilimo Trust 2014. Expanding Markets for Rice in the East African Community (EAC) Region.

42. MAFAP 2016.Grain and Feed Annual: Kenya Corn, Wheat and Rice Report.

43. National Irrigation Board 2007. Strategic Plan 2008 – 2012: Providing Leadership in Irrigation Development for food Security and Economic Development.

44. National Rice Development Strategic Plan (2008-2018). Ministry of Agriculture.

45. National Water Master Plan 2030 (2014).

46. Nkuba, J., A. Ndinguru, R. Madulu, D. Lwezaura, G. Kajiru, A. Babu, B. Chalamila and G. Ley, 2016. Rice value Chain Analysis in Tanzania: Identification of Constraints, Opportunities and Upgrading Strategies. African Crop Science Journal.24:73-77.

47. Neubert, S., V. Hesse, S. Iltgen, J.O. Onyando, W. Onchoke, V. Peters, A. Seelaff and D. Taras 2007. Poverty Oriented Irrigation Policy in Kenya: Empirical Results and Suggestions for Reform. German Development Institute, Bonn.

48. Norman, J.C. & Otoo, E. 2003. Rice development strategies for food security in Africa. In Proc. 20th session of the International Rice Commission, Bangkok, Thailand, July 2002.

49. Onyango, J.C. 2006. Inaugural Lecture Series No. 2: Rice a crop for wealth creation, productivity and prospects in Kenya's food security. Maseno University, Kenya.

50. Otsuka, K. and D.F. Larson 2016. In Pursuit of an African Green Revolution. Views from Rice and Maize Farmers' Fields.

51. PARDA project baseline survey report, 2018.

52. Rice Production Technologies Handbook 2017.

53. Rice Promotion Unit 2011. Annual Report 2010/2011 National Rice Development Strategy. Ministry of Agriculture, Kenya.

54. Rice Promotion Unit 2012. Annual Report 2011/2012 National Rice Development Strategy. Ministry of Agriculture, Kenya.

55. Rice Promotion Unit 2013. CARD Working week and Stakeholders Report. Ministry of Agriculture, Kenya.

56. The Financial Statements of the National Cereals and Produce Board, NCPB, June 2015

57. USAID Compete 2010. Staple Foods Value Chain Analysis; Country Report – Kenya.

ANNEXES

Annex 1: Developed rice varieties

S. No.	Variety name/code	Year of release	Owner(s)	Maintainer and seed source	Optimal production altitude range (Masl)	Duration to maturity (months /days)	Grain yield (t ha-1)	Special attributes
1	Basmati	KARI	KARI-Kibos	ND (Data not available)	ND	ND		• ND
2	Sindano	KARI	KARI-Kibos	ND	ND	ND		• ND
3	NERICA 1	2009	KARI	KARI (Mwea & Kibos)	15-1700	90-100	2.5-5.5	• Aromatic • Blast tolerant • Long grains
4	NERICA 4	2009	KARI	KARI (Mwea & Kibos)	15-1700	90-112	3.2-6.5	• Blast tolerant • Long grains
5	NERICA 10	2009	KARI	KARI (Mwea & Kibos)	15-1700	86-93	3.5-6.7	• Early, Long grains • Blast tolerant
6	NERICA 11	2009	KARI	KARI (Mwea & Kibos)	15-1700	90-105	3-5	• High ratooning ability • Long grains • Tolerant to blast & drought
7	Dourado Precose	2009	KARI	KARI (Mwea & Kibos)	15-1700	95-115	2.3-5.5	• Beardless
8	Trenasse	2010	Africe seed company	Africe seed company-Malindi	0-1700	3.5-4	6.0-8.1	• Earlymaturing • High ratooning • Excellent threshability & milling quality • Non-aromatic, semi dwarf, long grain • Intermediate amylose content • Cooks dry & non sticky • Intermediate gelatinization temperature • Resistant to blast, brown spot and stemborer

S. No.	Variety name/code	Year of release	Owner(s)	Maintainer and seed source	Optimal production altitude range (Masl)	Duration to maturity (months /days)	Grain yield (t ha-1)	Special attributes
9	SC 213	2010	Afritec seed company	Afritec seed company-Malindi	0-1700	4-4.5	6.2-9.6	• Long grain, high tillering ability, resistant to lodging • Non aromatic, good milling quality • Intermediate amylose content • Cook dry & non sticky, good threshing ability • Resistant to blast & stemborer
10	NIBAM 10	2010	National Irrigation Board (NIB)	NIB / MIAD	15 - 1700	90 - 100	3.5 – 6.0	• Aromatic • Tolerant to rice yellow mottle virus (rymv) • Long slender grains, awned • No anthocyanin, high ratooning ability
11	NIBAM 11	2010	National Irrigation Board (NIB)	NIB / MIAD	15 - 1700	95 - 112	3.2 – 6.5	• Aromatic • Tolerant to rice yellow mottle virus (rymv) • Long slender grains, awned • No anthocyanin, high ratooning ability
12	NIBAM 108	2010	National Irrigation Board (NIB)	NIB / MIAD	15 - 1700	135 - 145	6 - 10	• Medium maturing, non aromatic • Long grains, tolerant to blast, awnless • No anthocyanin, high tillering capacity
13	NIBAM 109	2010	National Irrigation Board (NIB)	NIB / MIAD	15 - 1700	135 - 150	8 - 12	• Late maturing, non aromatic • Short thick grains, tolerant to blast • Awnless, no anthocyanin • Very high tillering capacity
14	NIBAM 110	2010	National Irrigation Board (NIB)	NIB / MIAD	15 - 1700	110 - 120	3.0 – 5.0	• Medium early maturing • Tolerant to rice blast & rymv • Non aromatic, long slender grain • Awnless, no anthocyanin
15	TXD306	2013	ARI-KATRIN	ARI - KATRIN	Irrigated and rain-fed lowland ecosystems	2.5-3.0	4.5-6.0	• Aromatic paddy rice • Good eating & cooking qualities • Good milling quality • Moderate tolerant to some RYMV and blast diseases strain

S. No.	Variety name/code	Year of release	Owner(s)	Maintainer and seed source	Optimal production altitude range (Masl)	Duration to maturity (months /days)	Grain yield (t ha-1)	Special attributes
16	IR-05N221	2013	KARI-MWEA/IRRI	KARI-MWEA	Irrigated and rain-fed low-land ecosys-tems	2.5-3.0	4.0-6.7	• Aromatic paddy rice • Good eating & cooking qualities • Good milling quality • Moderate tolerant to some RYMV and blast diseases strain
17	KEH10004 (ARIZE 6444 Gold/ INH1001)	2014	Bayer Cropsci-ence, Germany	Bayer Biosci-ence PVT. Ltd, India	135-145 days		7.5- 9.0	• Highly tolerant to Bacterial leaf blight *(Xanthomonas oryzae pv. oryzae)* • Moderately tolerant to blast • Hybrid of medium-late duration • Medium slender grain • Slightly aromatic • Resistant to lodging • No chaffiness • Good milling yield (70 %)
18	KEH10005 (ARIZE TEJ Gold/ INH 11001)	2014	Bayer Crop sci-ence, Germany	Bayer Biosci-ence PVT. Ltd, India	125-135 days		7.0-8.0	• Highly tolerant to Bacterial leaf blight *(Xanthomonas oryzae pv. oryzae)* • Moderately tolerant to blast • Hybrid of early duration • Long slender high-quality grain • Slightly aromatic • Resistant to lodging • No chaffiness • Excellent milling yield (72 %)
19	AFEXH004	2018	Afritec Seed Ltd	Afritec Seeds Ltd	Suitable are-as from 5 to 1200m. Best above 500m	97 days	9.2	• Aromatic: 175ppb Basmati 370 = 175ppb of 2-AP • The aroma component • Good seed yields: Long Slender Grain
20	AFEXH001	2018	Afritec Seed Ltd	Afritec Seeds Ltd	Best suited for areas below 500m	102 days	8.1	• Aromatic: 90ppb Basmati 370 = 175ppb of 2-AP • The aroma component • Very high yields in high altitudes

S. No.	Variety name/code	Year of release	Owner(s)	Maintainer and seed source	Optimal production altitude range (Masl)	Duration to maturity (months /days)	Grain yield (t ha-1)	Special attributes
21	S5505*AT013	2018	AATF/ FreshCo	AATF/HEAL	Suited for all rice production areas in Kenya	99 days	9.3	• Good to excellent seed yields
22	S5517*AT013	2018	AATF/ SeedCo	AATF/HEAL	Suited for all rice production areas in Kenya	98 days	9.5	• Good to excellent seed yields
23	S5509*AT013	2018	AATF/Afritec Seed Ltd	Afritec Seeds Ltd	Sutiable for all production areas of Kenya.Broad adaptation to moisture stress	99-124	9.62	• Excellent Seed Yields, Excellent field yields, adapted to both rainfed and irrigated conditions'
24	24. AT054	2018	Afritec Seed Ltd	Afritec Seeds Ltd	Suitable from 20 msl to 1200msl. Best in areas above 500m, including Mwea and the Lake Basin	84-135	7.94	• Aromatic Basmati-like OPV with higher aroma levels than Basmati 370 (Aroma is over 220ppb)

S. No.	Variety name/code	Year of release	Owner(s)	Maintainer and seed source	Optimal production altitude range (Masl)	Duration to maturity (months /days)	Grain yield (t ha-1)	Special attributes
25	S5517*AT014	2018	AATF/Afritec Seed Ltd	Afritec Seeds Ltd	Suitable for all rice growing areas in Kenya; slightly better in altitudes above 500m Such as Mwea and Western Kenya	98-126	9.20	• Very high seed production values • Early maturing • High milling value • long slender grain
26	26. S5505*AT034	2018	AATF/Afritec Seed Ltd	AATF/HEAL	Suitable for all rice growing areas in Kenya, but slightly better in areas below 500m such as Hola ,Bura,Kisumu and Malindi	102-129	9.45	• high seed production values • Hybrid variety • Early maturing • High milling value • long grain

Source: KEPHIS website

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