



National Rice Development Strategy-II 2020 – 2030



**February 2020
Addis Ababa**

National Rice Development Strategy-II

2020 – 2030

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Addis Ababa, Ethiopia

This strategy is published with the financial support of JICA.

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Preface

Agriculture is a vital component of Ethiopia's economy and provides a livelihood for millions of our citizens. The Government of Federal Democratic Republic of Ethiopia has developed agricultural Development led Industrialization (ADLI) that led transforming the country's economy. It is aimed at transforming the country's economy in to a well-developed and prospered one.

The Ministry of Agriculture (MoA) is focusing to ensure food security, provide raw materials for the growing agro-industry parks and export commodities. Since agriculture is the mainstay of national economy; and the livelihood of the people, has set to make the sector vibrant, innovative and modernized. This entails diversification of crops and improvement of production systems.

Rice 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 (NRRDSE (2009 and 2019) Ethiopian rice production has increased (71,000 to 171,854 ton), establish national research and training center and various capacity building have been done to the rice research and extension of Ethiopia with the technical and financial support of JICA the Main country supporter of CARD initiative in Ethiopia.

The objective of NRDS-II is to achieve self-sufficiency objective of the country in rice by 2030. This strategy envisages a structure that will focus on core functions in commercialization of rice production, creating favorable environment in the provision of technologies, inputs, processing and marketing driven by public- private sector partnerships and all stakeholders along the value chain.

NRDS-II will also be an instrument of bidding for resources at the national, international and from private sector investors and county governments.

Acknowledgment

NRDS-II was developed under the agencies of the Ministry of Agriculture, Ethiopia and development partners. The documents benefited particularly from inputs and guidance provided by the members of this sector that steered the formulation of the strategy are listed below,

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3	Agricultural Growth and Transformation Advisory project (AGTAO)	Secretariat	Mr.Keisuke Urasugi
4	Agricultural Engineering Research Directorate Director	Member	Mr.Bisrat Getenet
5	Agricultural Economics Research Directorate Director	Member	Mr.Endeshaw Habte
6	Ethio-Rice	Member	Mr.Kiyoshi Shiratori
7	Agricultural Extension Director	Member	Ms.Yenenesh Egu
8	Agricultural Mechanization Director	Member	Mr.Tameru Habte
9	Ethiopian Agricultural Business Enterprise (EABE)	Member	Mr.Birhanu Yeshitla
10	Sasakawa Global 2000 (SG2000) - Ethiopia	Member	Mr.Melese Liyhe
11	Agricultural Transformation Agency (ATA)	Member	Dr.Zewde G/Tsadik
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13		Mr.Teshome Lemma	SG2000	Expert
14		Mr.Bitew Melaku	MEDA	Expert

Introduction

In Ethiopia, rice is recognized as a “millennium crop” with scopes for high job creation potential and significance on food security especially in places where other food crops like tef, maize, wheat and sorghum do not do well. Among the existing production ecologies, 81.2% is rain-fed lowland, 18.6% rain-fed upland and 0.2% is irrigated (EIAR, 2019). Ethiopia has land areas in nearly 6 million hectare for rain-fed and 3.7 million hectares irrigated rice production (MoARD, 2010). The total area under rice production has increased from about 10,000 ha in 2006 to over 63,000 ha in 2019, and production has increased from 71,316 tons in 2008 to over 171,000 tons in 2019 (CSA, 2019). The increase in rice production is due to increase in expansion of production. Despite such a growth, the rate of increase in rice import was considerably higher during the same period. Self-sufficiency in rice consumption has decreased from 60% in 2008 to 20% in 2016. Rice import increased from 22,500 tons in 2008 to 311,827 tons in 2016, which is 12.07 million USD in 2008 to 170.69 million USD in 2016.

Market analyses indicate that there are three basic types of rice consumers in Ethiopia (Meron Abebe, 2016). The first is consumers who prefer quality rice—aromatic, long grain and packed rice. The second category represents consumers who prefer local rice and imported rice. The third category consists of consumers who prefer local rice, especially as rice flour for making enjera. A vast majority of the local rice market that includes rural communities, falls within the third category.

Since rice was a relatively new crop in Ethiopia, the first National Rice Research and Development Strategy of Ethiopia (NRRDSE, 2009-2019) was developed to address the challenges in the sub-sector. Since NRRDSE has expired, this document National Rice Development Strategy-II (NRDS-II, 2019-2030) was developed.

NRDS-II emphasizes the status of rice production, challenges, goals, priority areas, interventions and actions along the rice value chain. The strategy aims at enabling stakeholders in coordinating their efforts towards the development of the sub-sector.

The Rice Sector

Status in National Policies

Rice is among the targeted commodities which received due attention in transforming agricultural production. Recognizing the comparative advantages of rice over other food crops, it is considered as the “Millennium crop” that is expected to contribute to ensuring food security in the country. This recognition has also been reflected by the preparation of the NRRDSE that has played crucial role in guiding the overall rice research and development in the country (MoARD, 2010).

Trends in Rice Production

As indicated in Figure 1, there is an increasing trend in both area and production of rice; although the rate of increase is not more than stated in NRRDSE (2009-2019). The area of rice was 35,088 ha in 2009, which has increased to 41,811 ha in 2013 and to 63,362 ha in 2019. The production of rice was 71,000 tons in 2009, 121,000 tons in 2013, and 171,854 tons in 2019. The increased production is linked with the expansion of area in the wetland and upland areas. Rice production in irrigated areas has not increased substantially.

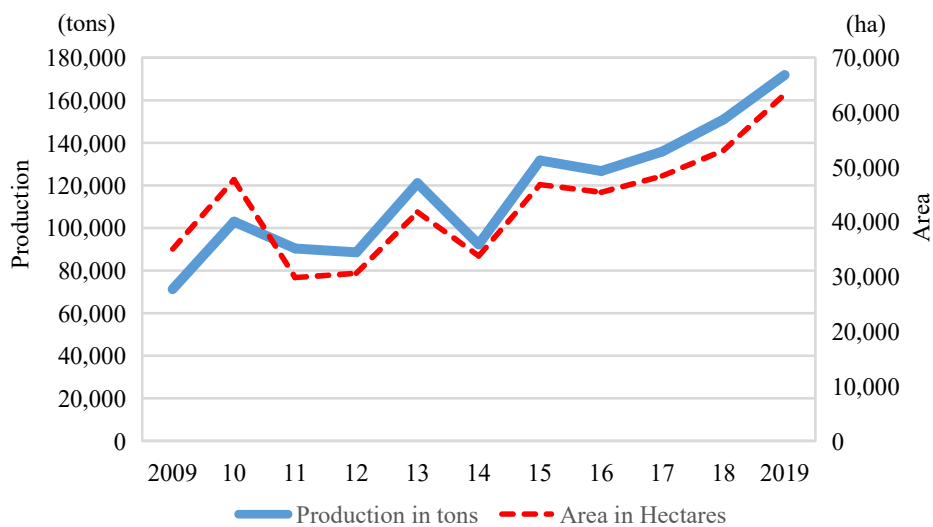


Figure 1 Area and production of rice
Source: Central Statistical Agency

Yield is a key factor related to the total production of rice. The trends in yield levels of the major crops, including rice are shown in Figure 2. Crops yields except rice have increased in recent years. In 2019, the national average yield of rice was 2.7 t/ha, which is far lower than the targeted average yield of 5.1 t/ha in NRRDSE.

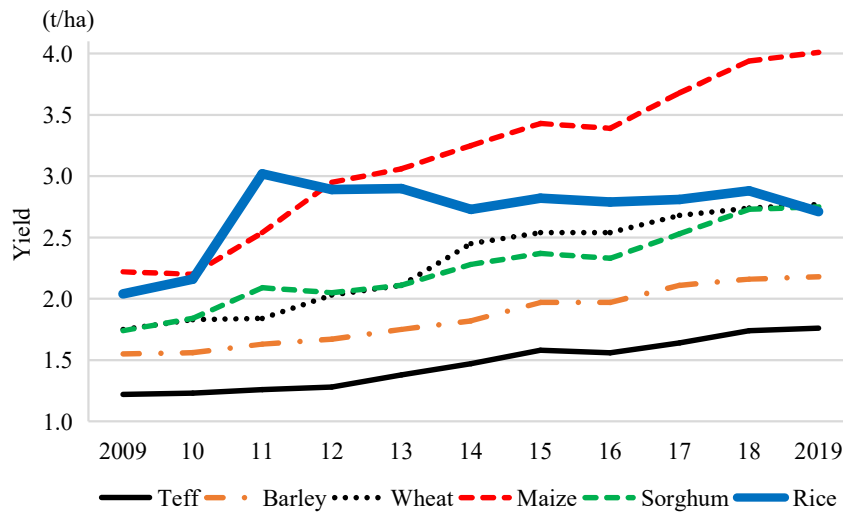


Figure 2 Yields of major crops
Source: Central Statistical Agency

Most of the rice production potential area is the western part of the country (Figure 3). However, the area covered under rice is low as compared to its potential. According to Smallholders Irrigation and Drainage Strategy (MoA & MoIE, 2018), Ethiopia has irrigation potential of 11.1 million hectares. Potential for expansion of area for irrigated rice exist in Tendaho, Shebelle, Omo and Gambella.

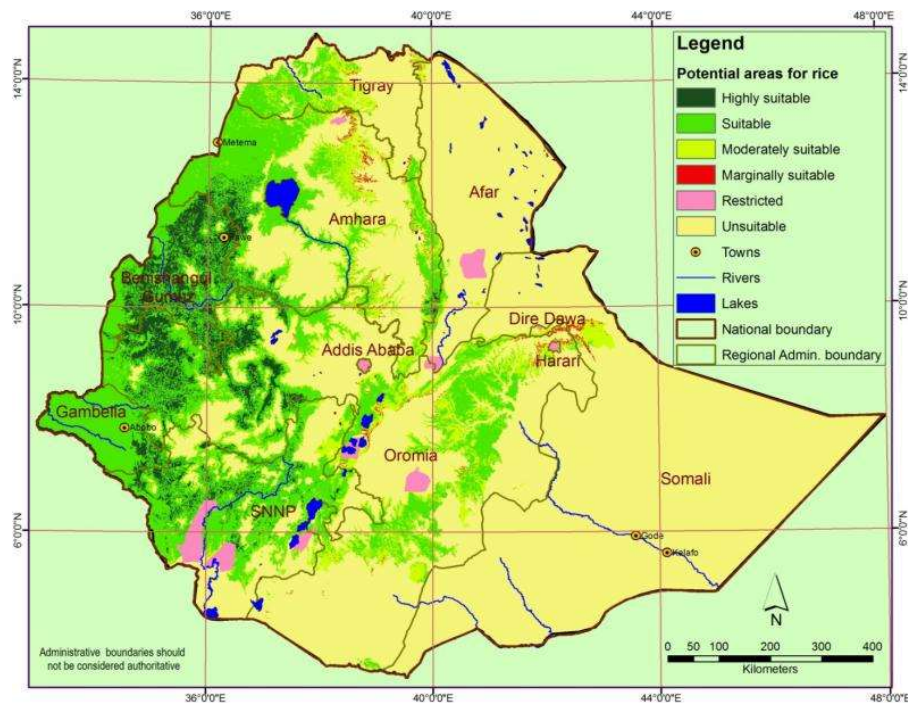


Figure 3 Suitability map of rain-fed rice production

Source: MoARD, 2010

The rice production coverage has increased from 10,000 ha in 2006 to over 63,000 ha in 2019 (CSA, 2019). There is a fast tendency of rice area increment in Ethiopia particularly in Amhara, Benishangul-Gumuz and Oromia Regions. There is plenty of suitable land for rice production (Table 1) in the west central highlands of Amhara Region (Figure 4). This area is presently grazing lands and planted with chickpea and grass pea using residual moisture after the seasonal water flooding recedes. Nonetheless, farmers have recently started rice production in these areas.

Table 1 Rice suitability class in west central highlands of Amhara region

Land suitability class	Area (ha)	Coverage (%)
Not suitable	39,931	3.13
Marginally suitable	312,135	24.44
Moderately suitable	629,320	49.28
Highly suitable	295,547	23.15
Total	1,276,933	100.00

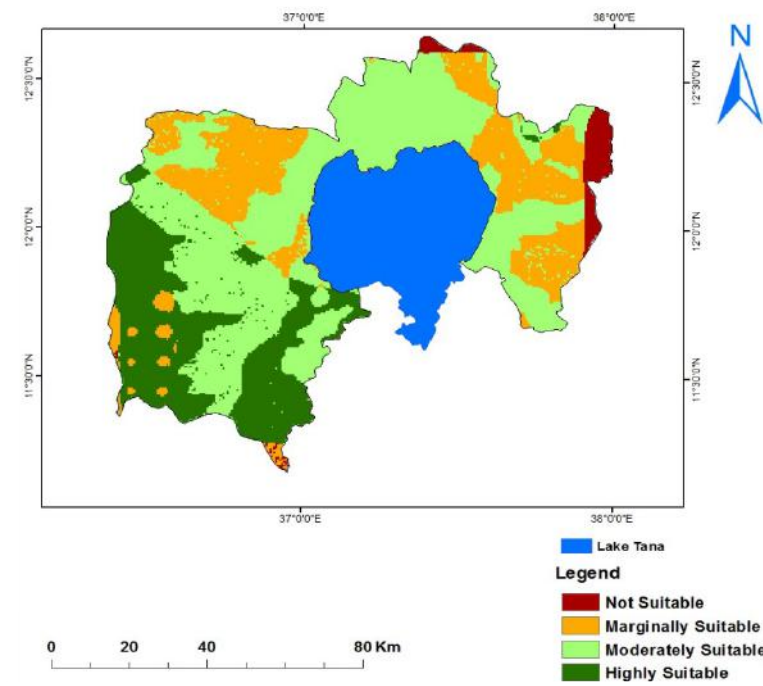


Figure 4 Suitability map of rain-fed rice production in west central highlands of Amhara Region
 Source: Getachew and Solomon, 2015

Inputs

Seed

Currently, the Ethiopian seed system is characterized by its three major components namely formal, intermediate and informal sector. These components operate in their respective domains. The formal sector is subject to compulsory certification and is strictly regulated unlike the informal which is regulation exempted. The intermediate sector is managed by the less stringent quality declared seed certification system, which has its own directive and standards and allows full responsibility of the producers with the regulatory engagement in field and seed certification. Moreover, the intermediate sector is managed by regional states to identify crop and production area. Since rice is a recent introduction to Ethiopia and its seed production focuses on limited geographies under low levels of engagement of the public, private and cooperative based enterprises. Overall, the rice seed supply, marketing and usage are at an infant stage.

According to EIAR (2019), unlike other cereal crops, rice Early Generation

Seed (EGS) is supplied mainly through EIAR and Regional Research Institutes. The total area allocated for 2013/14 for EGS production showed a four-fold increment after 5 years (Table 2).

Table 2 Early generation seed supply

Seed class	Total area (ha)				
	2013/14	2015/16	2016/17	2017/18	2018/19
Breeder seed	0.965	0.896	1.375	2.095	2.013
Pre-basic seed	7.005	6.975	8.175	30.75	24.65
Basic seed	1.5	9.25	10.25	21.5	37.78
Certified seed	6	6	6.25	6	6
Total	15.47	23.12	26.05	60.35	71.44

Source: EIAR survey data

According to the Ministry of Agriculture (2018), 11,335 q of certified seed C1 and 31,273 q of C2 seed was utilized from 2007 to 2017. The C2 seed was farmer-to-farmer exchange without the approval of the regulatory authority. More than 58% of the seed source was farmer-to-farmer seed exchange (EIAR, 2019). The survey also found that rice farmers used seeds supplied by government sources and NGOs. The regional breakdown showed that maximum seed is utilized in Amhara Region, however, the sources of the seeds vary amongst the regions. The majority of the household heads also showed preference to the ever-existing local variety X-Jigna 67%, unknown old varieties 10%, Gumera 9% and Nerica-4 3%. In general, the amount of rice supplied is inconsistent across data sources.

Fertilizer

Fertilizer supply is public and cooperative based with no private sector participation. The government generally takes all sorts of responsibility from import to farm gate delivery. Through a voucher, fertilizer supply system the supply chain has become more facilitative and easier to access.

CSA (2019) reported that an average of 20,545 q of fertilizer per annum is used for rice. Taking a three-year consistent data from 2014 to 2016, the CSA report showed that some of the farmers use 950 q of sole DAP/annum—at an average rate of 2 kg/ha, and some use 8,532 q of urea + DAP—at an average rate of 18 kg/ha. Unlike rice, per hectare utilization of sole DAP and urea + DAP for wheat is 77 kg/ha and 85 kg/ha, respectively. The total number of smallholder

rice farmers/annum who used both urea and DAP were 26,603 q—19% of the total holders.

Rice Consumption

The total consumption of rice in Ethiopia has grown faster than the domestic production, which has resulted in a considerable decline in the rate of self-sufficiency. As indicated in Figure 5, the rate of self-sufficiency has decreased from 60% in 2008 to 20% in 2016.

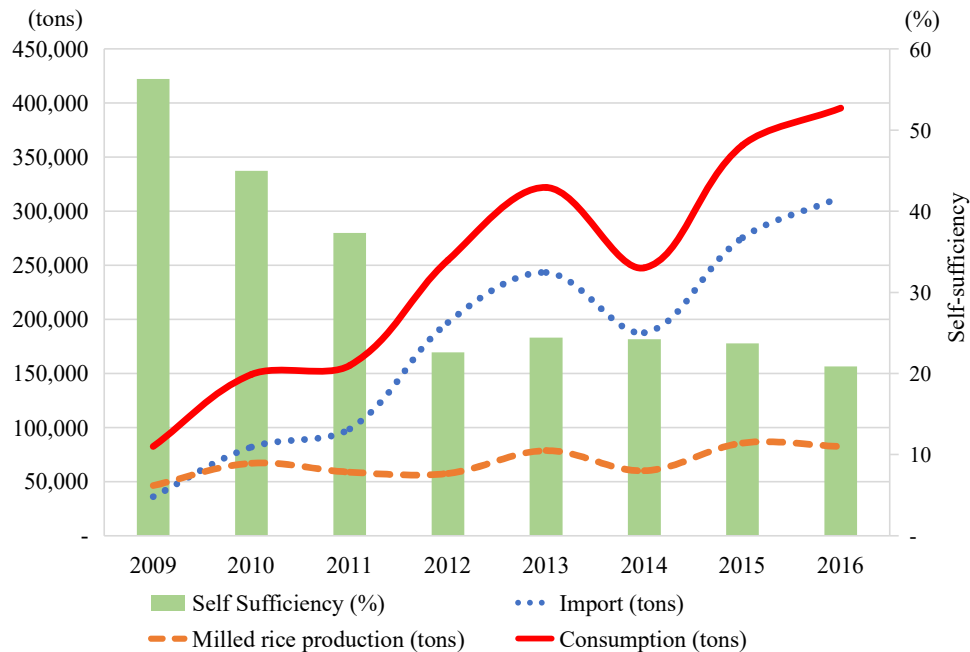


Figure 5 Rice production, import, consumption and self-sufficiency
Source: Dawit et al., 2019 (modified).

Structure of consumers and their preferences

There are three basic types of rice consumers in Ethiopia (Meron Abebe, 2016). The first type represents the consumers who preferred quality rice (aromatic, long grain and packed rice). These consumers generally fall under high-income group and are the smallest in numbers of the three. This market is currently served entirely by importers who import from large rice producing countries. The second category is comprised of the consumers who prefer both local and imported rice. Consumers in this category consume rice both as flour in enjera as well as boiled rice

especially for their children. This market is relatively less sensitive to brand, and more price-sensitive than the higher-income group. For these consumers quality is important and local rice is currently able to serve the needs of the consumers. The third category of consumers prefers local rice, especially rice flour to make enjera. The vast majority of the local rice market falls within this category. This market is growing quickly.

Typology of Rice Farmers, Processors and Traders

Nearly all paddy production operations are done using traditional tools. Family members provide labor for all operations. The current level and practice of agriculture in the Ethiopian smallholder context is characterized by low level of distribution and utilization of farm machineries and associated implements. Farmers have been losing from 10 to 20% prior to processing due the lack of mechanical harvesting, threshing, drying and storage technologies. Mechanical intervention in rice post-harvest operation is restricted to milling operations. The common milling machine is the Chinese made single pass friction type. This mill is relatively cheap, easy to operate and maintain. The total milled rice recovery is 53 to 65%, and head rice recovery is on average 30% of the milled rice (Mustafa, 2017).

Rice farmers

Majority of rice farmers in Ethiopia are smallholders who produce rice mostly for consumption in their own households, and sell surplus to processors or paddy collectors located close to the producers. About 161,376 smallholders are involved in producing rice with an average land holding of 0.59 ha (Meron Abebe, 2016). Recent surveys showed that, although some farmers have been growing rice for over 35 years, the average number of years of rice cultivation experience of farmers is about 11.37 years (EIAR, 2019).

In most rice producing areas, mixed farming is as an integral part of agricultural production. Consequently, farmers use power from animals and human beings for soil tillage, threshing and farm transport. Upland rice farmers are often engaged in mixed cultivation, in which rice is grown with other crops. Farmers in most of the lowland flooded ecology practice continuous rice cultivation. Commercial rice farming is mainly in Gambella, SNNPR and Oromia Regions. While the Saudi Star Agriculture Development Plc. has so far established irrigated rice cultivation over

1,300 ha out of the potential 300,000 ha of land under concession, Kisho Agro Industries has established 163 ha of land under rain-fed rice cultivation.

Processors

Farmers are responsible for most of the pre-milling post-harvest operations. Traditional tools and practices are used for harvesting and threshing. Entrepreneurs process rice husking and milling mostly using small machines. Although availability of efficient milling machines is a major constraint in rice processing, the number of registered rice processors has increased from 10 in 2009 to over 150 in 2018. In addition, the Saudi Star Agriculture Development Plc. establishes one modern large-scale rice-milling factory with modern large-scale processing facility at Bishoftu Town. These trends show increased demand for value addition and the scope for rice milling as a potential business enterprise.

Rice traders

The majority of paddy rice sold by the producers themselves and processors are the one who buys the milled rice in all rice producing areas. These processors serve as wholesalers and sell to traders. Wholesalers and retailers of both paddy and milled rice are scattered all over the country. Traders handle most of the milled rice. Since many of the production areas have poor transportation, paddy traders provide services to bring the farm to the markets. In most cases, the traders control the price of rice coming to the market from domestic and international suppliers.

Market Structure and Value Chain

As rice is a cash crop in several of the wetland and upland areas, the type and number of actors engaged in value chain is increasing considerably through time. Previous studies show that from 2013 to 2016, the proportion of produced rice sold in the markets has increased from 75 to 98% (Meron, 2016). This has provided diverse options for the value addition and marketing, and has enhanced the commercial orientation of smallholders. In addition to the processing service they provide, most processors operate as traders, and they channel the processed rice either through brokers or directly to wholesalers and retailers. Table 3 outlines the key actors involved in rice marketing in Fogera,

with a brief description of their characteristics and the main roles they play. The processed rice is often sold to wholesalers through brokers in distant markets such as in Gonder, Dessie, Mekelle and Addis Ababa. Figure 6 presents market channels of imported rice and Figure 7 presents domestic rice market channels in Ethiopia. In most cases, the traders control the price of rice coming to the market.

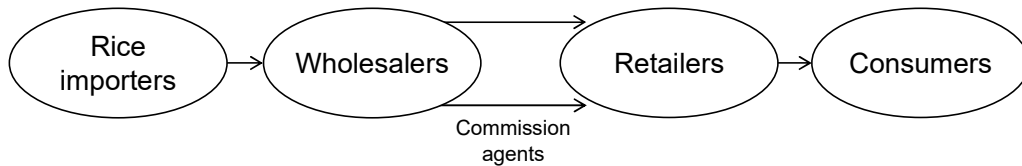


Figure 6 Market channels of imported rice

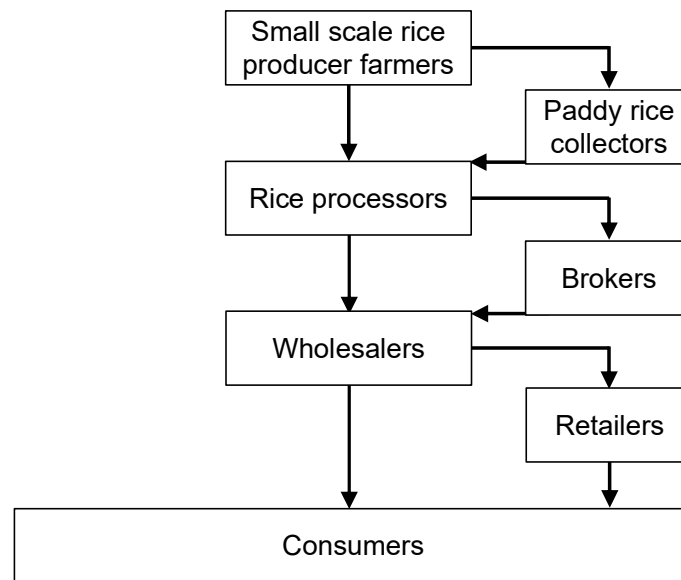


Figure 7 Domestic rice market channels

Source: Meron Abebe, 2016, Dawit et al., 2018, EIAR rice value chain baseline survey, 2019

Table 3 Characteristic and role of actors in rice market

Actor	Characteristic	Role
Paddy rice collectors	Village level operations on behalf of processors	<ul style="list-style-type: none"> • Operate aggregators • Often they are rice producers
Processors	Private processors	<ul style="list-style-type: none"> • Purchase main product and by-products (Operate as traders)
	Cooperatives	<ul style="list-style-type: none"> • Provision of processing services (dehusking, bran cleaning and milling)
Traders	Wholesalers and retailers	<ul style="list-style-type: none"> • Market processed rice to other traders in distant markets or to local consumers
		<ul style="list-style-type: none"> • There is an emerging trend that paddy rice traders from Chewaka sell to processors in Fogera especially when there is short local supply
Brokers	Operate on commission basis	<ul style="list-style-type: none"> • Link processors with wholesalers including those in distant markets • Also facilitate transport services

Youth Employment and Gender Dimensions

Since rice is a labor-intensive crop, the need for the contribution from household labor is very high. All household members play important role from land preparation until harvesting. The typical roles and responsibilities of women and girls include weeding, seed drilling and seed cleaning. On the other hand, men and male youths do tillage, planting, top dressing of fertilizer, pest control, harvesting, irrigation and drying. Generally, the boys at the age of 14 and above are able to plough land, while girls shoulder considerable responsibilities within the household. In spite of the substantial contribution of women to on-farm rice production, men regulate sales and control of incomes from the sale.

Comparative Advantages of Rice Production

Rice is a good source of food and cash for the farmers. The demand for rice is rising fast in both national and regional markets. In the local market, the price of rice is comparable to tef. Its straw and other by-products such as husk and bran are also used for animal feed, roofing, energy and articles such as hat. The

major comparative advantages of production of rice in Ethiopia are

- favorable public policy and good linkages with regional and international research institutes like IRRI, Africa Rice Center and JIRCAS;
- huge production potential in both rain-fed and irrigation conditions;
- acceptable, good taste of domestically produced rice and high water holding capacity for baking enjera compared with the imported ones;
- competitiveness of domestic rice production, mainly because of sufficient labor;
- cheaper price of locally produced than imported rice;
- high domestic demand;
- expansion of rice production linked with agro-ecological suitability;
- compatibility of rice in the local farming systems and traditional foods; and
- rapid increase in domestic rice consumption and associated burden on foreign currency due to rice imports.

Achievements and Lessons Learnt from NRRDSE

Achievements during the previous strategic period (2009-2019) indicated that the performances of rice research and source seed maintenance were more or less achieved except the introduction and adaptation of pre- and post-harvest technologies. On the other hand, the performances of the rice development with respect to production and productivity showed much small increment against the set targets. Other notable achievements and lessons include

- establishment of rice research and training center with moderately equipped facilities at Fogera;
- capacity building for rice researchers, extension staff and farmers locally and internationally;
- development and release of 23 new rice varieties;
- the need to strengthen capacity of partner institutions engaged in the rice research and development activities; and
- address systemic inadequacies in
 - coordination and partnership mechanisms between regional and federal government offices,
 - data collection and difficulty for monitoring and evaluation system, and
 - gaining attention from government and development partners.

Challenges and Opportunities

Challenges

Varieties

The national rice research program of Ethiopia targets lowland rain-fed, upland rain-fed and irrigated rice growing ecosystems. The major challenges related to variety include the following

- lack of strong variety release system and institution led to supply of incompetent varieties in the rice sector,
- lack of competitive market orientation in variety development;
 - inadequate involvement of the private sector in variety development including rice varieties;
 - lack of competitive, location-based recommended and multi-trait inclusive rice varieties;
- poor knowledge in rice seed and extension systems across the value chain limits the popularization and utilization of seeds of released varieties so far;
- lack of effective demand assessment for rice seed resulted in poor level of engagement of seed companies in rice seed production and marketing;
- lack of finance inclusiveness in rice unlike other crops example coffee;
- lack of certified seeds of traditional varieties like X-Jigna since the varieties are not officially registered.

Fertilizer

Fertilizer supply chain is characterized by its weak capacity with the following major setbacks

- inadequate policy that encourages private sector engagement in fertilizer value chain;
- insufficient fertilizer demand assessment;
- lengthy processing time in fertilizer supply chain;
- inadequate supply of fertilizer in amount and type;
- uneven supply to crop calendar; and
- recommended fertilizer rates for rice are not well popularized and usage is often below expected levels.

Mechanization

The pre-harvest and post-harvest mechanization are the most important processes in rice development. Mechanization service provision includes

encouraging the domestic manufacturing and assembly of equipment, import of adoptable and affordable machineries and prototypes is an imminent undertaking and is facing the following challenges

- too little attention has been given to the small machineries than large-scale multistage machineries;
- low level of participation of the domestic private sectors manufacturing and assembly of equipment is not well encouraged;
- weak institutional and technical capacity
 - in identification, verification and production of mechanization technologies;
 - weak extension system that could not efficiently promote mechanization technologies that is suitable to the rice sector;
 - absence of technical skill amongst rice growers and public technical personnel in handling machines especially motorized equipment;
- weak financial and marketing system pertinent to rice
 - higher interest rate or inadequate financial institutions that lend money for mid- and long-term credit for the equipment supply chain;
 - escalated price of machineries and limited purchasing capacity of smallholder farmers;
 - lack of efficient and effective distribution models and commercial milling industries for mechanization technologies;
 - Lack of importers and distributors in the vicinity of smallholder farmers in rural areas.

Pesticides and agro-chemicals

There is a growing pressure from pests on rice production due to frequent outbreaks, climate change, poor management of land and cropping systems. The major challenges in pesticide supply and usage include

- insufficient monitoring the quality of agro-chemicals;
- intrusion of unregistered pesticides;
- low quality pesticides in the market; and
- environmentally and economically unviable pesticides.

Agronomy

In recent years, rice yield has not increased, implying that crop management technologies are not sufficiently applied by farmers because of the following challenges

- lack of effective extension system;
- inappropriate crop management; and
- bird attack on large-scale commercial rice production.

Irrigation

Since irrigation of rice fields require a high level of coordination on the amount and timing of water; farmers need to cooperate in accessing and efficiently using the available water. Hence, the rice irrigation requires careful coordination.

Construction of an environment friendly irrigation scheme that will ensure climate smart irrigation needs large-scale of finance, labor and time. In the country, rice irrigation areas have not increased due to the following reasons

- weak linkages with research and extension;
- low capacity of water management, water conservation and drainage;
- priority of irrigated rice cultivation has not gained track;
- assessment results on rice irrigation potential of the country is not well known;
- inadequate use of mechanization technologies; and
- best practices and schemes on irrigated rice are not properly shared with farmers, investors, researchers and extension staff.

Post-harvest

The high proportion of broken rice grains in domestically processed rice and the various losses during milling that lowers the value and reduces farmers' income are mainly due to the poor performance of the milling machines. The situation has not changed over the years due to the following challenges

- farmers are not well aware that harvesting activities such as excessive drying, sand mixing and improper storage can affect the quality of the milled rice; and
- no strong communication with rice processors because farmers generally sell rice through traders and farmers cannot give strong opinions to processors on improving rice quality and reducing losses.

Based on the survey in 2018 in Fogera area the main challenges are summarized in Table 4.

Table 4 Challenges of rice processors

Category	Challenges	%
Paddy supply	Supply of poor quality paddy rice	92.0
	Inadequate supply of paddy rice	85.2
	Challenges related with aggregation from small producers	50.8
Processing technology	Poor quality, old model or inefficient machines	51.6
	Unavailability of quality and modern machines in the local market	63.1
Required resources and services	Lack of land to expand processing business	59.0
	Lack of capital to expand processing business	73.8
	Lack of land to establish other businesses	54.1
	Lack of skilled labor for processing	51.6
	Frequent interruption of electric power	91.8
Rice market	Inadequate demand for milled rice	61.5
	Lack of price incentive for quality rice product	59.0
	Lack of market information	43.8
	Huge competition from imported rice	71.9

Source: Dawit Alemu, 2019

Market

Most of the imported rice is milled, aromatic and long grain rice. The contribution of domestic rice in this market is insignificant. The market is engaged in the low-quality and low-price rice market that is consumed in rural areas. The reasons behind this include the following

- the domestic rice has not been adapted to the preferences of urban areas;
- aromatic seeds are not developed locally;
- limited opportunities for market access;
- limited systems or organizations that allow farmers to store rice properly;
- limited capacity of farmers to negotiate prices with traders; and
- inferior quality of domestic rice to imported rice.

Utilization

A variety of products has been developed from rice—sole or mixed with other cereals, and is being widely utilized in Ethiopia. However, rice straw, husk and bran are not widely used as alternative feed for poultry and livestock, soil conditioners and energy sources. The reasons include

- inadequate demonstrations on the use of by-products that could lead to an income increase for the farmers; and
- inadequate knowledge amongst researchers and extension staff about how to

make materials that can be easily generated and used by farmers using by-products.

Investments

Although there is commercial farming of rice by Saudi Star Agriculture Development Plc. and a huge rice processing facility established at Bishoftu, investments in the rice sector are limited. The government has not been able to appeal its attractiveness both inside and outside of the country because for the following reasons

- at smallholder level, investors prefer irrigation pump with a relatively small initial investment, but the government has not been able to select suitable candidate sites;
- in rice processing and marketing, the government provides limited infrastructure such as water and electricity; and
- lack of candidate sites where investors and many farmers or farmers' organizations can make production and shipping contracts.

Human capacity

Building human capacity along the entire rice value chain is one of the strategic challenges in developing the rice sector. Several technical and enumerative gaps exist in the current roster of available human resources such as for rice seed production and seed inspection under the public domain at federal and regional levels. Specifically

- the majority of development agents (DAs) and experts do not have enough technical knowledge and skills to provide practical training and demand-driven advisory services to farmers in the various rice ecologies;
- DAs do not have adequate communication and adult education skills in response to the community needs; and
- seed certification agencies lack enough technical knowledge about the rice crop/varieties, the major rice disease and pest identification.

Institutional capacity

Institutions play a key role in developing the rice sector and providing appropriate linkages among stakeholders. Since rice is a relatively new crop in Ethiopia, institutional focus on rice-specific policies, research, and extension is still at an embryonic stage. The institutional challenges include

- poor methodology and non-reliable rice related data in areas where the CSA does

not adequately capture. The only gap to fill the data shortage in areas not addressed by CSA is to use the administrative data. However, it is mostly exaggerated and unreliable. For instance, the average rice yield in 2019 according to CSA (2019) is 2.71 t/ha while it said to be 4.48 t/ha in the case of the administrative reports (EIAR, 2019 rice value chain base line survey report) which had estimated the productivity of Amhara region to be 5.74 t/ha;

- poor utilization of ICT-based extension services;
- insufficient logistic resources for Farmers Training Centers (FTCs) and motivation to retain DAs and experts; and
- poor linkages among rice value chain actors.

Climate

The vagaries of climatic conditions impose serious challenges on the sustainability of rice production, especially in smallholder farms where rainfall variability heavily influences the productivity levels and the household food security and incomes. The key abiotic stress that affects rice production includes the following

- reduced yield owing to terminal moisture stresses (early cessation of rainfall); and
- yield reductions due to cold injury—more rice sterility due to occasions of lower temperatures at flowering.

Others

- Limited policy focus on considering rice as a strategic commodity in GTP-I & II;
- Non-inclusion of rice in agricultural commercialization cluster; and
- Poor gender and youth participation in extension services.

Opportunities

Rural poverty reduction and economic growth

There is nearly 6 million hectare of land highly suitable for rice production in the country. The country is also endowed with huge irrigation potential of about 3.7 million hectare of land (Awulachew et al., 2007). Rice has become an increasingly important cash crop in rice producing areas. This is mainly due to its high demand as a food crop. Its relatively stable price trends in the food market enable the farmers to earn cash income when produced in excess. In addition, the following advantages widen the scopes of rice in reducing poverty and inducing economic growth in the country

- Ethiopia has prioritized rice sector development and labeled it as a “Millennium Crop”;
- the crop can grow in waterlogged areas, rain-fed and irrigated agro-ecosystems of both lowland and intermediate areas;
- the number of producers, processors, traders and consumers of rice is increasing;
- rice can be grown in rotation with pulses like chickpeas, grass peas, etc.; and
- investment and infrastructure for rice production and processing are improving in some parts of the country.

High yielding and adaptable varieties

Infrastructure and human capacities for conducting rice research and development and seed production have significantly improved in recent years. Some of these developments include the following

- more than 35 rice varieties are released;
- fertile legal and regulatory environments including rice quality standards are put in place;
- emergence of seed unions near rice growing ecologies and other companies;
- presence of development partners working on rice seed; and
- increased quantities of certified seeds from regional seed enterprises.

Technology dissemination channels

There is a well-developed dissemination system in the country for agricultural technologies. The available opportunities in rice technology dissemination include

- existence of considerable number of extension workers;
- exchange visits of rice scientists, extension officers, processors and farmers;
- the possibility of promoting rice technologies through FTCs;
- use of Farmers’ Research and Extension Group (FREG);
- use of publications, mass media, seed fairs and websites;
- existence of cooperatives & private sector in mechanization service provision; and
- establishment of a system and scaling up of the one-stop shop to ensure pesticide supply at farm gate level.

Institutional environment

Although recent, the recently established NRRTC has widened the scopes for building a strong national rice research and training program in Ethiopia. The

MoA has established a general national agriculture extension system across the country, and has put in place an institutional structure for overseeing developments. The specific institutional structure and system are as follows

- existence of different strategies, guidelines and manuals in agriculture sector;
- establishment of the National Rice Steering Committee and existence of research centers involved in rice;
- tax exemption, leasing policy, piloting of mechanization service center;
- existence of cooperatives across the country to facilitate rice market;
- availability of rice development projects from development partners; and
- interest from the government for higher investments in expansion of irrigation schemes and affirmative policy to support expanding lowland irrigation.

Vision and Scope

Vision

Vibrant and dynamic domestic rice industry that responds to national and regional consumers' needs.

Scope

The strategy encompasses various domains of rice value chain such as production, processing, marketing and trading in Ethiopia.

Goal

Achieve increased production, productivity and quality of locally produced rice in order to drive the rice sector towards self-sufficiency in Ethiopia.

Strategic Objectives

The major objectives of the strategy are

- to increase domestic rice production by increasing rice area;
- to increase rice yield of smallholders' and large-scale production environments through improved management of on-farm and off-farm practices;
- to improve the quality of domestic rice through improved handling and processing; and
- to improve the enabling environment for improved performance of the rice sector.

Projected Targets

Targets for area, production, productivity and self-sufficiency

The targets are cascaded in two ways, namely the ecosystem-based and their overall area, productivity and production potential (Table 5) and national self-sufficiency (Table 6). As stated earlier, the rice ecosystem includes rain-fed upland, rain-fed lowland and irrigated. The key attention in target setting is

productivity, area, production and self-sufficiency. Meeting targets will be highly driven by escalating demand in domestic and regional markets.

The central theme of the projected target in 11 years-time (2020-2030) is to substitute import with domestic rice production. However, this ambitious scenario requires aggressive and substantial interventions of the top officials across the federal and regional administrative levels. The pre-conditions are highly governed by level of decision making, public and private investments. This requires high input utilization and workable input system. In NRRDSE strategic years, grass root level institutions like research centers, Woreda offices of agriculture, FTCs and development partners implemented strategic interventions.

Ecosystems

At the end of the strategic year, 75% of the paddy rice production will be in rain-fed lowland, 20% rain-fed upland and 5% in irrigation ecosystem (Table 5). The yield is calculated using high yielding varieties increase, fertilizer and pesticide utilization increase, mechanization and other futuristic technologies used, large-scale irrigated rice operationalized, considering best global productivity achievements (12-14 t/ha in Egypt, Australia and China), considering domestic best rice productivity achievements at farmers level (9 t/ha) near lake Tana. Moreover, to meet the strategic plan of the federal government towards self-sufficiency and import substitution also is considered.

Unlike the NRRDSE strategic years, in NRDS-II years more emphasis will be given to scale-out commercial rice farming by private investors and the targets in productivity is set based on the capacity of private sector to absorb future production technologies and irrigation. To speed up transformation of the rice sector, it is also projected that Ethiopian government will attract more foreign direct investment in rice production, processing and marketing. This is because the government is currently promoting more engagement of the private sector across economic sectors (Home Grown Economic Reform, 2019).

Table 5 Ecosystem based rice area and production targets

Ecosystem	2019				2030			
	Area (%)	Area (ha)	Yield (t/ha)	Production (tons)	Area (%)	Area (ha)	Yield (t/ha)	Production (tons)
SH RF Upland	18.6	11,785	2.50	31,964	20.0	65,450	3.50	229,075
SH RF Lowland	81.4	51,577	2.80	139,889	75.0	245,438	4.20	1,030,838
SH Irrigation	0.0	0	0	0	5.0	16,363	5.30	87,588
SH Total	-	63,362	2.71	171,854	100.0	327,250	4.12	1,347,501
Private investment	-	1,300	5.00	6,500	-	57,750	10.00	577,500
SH + Investment	-	64,662	-	178,354	-	385,000	5.00	1,925,001
Total NRDS-II targets	-	-	-	-	-	385,000	5.00	1,925,000

NB: SH refers to Smallholders of CSA data. RF refers Rain-fed.

Self-sufficiency

It is projected that import substitution is completely attained and self-sufficiency is secured. The assumptions include increase in liberal, land consolidation, contract farming, input utilization and aggressive promotion of private sector investments, higher levels of farmers' adoption of best practices, mechanization and water use efficiency, increased access to finance and markets and enhanced support from ministries and regional bureaus of agriculture and other stakeholders.

After 11 years, the total paddy grain production will reach 1,925,000 tons by employing 385,000 ha of land with average productivity levels of 5 t/ha. This level of production will enable self-sufficiency and import substitution at the end of the strategic year. In the second half of the strategic year, 2027, 83% of self-sufficiency will be achieved. At the end of the strategic year, 2030, it is projected that a total of 12,094 tons of surplus paddy rice will be produced (Table 6).

Table 6 Self-sufficiency targets

Description	2019	2024	2027	2030
Projected consumption (tons)	551,585	849,065	1,053,862	1,243,389
Expected domestic paddy production (tons)	848,592	1,306,254	1,621,327	1,912,906
Actual local paddy (tons)	171,854	-	-	-
Self-sufficiency ratio (%)	20	57	83	100
Current area (ha)	63,362	-	-	-
Area to be deployed for self- sufficiency (ha)	-	353,041	360,295	382,581
Targeted area under NRDS-II (ha)	-	200,000	300,000	385,000
Current yield (t/ha)	2.71	-	-	-
Targeted yield under NRDS-II (t/ha)	-	3.70	4.50	5.00
Targeted production under NRDS-II (tons)	-	740,000	1,350,000	1,925,000
Surplus/Deficit (Paddy rice; tons)	- 676,738	- 566,254	- 271,327	+12,094
Surplus/Deficit (Milled rice; tons)	- 439,880	- 368,065	- 176,362	+7,861

NB: - indicates deficit and +indicates surplus.

Certified rice seed

The targets for the usage of certified seed are set as percentage of the projected area under rice cultivation. As shown in Table 7, the assumption for certified seed use for 2020 to 2024 is 10% of the total cultivated area. In 2027, it is projected that it will be 20% and by the end of 2030, it will reach 30% of the total cultivated area. It is also understood that requirement of upstream classes of breeder, pre-basic and basic seed can be established based on the certified seed projections below and effective seed usage during implementation. It is assumed that certified rice seed supply of seed firms will increase in the coming years due to various policy interventions and aggressive promotion activities.

The exiting progresses at grass root level like availability of seed unions and primary cooperatives within potential rice agro-ecologies also can pave away for boosting improved seed supply. Moreover, the contract based EGS and certified seed supply system established currently will contribute to catalyzing initiation of seed companies and research centers agreement on rice seed supply. Moreover, it is envisioned that multi-national seed companies' engagement in the seed sector will also increase.

Table 7 Projected certified rice seed production under NRDS-II

Year	Area under rice cultivation (ha)	Projected adoption (%)	Seed target under NRDS-II (tons)
2019	63,361	-	-
2024	200,000	10	2,000
2027	300,000	20	6,000
2030	385,000	30	11,550

Strategic framework

Table 8 illustrates the specific objectives and major interventions under each strategic objective. Indicators for tracking the progress made through the proposed interventions are shown for mid-term (2024) and long-term (2030) of the strategy period.

Table 8 Strategic framework of NRDS-II

Strategic objective	Specific objective	Major interventions	Macro-indicators	
			Mid-term (2024)	Long-term (2030)
1. To increase domestic rice production by increasing rice area	1.1. Expand smallholder rice cultivation by farmers in rain-fed upland, lowland and irrigation ecosystems	<ul style="list-style-type: none"> • Scale-out rice production in Amhara, Benishangul, Oromia, SNNPR and Tigray using GIS analyses on suitability and demonstrated potential • Promote rice production techniques through sensitization, improved access to inputs, capacity building of farmers and development agents • Rehabilitate existing irrigation schemes • Create new irrigation schemes 	<ul style="list-style-type: none"> • At least 40,000 ha of new lowland areas are cultivated with rice 	<ul style="list-style-type: none"> • At least 100,000 ha of new lowland areas are cultivated with rice
	1.2. Expand large-scale commercial rice cultivation	<ul style="list-style-type: none"> • Create enabling environment that will enable access to land, infrastructure and power for private investors 	<ul style="list-style-type: none"> • At least 12,000 ha of rice will be cultivated under irrigated conditions 	<ul style="list-style-type: none"> • At least 50,000 ha of rice will be under commercial irrigated rice production
		<ul style="list-style-type: none"> • Private-public dialogues and partnerships 	<ul style="list-style-type: none"> • At least 1 new private investor engaged commercial rice farming 	<ul style="list-style-type: none"> • At least 3 new private investors produce rice
2. To increase rice yield under both smallholders' and large-scale production environments	2.1. Promote the use of productivity-enhancing inputs	<ul style="list-style-type: none"> • Develop farmer-preferred, market-oriented and climate-resilient rice varieties 	<ul style="list-style-type: none"> • At least 5 improved rice varieties are released and adopted 	<ul style="list-style-type: none"> • At least 10 improved rice varieties are released and adopted
		<ul style="list-style-type: none"> • Increase availability and access to certified seeds of improved varieties to farmers 	<ul style="list-style-type: none"> • At least 10% of cultivated area use certified seed 	<ul style="list-style-type: none"> • At least 30% of cultivated area use certified seed
		<ul style="list-style-type: none"> • Improve availability, appropriateness and access to fertilizers and other agro-chemicals 	<ul style="list-style-type: none"> • Amount of inorganic fertilizer used increases from 18 to 30 kg/ha 	<ul style="list-style-type: none"> • Amount of inorganic fertilizer used increases to 40 kg/ha

Strategic objective	Specific objective	Major interventions	Macro-indicators	
			Mid-term (2024)	Long-term (2030)
		<ul style="list-style-type: none"> Promote usage of machineries and implements for land preparation planting, weeding and harvesting 	<ul style="list-style-type: none"> Tractor power/area amongst smallholder rice farms increased to 0.1 kW/ha 	<ul style="list-style-type: none"> Tractor power/area amongst smallholder rice farms increased to 0.2 kW/ha
	2.2. Improve soil, water and crop management practices	<ul style="list-style-type: none"> Promote sustainable and efficient management of resources through development of appropriate techniques 	<ul style="list-style-type: none"> At least 10,000 rice farmers are provided with knowledge and training on management practices 	<ul style="list-style-type: none"> At least 20,000 rice farmers are provided with knowledge and training on management practices
		<ul style="list-style-type: none"> Promote best rice crop production and protection practices through improved extension services 	<ul style="list-style-type: none"> At least 10% of rice farmers adopt full package on rice production 	<ul style="list-style-type: none"> At least 30% of rice farmers adopt full package on rice production
	2.3. Reduce post-harvest losses	<ul style="list-style-type: none"> Promote use of machineries in post-harvest handling 	<ul style="list-style-type: none"> At least 5% of rice farmers adopt improved post-harvest technologies 	<ul style="list-style-type: none"> At least 10% of rice farmers adopt improved post-harvest technologies
		<ul style="list-style-type: none"> Improve storage facilities 	<ul style="list-style-type: none"> At least 3,000 improved household storage facilities and 2 warehouse facilities accessed by rice farmers 	<ul style="list-style-type: none"> At least 5,000 improved household storage facilities and 4 warehouse facilities accessed by rice farmers
	3. To improve the quality of domestic rice through improved handling and processing	3.1. Enhance quality of domestic rice through improved on-farm and off-farm handling	<ul style="list-style-type: none"> Raise awareness on the importance of quality of paddy rice in improving the marketability amongst smallholder farmers and processors 	<ul style="list-style-type: none"> At least 100 DAs, 10,000 farmers and 200 processors trained

Strategic objective	Specific objective	Major interventions	Macro-indicators	
			Mid-term (2024)	Long-term (2030)
	3.2. Increase the availability and accessibility of modern processing technologies to farmers	<ul style="list-style-type: none"> Promote small-scale and industrial scale rice processing facilities that can produce clean and graded rice efficiently 	<ul style="list-style-type: none"> At least 50 small-scale processors and 1 large-scale processors use modern rice milling technology 	<ul style="list-style-type: none"> At least 100 small-scale processors and 2 large-scale processors use modern rice milling technology
4. To enhance enabling environment for improved performance of the rice sector	4.1. Facilitate improved linkages among rice value chain actors	<ul style="list-style-type: none"> Promote rice stakeholder linkage through a Rice platform 	<ul style="list-style-type: none"> Rice platform established at national level 	<ul style="list-style-type: none"> Rice stakeholder association established
	4.2. Facilitate the design and implementation of policies, regulations and directives to enhance the performance of the rice sector	<ul style="list-style-type: none"> Engage with relevant stakeholders to address the key policy bottlenecks including those that can boost the competitiveness of domestic rice 	<ul style="list-style-type: none"> Number of policies/regulations/directives put in place 	<ul style="list-style-type: none"> Number of policies/regulations/directives put in place

Priorities and Approaches

Agro-ecology based promotion

Interventions will be conducted according to the specific characteristics in the two ecosystems such as seed selection and fertilizer application in the short-term (1-3 years). Under irrigated ecosystem, water management and maintenance of irrigation facilities will be introduced in the mid-term (3-5 years) and long-term (5 years onwards), and rehabilitation of existing schemes and construction of irrigation schemes will be carried out.

Promoting Small-scale and Large-scale Rice Production

Mainly small-scale farmers contribute to current domestic rice production. Promoting small-scale rice production is critical in the short-term (1-3 years) and mid-term (3-5 years). On the other hand, for large-scale private commercial farms, it is important to ensure high profitability by introducing irrigated rice with irrigation facilities. Establishment of some successful irrigation schemes shall appeal to investors in the long-term (5 years onwards).

Gender Consideration

In Ethiopia, women do most of the on-farm rice production work. Training for farmers on increasing rice production using small tools and machines shall decrease the drudgery and labor burden of women and engage youth in rice production. Women and youth needs should be identified before the training. Training will be based on creating awareness of substantial improvements in women's lives and youth participation in rice value chain activities. Women and youth will be encouraged to participate in decision-making and entrepreneurial initiatives. New policy measures will be introduced to reduce women's labor burden, youth participation in micro, small and medium enterprises and service provisions in rice production areas.

Value Chain Approach Promotion

Interventions will be promoted to make sure that all actors along the chain—input supply, rice production, aggregation, storage, transport, processing and marketing—will get the benefits from domestic rice production. Private sector, farmers' cooperatives, unions and associations will be included in the network of actors.

Environmental Sustainability

Rice production in Ethiopia is ecologically sustainable as it effectively recycles substances such as water, nitrogen and carbon in nature. However, with the rapid promotion of rice production, it may cause environmental impacts such as soil degradation due to inappropriate use of chemical fertilizers. Inputs and technologies used for rice production will be carefully evaluated for environmental impact, and measures to mitigate the impact will be introduced if necessary.

Strategies

Input supply and utilization

Use of improved technologies like improved seeds, fertilizers, pesticides and agricultural machineries on rice production is at an infant stage. Therefore, to increase production and productivity of rice in contributing self-sufficiency and in the end for import substitution the following strategic interventions on input utilization are proposed.

Rice seed

Certified rice seed utilization will increase in the upcoming 10 years due to the following interventions.

- **Enhance knowledge on the use of quality rice seed:** this includes raising awareness on available seeds of rice varieties to every public and private value chain actors, farmers and other stakeholders through demonstrations, trainings, mass media promotion tools;
- **Introduce innovative systematic interventions that enhance improved seed utilization:** this includes,
 - design a strong variety approval and release system for rice varieties,
 - decentralize Quality Declared Seed (QDS) registration system to be administered by regional states that will allow to maintain seed quality and official commercialization of dominant local varieties like that of X-Jigna of Fogera plain,
 - strengthen out-grower schemes in rice agro-ecologies and ensure quality seed production,
 - incorporate rice in seed marketing intervention of rice agro-ecologies,
 - introduce rice seed small packs through one-stop shopping services,
 - support agro-dealership,
 - support voucher credit system in rice agro-ecologies,
 - prioritize special finance access in terms of credit or revolving fund for both farmers and rice seed producers;
- **Strengthen institutional capacity:** this includes enhancing the capacity of rice seed production of public, cooperative and private seed companies to ensure production of pre-basic, basic and certified rice seeds. Moreover, strengthen regional & federal seed certification capacities to enhance their support of quality seed supply;
- **Use irrigation for seed production:** this includes engaging potential private grain producer companies to produce improved rice variety seed. Moreover, it requires linking them to farmers in potential rice agro-ecologies in terms of

- variety popularization, awareness creation and marketing of their varieties;
- **Involve foreign seed companies in hybrid rice seed production and marketing:** this requires creating joint venture among local and foreign seed companies, promoting engagement of foreign companies of potential rice varieties to engage in rice seed business at local level; and
 - **Improve the informal seed system:** the certified seed production is expected to cover 30% of the rice land area by 2030. This shows that majority of the rice seed source will remain the informal seed system including self-seed recycling. There should be strategic interventions to be applied for the improvement of the informal seed system.

Fertilizer and other agro-chemicals

Improving inorganic fertilizer and pesticide supply and utilization is one of the mechanisms that are expected to enhance production and productivity of rice in the upcoming 10 strategic years. No one will expect separate intervention to supply fertilizer and pesticides for rice production. However, unlike NRRDSE strategic years, emphasis will be given to the following strategic interventions to transform inorganic fertilizer and pesticide utilization in the rice potential agro-ecologies.

- **Improve fertilizer demand assessment mechanisms and improve awareness on utilization of fertilizer:** this will be done by digitalizing the demand assessment and intensive training to demand assessment linked partners;
- **Develop a strong knowledge base at DAs level to carry out soil test-based assessment:** to ensure effective fertilizer utilization DAs will be supported to improve their knowledge in soil test through training and providing quick test methods enabling tool kits. Moreover, a mobile soil test will be promoted across rice agro-ecologies, and wide-scale promotions and demonstrations will be carried out to improve fertilizer utilization of smallholder farmers and investors; and
- **Improve fertilizer and pesticide supply chain efficiency:** this shall be achieved incorporating fertilizer voucher system in all rice producing areas, by shortening fertilizer supply chain, consider alignment to rice crop calendar, scale-up one-stop shopping to ensure access of pesticide to rice growing areas and incorporate pesticide, herbicides and other agro-chemicals in the current fertilizer supply chain.

Mechanization

The Ethiopian National Agricultural Mechanization Strategy gave detail areas

of interventions in improving utilization across crops and ecosystems. In the upcoming years, special emphasis will be given to the below mentioned strategies to improve utilization of agricultural machineries.

- Promote the creation of a distribution network for agricultural machineries at the federal and regional levels for adoptable and affordable small and medium tools and implements;
- Attention should be given to small-scale mechanization and mechanization service provision for rice producing farmers particularly by the policymakers;
- Encouraged private sector actors to participate in the supply chain of mechanization technologies;
- Ensure access to globally available rice mechanization equipment through technology shopping;
- Promote multiplication of prototypes adapted elsewhere from other countries;
- Encourage the domestic manufacturing and assembly of equipment;
- Establish joint-venture partnerships with foreign companies;
- Develop the skill of farmers, technicians, experts and supply chain actors;
- Encourage the involvement of groups of farmers, cooperatives, associations and unions in the supply chain and providing hiring services to members/non-members;
- Device a mechanism for medium and large-scale farmers to provide custom hire services to other farmers in their locality after working on their own farms and sometimes migrate to other districts and regions; and
- Establish a “machine distributor” fund to provide liquidity to local distributors;
- Strengthen the tax-exemption opportunities to import of agricultural machineries and spare parts.

Crop Management

Rice production potential will be maximized and yield shall be increased by applying modern farming practices such as improved varieties, land preparation, seeding rate, fertilizer application and pest control. In order to increase the productivity of rice in smallholder farms, the use of improved crop management practices is therefore crucial. The following strategic interventions related to crop management are proposed.

Promoting and developing varieties

- Promote and demonstrate improved rice varieties;
- Develop high yielding, market-driven and climate-resilient varieties i.e. early

- maturing, cold stress tolerant, moisture stress tolerant;
- Develop varieties considering criteria of the farming community;
- Facilitating the QDS registry of X-Jigna variety and its entrance to the formal seed production system; and
- Hybridization of X-Jigna and other varieties to combine best attributes into new varieties.

Agronomic practices

- Develop soil test-based fertilizer recommendations for different rice growing ecosystems;
- Identify the effects of soil micronutrients on rice growth and development;
- Develop best agronomic practices for different rice ecosystems;
- Develop integrated soil fertility management recommendations for different rice ecosystems;
- Develop cropping systems (recommendations for different rice ecosystems);
- Evaluate and promote appropriate soil conservation measures particularly in upland rice growing areas where soil degradation is critical;
- Promote and demonstrate improved agronomic practices; and
- Strengthen the capacity of soil testing laboratories.

Pest management

- Develop pest and disease resistant rice varieties;
- Develop control technologies to major rice pests and diseases;
- Promote improved and integrated rice disease, insect, weed and post-harvest pest management practices;
- Strengthen pest and disease forecasting system;
- Strengthen the human and infrastructure capacity of seed and plant health regulatory body and plant health clinics; and
- Improve the skills of agricultural experts and DAs on pest and disease diagnosis and management.

Irrigation

Irrigation including drainage has the effect of dramatically increasing rice yield. Improving traditional irrigation systems as well as expanding areas under modern irrigation is important to increase productivity and improve rural livelihood. The rice strategy under irrigation shall focus on the following

- rehabilitate the existing irrigation schemes and demonstrate best agronomic

- practices for irrigated rice production;
- conduct assessment study on rice irrigation potential of the country;
 - encourage and enhance the involvement of private investors in rehabilitation and construction of irrigation schemes and irrigated rice production through collection or identification of best practices at national and international level in irrigated rice investment;
 - expand irrigation schemes development through construction of new irrigation schemes and enhance community participation in rice irrigation potential areas of the country;
 - develop recommendations for irrigation water management;
 - develop upland and lowland climate resilient water management practices;
 - establish and strengthen the capacity of Irrigation Water User Associations (IWUAs) in rice growing areas for efficient scheme management and administration, scheme maintenance and operation;
 - increase access to infrastructure and mechanization technologies;
 - adopt and apply land consolidation and clustering; and
 - improve extension services on irrigated rice production through demonstration, experience sharing visit, farmer's field days and staff training.

Pre- and Post-harvest

Timeliness of tillage and planting, weeding and harvesting are critical factors where affordable labor is insufficient to permit timely operation. In order to improve the yield and quality, and reduce post-harvest losses, the following strategic interventions are proposed.

- Evaluate, adapt and promote verified pre- and post-harvest mechanization technologies which includes
 - improved animal-drawn implements and farm tools like row seeders, row weeders, mold-board ploughs, animal-drawn harrows, wheelbarrows and animal-drawn carts,
 - motorized pre-harvest implements (tillage implements, row planters, row weeders), and
 - cost and energy saving rice post-harvest and processing technologies such as harvesters, threshers, cleaners, driers, storages, parboilers and millers;
- Establish pre- and post-harvest service providers for mechanized farming with special attention to improving rural youth groups;
- Improve knowledge and skills on pre- and post-harvest mechanization technologies which include training for
 - mechanization experts, extension agents, farmers and manufacturers on proper handling and utilization of pre-harvest mechanization technologies,

- farmers, traders and product handlers on proper drying, storage and cleaning of paddy and milled rice,
- mill operators on optimized rice milling techniques and create awareness of processors to upgrade processing capacity of milling machines,
- youth groups on operation, handling and maintenance of rice harvesting, threshing, mechanization technologies and create awareness on establishment of small and micro enterprises for service provision,
- service providers on business management and technical aspects, and
- manufacturers on fabrication and marketing of mechanical equipment;
- Encouraging manufacturers and service providers by developing more suitable policy and financial access;
- Strengthen capacity and familiarize researchers and experts with current state of the art knowledge and scientific tools through short- and long-term training;
- Create enabling environment for private investments on manufacturing agricultural machineries, service provision and rice milling;
- Encourage cooperatives to establish rice milling industries; and
- Provide electric power in rice processing areas at private and cooperative level.

Maintaining Agricultural Equipment

Establishment and strengthening of maintenance centers for agricultural equipment mainly in rural areas are very important in improving rice production and productivity. Therefore, the NRDS-II will focus on the following strategic interventions

- provision of reliable and timely maintenance services, spare parts, fuel, and lubricants for farm equipment, water lifting and saving technologies and other tools;
- technical backstopping for timely maintaining and skill development;
- encourage small-scale and micro enterprises for effective management and maintenance of farm machineries; and
- develop capacity of technicians and farmers in technical issues, business management and entrepreneurship.

Marketing

To promote the marketing of Ethiopian rice, the following strategic interventions shall be addressed.

- Establish standard market centers around rice producing areas;

- Create market linkage among the value chain actors;
- Establish market information and market promotion systems;
- Support implementation of regional and international market agreements;
- Develop legal binding rules and regulations for restricting rice market actors on deliberate quality adulterations;
- Build capacity of stakeholders in grading, labeling and packaging as well as promotion of milled rice marketing;
- Promote quality-based rice market pricing based on consumer's preference;
- Expand modern warehouse receipt system; and
- Improve access to finance for actors in rice value chain for the purchase of inputs, machineries, and marketing.

Utilization

Limited numbers of value-added products have been developed from rice as sole or mixed with other cereals and are being utilized in Ethiopia. Though, rice-derived by-products such as rice straw, husk and bran are widely used as alternative animal feed ingredients and energy resources, they are not fully exploited. The following strategic interventions will improve the utilization of rice.

- Assess the appropriate mix-ratio of rice and other grain crops for better preparation of local recipes;
- Assess the quality aspect of different rice varieties to production of different recipes;
- Promote rice husk briquette manufacturing as source of energy and job opportunity to youths;
- Train DAs and farmers, especially women on preparation of different food recipes out of rice; and
- Promote different rice based food recipes.

Investment

To attain rice self-sufficiency in the coming decades and to start production of exportable quality rice, involvement, and expansion of large-scale rice production is most important. In order to motivate agricultural investments in the rice value chain, the following strategic points need consideration.

- Improve availability and accessibility of land to rice production;

- Improve access to infrastructures like road, irrigation electricity and credit facility;
- Create favorable policy and security environment and improve the relation with local communities;
- Ensure continued support and follow-up to investors;
- Facilitate provision of agricultural inputs, machines, equipment and credit system;
- Promote out-grower and other contract farming schemes in rice value chain;
- Develop favorable policies by revising the existing ones (in relation to taxation, labor laws); and
- Encourage private sector engagement in irrigated rice production.

Extension Systems and Services

Though rice is considered as a “millennium crop” of the country, rice is not included in the agricultural commercialization cluster approach. The following strategic issues are put forward to strengthen the rice extension system.

- Establish and strengthen woreda-based technology demonstration centers that can use rice-based producing kebeles;
- Update rice production package as required;
- Upgrade the knowledge and skill of agricultural experts at all level on rice production;
- Capacitate FTCs by:
 - engaging as demonstration and practical training sites for rice technologies,
 - capacitating in rice growing areas with basic infrastructure and facilities;
- Establish and strengthen linkage among rice value chain actors;
- Include rice in the Agricultural Commercialization Cluster (ACC) approach;
- Improve communication systems to address appropriate information to end users/farmers:
 - conduct video-based and other rice extension service which enhance farmers practical knowledge and skills,
 - use ICTs such as radio, TV, mobile phone, tablets and other supportive materials as technology promotion methods for rice,
 - strengthen weather and metrology forecast information communication;
- Improve the human and institutional capacity and create an accountable system in data collection and management at all administrative levels;
- Enhance staff motivation and retention of DAs in rice production areas.

Enabling Environment

Addressing priority policy related bottlenecks for improved performance of the

rice sectors is very crucial. Accordingly, continuous evaluation of existing policies and respective regulations and directives will be made through proper and active engagement of relevant stakeholders. Specifically, the following activities will be implemented.

- Facilitating linkages among rice value chain actors through establishing and promoting proper functioning of rice platform; and
- Facilitating design and implementing policies, regulations, and directives that can enhance the performance of the rice sector.

Producer Organizations

Rice producer farmers in most of the regions are not well organized. Farmers' cooperatives and unions could participate in production and marketing of rice. Establishing and strengthening them may be the most likely avenue to attain maximum quality for products and efficient marketing. The following actions will help enhance producer organizations

- Strengthen existing farmers' cooperative and establish new ones;
- Facilitate linkage of cooperatives with input suppliers and service providers ;
- Build the capacity of cooperatives in leadership, entrepreneurship and organizational skills;
- Encourage cooperatives to participate in contractual farming practices;
- Encourage cooperatives to invest in rice value chain for better income; and
- Support cooperatives with provision of seed money, access to credit, infrastructure, store, and machinery.

Implementation

Governance

To ensure the proper implementation of the NRDS-II, there is a need to have a governance structure. MoA is the lead implementer. National Rice Steering Committee (NRSC) and National Rice Technical Committee (NRTC) coordinate the implementation at the national level (Figure 8). The main roles and responsibilities of NRSC and NRTC are

- National Rice Steering Committee (NRSC) is chaired by State Minister and co-chaired by Director General of EIAR. NRSC members meet twice a year and urgent meetings can be called whenever required. The main tasks include:
 - overlook the implementation of NRDS-II at the national level,
 - facilitate all actors involved in rice research and development,
 - identify constraints and opportunities and propose interventions,
 - facilitate experience sharing among regions in rice activities,
 - support, monitor and evaluate NRTC;
- National Rice Technical Committee (NRTC) is chaired by Crop Development Director of MoA and co-chaired by Crop Research Directorate Director of EIAR. NRTC members meet twice a year. The main tasks include
 - based on the recommendation from NRSC, prepares an annual plan, follow the implementation,
 - implement the activities approved by NRSC and by the secretariat (Planning Monitoring and Evaluation Directorate (PMED) of MoA).

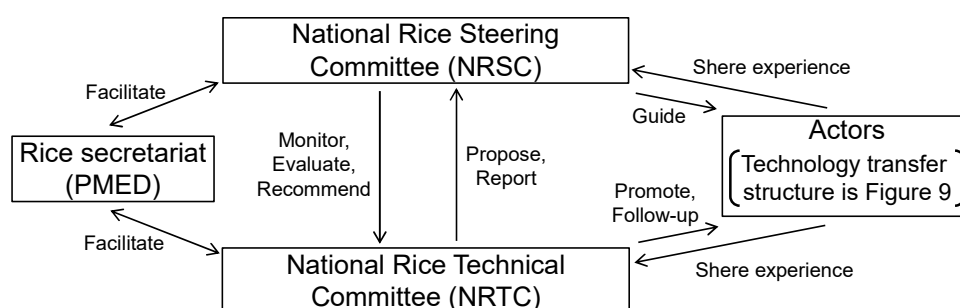


Figure 8 NRDS-II governance structure

Technology Transfer

Dissemination of technologies and information to farmers by the implementation of NRDS-II is an important and desired change. It is essential to share roles and responsibilities among implementing partners, individuals and leadership at all levels (Figure 9). The main roles and responsibilities of each institution and Rice platform are

- Ministry of Agriculture (MoA) is responsible for the coordination of development of technologies, approval and implementation through its extensive federal and regional clear line of reporting and feedback system. In addition to this ministry is responsible to give technical support, provide gap-filling skill training at all level, implementation of agricultural commercialization clustering across the value chain, for easy transfer of technologies implementation of demonstration both at FTCs and farmers field to improve the productivity of the rice commodity are the major once. Ethiopian Institute of Agricultural Research (EIAR) is responsible for the coordination of nationwide research and generate, adapt and promote agricultural technologies;
- Regional Agricultural institutes (RARIs) conduct more targeted research in their centers and sub-centers located in various agro-ecological zones of the respective regions. Fogera NRRTC conducts generating adapting, promoting rice-specific technologies, and capacity building training to researchers, experts, DAs and farmers;
- Regional Bureaus of Agriculture (RBoA) is responsible for coordinating and leading agricultural development in their respective regions. It oversees the implementation of the extension packages and provides support to Zonal Department of Agriculture and Woreda Offices of Agriculture;
- Zonal Department of Agriculture (ZDoA) plays coordination and technical support roles for WOOA and DAs;
- Woreda Offices of Agriculture (WOOA) also plays coordination and technical support role for DAs;
- Farmers' Training Centers (FTCs) serve as an entry point to bring about behavioral changes among farmers. DAs give a wide range of agricultural extension services to farmers; and
- Rice platform is vital to promote dialogue, enhance learning, decision making and collective action and to develop partnerships and strengthen relationships amongst the actors.

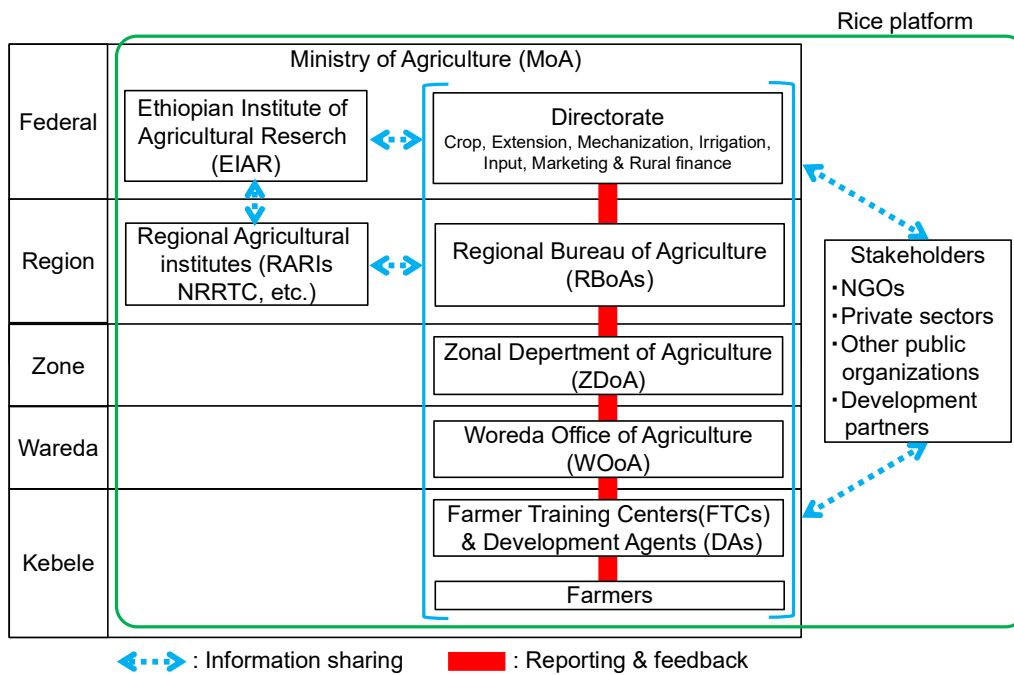


Figure 9 NRDS-II technology transfer structure

Financing

The main source of finance for implementing NRDS-II is the government. Implementation will be co-financed with resources from a number of sources including development partners, non-government organizations, private investors and financial institutions such as commercial banks and micro-finance institutions. Based on the impacts of the interventions proposed under the NRDS-II, key intervention packages will be prioritized and developed as project concept notes. The concept notes shall be submitted to NRTC for verification and affirmation. The confirmed project concept notes will then be submitted to NRSC for approval of direct funding from the government and for consulting with the development partners on potential funding. Upon approval of the projects, the activities will be implemented through regional and national institutions.

Private sector participation is very crucial in the implementation of the NRDS-II. Micro, small, medium and large enterprises along the rice value chain will be included in training and outreach activities under the NRDS-II. Wherever possible, partnerships between public and private organizations will be encouraged in designing, costing and implementing the project activities.

Project based interventions are promoted by cost sharing with beneficiaries and donor assistance and through effective partnerships with all stakeholders within the country and abroad.

Monitoring, Evaluation and Learning

To track progress during implementation and to take corrective measures when the needs arise, effective monitoring, evaluation and learning system should be in place. In particular, the timely review of achievements should be conducted based on the targets and key indicators shown in Table 8 (strategic framework). Progress made under projects that will be developed along the rice value chain during NRDS-II period will be monitored and tracked through arrangements with the implementing institutions. Project-based indicators assessed on the basis of their contributions and impacts towards achieving the objectives of NRDS-II. The monitoring of the strategy and the internal evaluation will be carried out by NRSC and NRTC every year. The external evaluation will be conducted in 2024 and 2030. Based on the findings of monitoring and evaluation and lessons learned, NRDS-II will be revised and updated by 2024.

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