THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF AGRICULTURE FOOD SECURITY AND COOPERATIVES

NATIONAL RICE DEVELOPMENT STRATEGY

FINAL DRAFT

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MAY, 2009

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List of Abbreviations

AGRA	Alliance for a Green Revolution in Africa
ASA	Agricultural Seed Agency
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
ASLMs	Agricultural Sector Lead Ministries
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Programme
DIDF	District Irrigation Development Fund
DPP	Department of Policy and Planning
DRD	Department of Research and Development
FAO	United Nations Food and Agricultural Organization
KATC	Kilimanjaro Agricultural Training Centre
LGAs	Local Government Authorities
MAFC	Ministry of Agriculture Food Security and Cooperatives
MATI	Ministry of Agriculture Training Institute
MDGs	Millennium Development Goals
MTEF	Medium Term Expenditure Framework
NGOs	Non-Governmental Organizations
NIDF	National Irrigation Development Fund
NIMP	National Irrigation Master Plan
NPGRC	National Plant Genetic Resource Centre
NRDS	National Rice Development Strategy
NSGRP	National Strategy for Growth and Reduction of Poverty
SACCOS	Savings and Credit Cooperative Societies
SUA	Sokoine University of Agriculture
TC- SDIA	Tanzania – Japan Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture
TDV	Tanzania Development Vision
TICADIV	Fourth Tokyo International Conference on African Development
TOSCI	Tanzania Official Seed Certifying Institute
WSSD	World Summit on Sustainable Development

SUMMARY

In 2006, the Government started implementing the Agricultural Sector Development Programme (ASDP) as an operational response to the Agricultural Sector Development Strategy (ASDS). ASDP is focusing on increasing agricultural productivity, profitability and farm incomes. National policies and strategies on agriculture in the country address the need to increase food production to meet the food security objective in achieving self sufficiency in staple food production, including rice. Thus, the proposed National Rice Development Strategy (NRDS) is in line with both national policies and international commitments that Tanzania has ratified aimed at improving the livelihood of the majority rural communities through enhancing household food security and incomes.

The existing potentials for rice production in Tanzania include: rainfed - upland, and lowlands and irrigated lowlands eco-systems; range of small, medium and large scale producers; comparative advantage of rice over other food crops for income generation and enhancing household food security; availability of some improved rice production technologies and dissemination channels, and availability of some programmes for increasing production and productivity of cereals including rice.

Despite of the aforementioned potentials, there exist challenges in rice development which include inter alia: i) Development and availability of improved seeds resistant or tolerant to major biotic and abiotic stresses; ii) Development and availability of improved post harvest processing technologies and value addition (grading and packaging) processes; iii) Low use of labour saving technologies and inadequate technology transfer; and iv)construction of more irrigation infrastructure.

There are opportunities for rice development in the country. These are: i) Availability of land (21 million ha) suitable for rice and abundant water resources (underground, rivers and lakes) for irrigation; ii) Availability of seed production ventures and seed certification systems (conventional and community based); iii) 18% of the agricultural households are engaged in rice production; iv) Political will of the Government to enhance production and productivity of rice; and v) Suitable policy environment such as exemption of taxes on agricultural inputs e.g. machinery, fertilizers, and subsidy on agricultural inputs such as fertilizers, improved seeds and pesticides. Also the Government provides enabling environment for private sector participation in the agricultural production, processing and marketing. Priority areas for rice production are: irrigated lowland, upland ecosystem and rain-fed lowland ecosystems.

As a component of the ASDP 2013 and Tanzania Development Vision (TDV) 2025, the vision of NRDS will be to transform the existing subsistence-dominated rice sub-sector progressively into commercially and viable production system .General objective is to double rice production by 2018 which would be achieved through the following specific interventions: i) Improving rice production through better farmer access to improved varieties, crop management practices and post harvest technologies; ii) Introducing and adopting small scale labour saving technologies to improve timeliness and efficiency of farm operations; iii) Strengthening seed systems for delivery of the improved varieties to farmers and other end users (public and private); iv) Strengthening the capacity of public and private institutions responsible for research, extension and training in rice technology development and dissemination; v) Enhancing agro-processing and value addition; and vi) Strengthening collaboration and linkages between national, regional and international institutions involved in rice research and development programme.

Development for NRDS would facilitate increasing national food security and enhancing income generation at household level through production of sufficient quantity and quality rice and improving agricultural processing with a view to add value to agricultural products and create job opportunities. Also, improved production of quality products would enhance competitiveness of agricultural products in the markets (domestic and external markets) and increasing foreign exchange savings and earnings from rice. In implementing NRDS there are eight identified strategic areas:

i) Improving seed systems and fertilizer distribution;

ii) Developing improved varieties, production and integrated crop management options;

iii) Post-harvest and marketing of rice;

iv) Improving irrigation and water harvesting technology;

v) Enhancing access to and maintenance of agric. equipment;

vi) Improving capacity for technology development, training and dissemination systems;

vii) Access to credit/agricultural finance; and

viii) Promotion of medium and large scale processing industry

These strategies have been further classified into implementation time-frame of the Medium Term Expenditure Framework (MTF) of the Government.

i) Short term (1-3 years) strategies:

- Increasing production and productivity of rice in selected irrigation schemes;

- Reducing production and post-harvest losses;
- Increasing availability and access of agricultural inputs (improved seeds, fertilizers, pesticides and appropriate farm machineries);
- Rehabilitation and development of new irrigation schemes which is urgently required.

ii) Medium (3-5 years) and long term (5 years onwards) strategies:

- Expansion of areas in lowland irrigation, rain-fed lowland and upland ecosystems;
- Increasing access to farm machinery and post harvest technologies;
- Encouraging investment in medium and large scale processing industry.

Phased implementation plan takes into consideration priority strategic areas. Sustainability of the developed rice sub-sector including environmental issues has been addressed. The strategy can be successful but implies changing business as usual and call for some innovative approaches, partnership and an overall enabling environment.

Production of paddy rice can be doubled from 899,000 tons produced in 2008 to 1,963,000 tons by 2018 and productivity will be improved from 1.3 to 2.8 tons per ha. In addition, area in low land irrigated and up-land ecology systems will increase, whereas the area under rain-fed lowland ecology will be relatively reduced. In general, productivity per unit area in all rice production ecologies will be relatively improved.

1.0 INTRODUCTION

Tanzania has a total land area covering 94.5 million hectares of land out of which 44 million hectares are suitable for agriculture. However, it is estimated that only 10.1 million ha or 23 percent of this arable land is under cultivation. The population is approximately 40 million people, with 45 percent of the population under 15 years of age and annual population growth rate is 2.8 percent.

The agriculture sector is the driving engine of the Tanzania economy; the need to develop it can never be over emphasized. In 2008, the sector accounted for about 25.7 percent of the GDP and 22 percent of foreign exchange earnings. The sector provides 95 percent of the national food requirements and livelihood to more than 70 percent of the Tanzanian population. Tanzania's medium-term development strategy as outlined in the National Strategy for Growth and Reduction of Poverty (NSGRP, commonly known by its Kiswahili acronym – MKUKUTA) is to increase growth of the agriculture sector from 5 percent to 10 percent per annum by 2010 and the number of food insecurity household considerably reduced by 2015. These targets would be realized as outcome of implementing Agricultural Sector Development Programme (ASDP)and Cooperative Reform and Modernization Programme (CRMP).

The performance of the crop sub sector is mixed. Since 1985 the six main food crops (maize, rice, sorghum, millets, wheat and legumes) have grown at 3.5 percent per year, while export crops have grown at 5.4 percent. Changes in food crop productivity have not been encouraging. The recent experienced food crisis at global and national levels is expected to increase food insecurity if measures are not taken to address this problem. Thus, the Government has accorded high priority in production of rice as one of the means of meeting the country's food security needs as well as economic growth in both rural and expanding urban areas.

1.0 Global and national context of forecast of rice production, imports and exports

In 2009, with favourable growing conditions and improved economic incentives, the global rice cultivated area is forecasted to rise by 1.5 percent from 156.3 million to 158.6 million hectares and the yield by 2.4 percent from 4.2 tons to 4.3 tons of paddy per hectare (FAO 2008). The rice production in Africa is forecasted to expand by 7 percent to a record of 24.5 million tons driven mainly by Egypt, Madagascar, Mali and Nigeria. Based on this overall global trend, the rice has been forecasted to reduce its prices. However, the 2008 financial crisis across the world was expected to turn the trend upside down, accelerating focus shift from consumers to producers.

In Tanzania, annual milled rice production in the last ten years ranged between 530,000 and 851,000 tons (USDA 2009). With the population of approximately 40 million, annual growth rate of 2.8 percent and annual milled rice consumption per capita of 25 kg, the forecasted production to meet demand is expected to increase annually at around 100,000 tons of milled rice. Identified gaps to meet local demand are usually met through imports. For example to meet the domestic demand in 2001-2005, fifty thousand to hundred thousand tons of milled rice was imported (International Trade Centre-UNCTAD/WTO 2005). Thus substantial amount of foreign exchange worth US$130 million was spent for the import during the period though the small quantity of export worth US$7.84 million was also recorded. Therefore, there is growing concern about the foreign currency drain resulting from rice import. To avoid the foreign exchange loss and the influence from the unstable global market, the Tanzanian Government is now seriously considering

increasing the self-sufficiency rate of rice. The surplus produce is expected to be exported and earn foreign exchange.

1.1 National Trends of Rice Production and Consumption

In Tanzania, rice is one of the widely grown crops and is the second most important food crop in terms of number of households, area planted and production volume. Besides meeting local consumption demands, the rice sector is a major source of income and employment in rural areas. The leading regions in rice production are Shinyanga, Tabora, Mwanza, Mbeya, Rukwa and Morogoro. Others include Kilimanjaro, Arusha, Manyara, Iringa, Mara, Tanga and Kigoma. Total area under rice cultivation in 2005 was 702,000 hectares of which 90 percent is under small scale farmers and the rest under large scale.

Rice is grown under three major ecosystems namely rain-fed lowland, upland rice and irrigated. The trends in acreage, production and consumption of milled rice in Tanzania for the past ten years are summarized in Table1. The area increased from 490,000 hectares in 1998 to 665,000 hectares in 2007 representing an increase of 36 percent. Likewise, production did increase by 54% from 530,000 tons (equivalent to 803,030 tons of paddy rice) to 818,000 tons (equivalent to 1,258,462 tons of paddy rice) during the same period.

Productivity of milled rice for the same period did not change much and varied from 1.0 to 1.2 tons of milled rice per ha (equivalent to 1.6 to 1.8 tons of paddy per ha.) The low yield is mainly caused among others, by the use of genetically low yielding varieties, drought, low soil fertility, weed infestations, prevalence of insect pests and diseases and birds.

Consumption of rice is gradually increasing and per capita consumption in 2007 is 25.4 kg. Self sufficiency ratio (SSR) is 84.5 percent (USDA 2009). A recommended level of SSR ensuring a country's sustainable food availability is above 120 percent.

Table 1: Trend of milled rice production and consumption

Year	Area harvested (1000 ha)	Yield (t/ha)	Production (1000 t)	Self-sufficient ratio (%)	Per capita consumption (kg)
1998	490	1.08	530	82.3	20.5
1999	475	1.08	511	67.1	23.6
2000	500	1.02	511	67.1	23
2001	530	1.07	569	76.5	22
2002	500	1.29	645	76.3	24.4
2003	570	1.26	720	78.3	26
2004	650	0.86	556	69	22.3
2005	688	0.83	573	76.6	20.3
2006	650	1.21	785	81.8	25.6
2007	665	1.23	818	84.5	25.4

Source: USDA 2009 World Rice Statistics and Graphics: Tanzania In PS&D Online January 2009 USBC International Data Base

2.0 REVIEW OF THE NATIONAL RICE SECTOR

2.1 Status of the sector in national policies

The Tanzanian Government's commitment is replicated in implementing the World Food Summit Plan of Action contained in the 1996 Rome Declaration on World Food Security and the Millennium Development

Goals (MDGs), as internationally agreed targets of halving poverty, malnutrition and hunger by the year 2015. Similarly, the Government is committed to implement the African Union's (AU) Comprehensive Africa Agriculture Development Programme (CAADP). CAADP has five pillars, one of which is increasing food supply and reducing hunger.

Furthermore, the Government's commitment to address the food security issues is well reflected in implementing the National Strategy for Growth and Reduction of Poverty (NSGRP) goals and objectives. NSGRP envisages the agriculture sector growth from 5 percent in 2002/03 to 10 percent per annum by year 2010. Thus, NSGRP requires an increase in agricultural productivity, higher added value and improved producer price incentives (Tanzania, United Republic of, 2006).

In 2001, the Government approved the Agricultural Sector Development Strategy (ASDS). The primary objective of ASDS is to create an enabling and conducive environment for improving productivity and profitability of the agricultural sector as the basis for ensuring household food security, improved farm incomes and rural poverty reduction in the medium and long-term. In 2006, the Government operationalised the Agricultural Sector Development Programme (ASDP) as an operational response to the ASDS. Basically, ASDP is focusing on increasing agricultural productivity, profitability and farm incomes. In general, the national policies and strategies on agriculture in the country address the need to increase food production to meet the food security objective in achieving self sufficiency in staple food production, including rice. Thus, rice development strategy is in line with both national policies and international commitments that Tanzania has ratified aimed at improving the livelihood of the majority of rural communities through enhancing household food security and incomes.

2.2 Consumer preferences and demand projection

Rice consumers in Tanzania are very keen on the grain size, colour, taste/flavour and cooking attributes of rice. The majority of the consumers prefer aromatic to non-aromatic rice. Example of aromatic rice is Super Kilombero and SARO 5 (TXD 306) and non aromatic is IR64. Consumers also prefer sticky white long grain rice to white broken and coloured long grain rice. The common grade standards of rice available in the local markets are premium grade one and standard. Premium prices are usually given to aromatic rice type e.g. Kyela brand and rice brand of premium or grade one in attractive package. Grade one is 25 percent broken, while standard is not more than 50 percent broken grains. The demand projection for rice is envisaged to increase as a result of urbanization where most of consumers are found and increase in diversified use of rice based products.

2.3 Typology and number of rice farmers, processors and traders

a) Majority of rice farmers (females, males and youth) are smallholders who produce rice for home consumption and sale surplus directly to customer or through a cooperative society where there is a Warehouse Receipt System in operation. Size of farms ranges from 0.5 to 3 hectares, and there are three large scale farms located in Mbeya and Iringa regions. These

farms were operated by the National Agricultural and Food Company (NAFCO). However, these farms have now been privatized.

b) Processors (millers) are located in production areas and range from medium to large scale ones .Medium scale processors of paddy into milled rice are located in urban centres near production areas and owned by male and female entrepreneurs. Some processing machines can produce white stone–free rice of premium (unbroken), standards (half broken) and regular (three quarters broken) grades. Large scale processors are three namely: Kapunga and Mbarali rice farms in Mbeya region and Madibira rice farm in Iringa region. These processors do process their farm produce and paddy from other farmers in the vicinity.

c) Traders in paddy and milled rice are scattered throughout the country. Females and males are involved in this trade. Paddy trade is concentrated in production areas while trade in milled rice is usually done at whole sale and retail levels in production and distant markets. Price for milled rice is relatively higher than that for paddy of same quantity irrespective of whole sale or retail market. Physical mixing of aromatic and non aromatic rice is often practiced by some traders in order to get good price. Rice sold at retail shops and open markets is usually put into jute sacks. Export trade of milled rice is common particularly to neighbouring counties and men are leading. Crop levy not more than five percentages is charged by officials of District Councils to both paddy and milled rice traders in producing areas. In general, there is a potential for expanding both internal and external markets.

2.4 Gender dimensions of rice production, processing and trading

A majority of Tanzanian farmers are women and make a significant contribution to food production and to the processing and marketing of foodstuffs. They form 60 - 80% of the agricultural labour force in the rural areas. Women play a major role in rice production in the country. They are involved in all aspects of rice value chain particularly planting, weeding, bird scaring, harvesting, processing and trading. It is observed that men are mostly involved in the land preparation. Both men and women are engaged in rice harvesting and threshing. Generally, the women in agriculture experience the following:

- Excessive workload due to farm work and household chores; and
- Difficulty in accessing the key factors of production – land, water, credit, capital and appropriate technologies. It is far easier for men to access these inputs

Therefore the introduction of mechanization technologies will take attention of gender issues to ensure that gender sensitive technologies are introduced so that women and the youth are not left out.

2.5 Comparative advantage of domestic production (farm, processing and retail level in urban and growth centres

Comparative advantages of domestic production of rice are in the following:

- Domestic produced rice is of acceptable type due to its aromatic qualities;
- Excess rice can be exported and earn foreign exchange and contribute to foreign currency saving;
- Production costs can be reduced by utilization of cost effective production technologies and installation of milling and processing facilities close to the production areas. Thus, the price of locally produced rice can be equal or cheaper than the price of imported rice; and

- Assist small businesses, enterprises and communities to create sustainable jobs in production and processing of rice as well as in the development of supporting industries e.g. Repair and maintenance of machinery used in production and processing.

3.0 CHALLENGES & OPPORTUNITIES FACING NATIONAL RICE SECTOR DEVELOPMENT

3.1 Challenges

A number of challenges that have been identified as limiting factors to the rice sector development in Tanzania include:-

- Development and availability of improved seeds. Availability of adequate varieties having tolerance to drought, cold weather, major insect pests and diseases are major challenges facing the rice sub-sector in the country. There are hundreds of local/traditional rice varieties grown by farmers in the rain-fed lowland, irrigated low land and upland ecosystems. Most of these varieties have, however, low yield potential, late maturing, and prone to lodging when improved management practices such as application of fertilizers are used. Improved seeds have been applied by only 10 percent of farmers. The use of self-saving seeds is common among small scale rice farmers and these seeds are of low quality.

- Availability of water is a prerequisite for increased rice production. Most of the rice production in the country depends on rainfall. Annual variation in the amount and distribution makes rain-fed rice production susceptible to flooding and/or drought, often within the same season. Drought risk impedes investment, causing production to stagnate at subsistence level. The deterioration of the drainage and irrigation facilities is posing a considerable constraint to the increased production of rice. The funding for the necessary rehabilitation of the irrigation infrastructure is beyond the capacity of small producers.

- Development and availability of improved post-harvest processing technologies and addition value processes. Inadequate post-harvest technologies influenced limited use of the crop as opposed to Asian countries which can prepare many dishes from rice. Processing is done by inferior processing machines except for large scale production farms and hence the quality of milled rice is low. Consequently, in the market this fetches as low as TShs.600 (US$0.5) per kilogram compared to premium price of TShs.1, 200 (US$1) per kilogram.

- Development of labour saving technology. Ninety-five percent of farm operations in paddy production are done manually. These operations are coupled with intensive labour requirements. Planting is mainly done by hand (both during direct sowing/broadcasting, seeding and transplanting of seedlings), likewise harvesting, threshing and cleaning of paddy. Transportation of paddy from the field to storage (home/market) is by direct head loading and sometimes ox-carts or vehicles are used depending on availability. The labour input in paddling is high, requiring between 300 and 350 man hours/ha. Similarly manual transplanting and weeding are labour intensive, and each operation requires between 200 and 300 man hours /ha.

- Improving accessibility of credit to farmers. Rice producers and processors have restricted access to credit due to the reluctance and inability of commercial banking institutions to supply financial opportunities to the rural sector. The usual reason for the lack of credit is the insistence of commercial banks to have land as collateral, and their reluctance to accept leasehold land, especially short leases, as collateral. Farmers and processors lack collateral to be able to borrow from commercial banks. Also, loans from the banks have very high interest rates. The Government has been promoting Savings and Credit Cooperative Societies (SACCOS), but the members are still limited. Farmers are also decapitated by low producer prices.

- Development and rehabilitation of communication, transportation and marketing infrastructure. Most of the rural infrastructures are in poor state and in need of rehabilitation. It has been observed that rural feeder roads are impassable during the rain season when agricultural inputs are needed. This as a result contributes to the increased costs of production. Besides, inadequate storage and marketing infrastructures also deny the farmers access to sell their produce at convenient place compelling them to sell at lower price as they cannot bargain for better prices. In this regard, the development and rehabilitation of rural infrastructures can contribute positively to the reduction of production costs and fetch better prices of product at the market, to facilitate access in marketing information and to enhance quick transport of both paddy and milled rice to the central warehouses near major roads and to the markets in urban centres.

- Improving private sector participation: Private sector participation in rice value chain is limited due to inadequate financial capabilities and inadequate availability of information on markets. However, participation of private sector is noted in rice milling, supply of agro-inputs (fertilizers, pesticides) and trading. Participation of private sector in production is only manifested in large scale rice production farms at Mbarali and Kapunga in Mbeya Region. Production and marketing of improved seeds e.g. SARO 5 (TXD 306) is only carried out by Agricultural Seed Agency (ASA).

3.2 Social issues

Social issues in rice sub-sector have an implication on the overall performance of the sub-sector. Prevalence of HIV/AIDS and malaria in all rice ecosystems and waterborne diseases in lowland irrigated areas has adverse effects of the farming households. Furthermore, social issues related to access to water for irrigation are common in areas where water users associations have not been established.

3.3 Trans-boundary and regional issues

There is a trans-boundary trade in rice between Tanzania and its neighbours such as Malawi, Zambia, DRC Congo and Kenya. This trade could be strengthened through harmonization of trade policies and regulations .The East African Community has imposed a tariff of 75 percent on the rice imported in the region. Export markets in other regions such as Middle East need to be explored.

3.4 Lessons learned from previous rice R&D

- Availability of high yielding and adaptable varieties

There are active breeding activities implemented by the Research and Development Institutions in the country and other countries in Eastern and Central Africa (ECA) in the region where improved varieties that are resistant to biotic and abiotic stresses are generated. For example varieties released in Tanzania such as Kalalu and Mwangaza are Rice Yellow Mottle Virus (RYMV) disease resistant, while high yielding variety TXD 306 (SARO 5) which has improved grain quality and aroma is highly preferred by consumers and farmers followed by non-aromatic high yielding varieties such as TXD 85 and TXD 88. At regional level WARDA has introduced 18 upland NERICAs and several lowland varieties that are currently being evaluated in fields. There are also some materials introduced by IRRI. Regional Rice Research Centre of Excellency for East and Central Africa(ECA) is planned to be established in Tanzania. The Regional Rice Research Centre of Excellence will be established under the Eastern Africa Agricultural Production and Productivity Programme (EAAPP) funded by the World Bank and coordinated from regional level by the Association for Strentherning Agricultural Research in Eastern and Central Africa (ASARECA) in Uganda.

- Availability of technology dissemination channels

Overtime effective methods of technology dissemination for rice have been developed. Channels commonly used for rice technology dissemination in Tanzania include the following:

(i) Involvement of stakeholders in development, verification and exchange of technologies through participatory approaches in variety selection and use of farmer field schools. Rice researchers and farmers from other East and Central African (ECA) countries can participate in selection and testing through organized national and regional training workshops;

(ii) Exchange visits of rice scientists, extension officers, processors and farmers from institutions/areas within the country and other countries in ECA;

(iii) Other channels include training of key and intermediate farmers, processors, extension officers and other stakeholders in rice technologies at the Ministry of Agriculture Training Institutes/centres

(iv)The use of publications (Annual reports, Journal articles and proceedings of scientific meetings/workshops), Newsletters, Extension materials (leaflets, brochure, and posters), Radio and TV programs, Exhibitions/Agriculture shows/Seed fairs and Websites; and

(v) On farm training of paddy farmers in irrigated schemes.

3.5 Human and institutional capacities

- Human capacities

The number of trained scientists working on rice has increased over the years. The rice research sub-programme has about 36 professional staff (5 PhD, 20 MSc. and 11 BSc.) scattered in Department of Research and Development (DRD) institutions, Universities, and Training institutes. More researchers will be required and those on board need further training and facilities.

The transfer of technology is of fundamental importance to the future of the rice industry. However, in 2007 there were 3,379 Agricultural Extension Officers, while the established demand was 15,082. These Extension Officers are providing extension services for rice and other crops. The Government is currently implementing programme aimed at training and allocating extension staff to all villages (12,227) by 2011. These staff need to be facilitated with working tools and given opportunities for training to improve their skills.

- Institutional capacities

Training institutes and centres of the MAFC are actively involved in the participatory extension of improved rice technologies and management of small scale irrigation schemes through training of farmers and extension staff. These institutes and centres include the following: Kilimanjaro Agricultural Training Centre (KATC) in Moshi, MATI Ukiriguru in Mwanza, MATI Igurusi in Mbeya, MATI Ilonga in Morogoro and Mkindo Farmers Training Centre in Morogoro.

Whereas the Mkindo Farmers Training Centre offers short term training to farmers, KATC Moshi and the three MATIs with a total annual enrolment capacity of 763, offer long term training programmes in general agriculture at diploma and certificate levels. Both programmes last for two years. Moreover MATI Igurusi offers two specialized diploma courses in 'Irrigation' and 'Land Use Planning'. Upon successful completion of the two year training the graduates are employed as front line extension staff by the local Government Authorities (LGAs).

An outcome of the Kilimanjaro Agricultural Training Centre (KATC) Phase 2 Project in Tanzania supported by Japanese Government from 2001 to 2006 was that the average paddy yield per unit area of sample farmers in model sites increased by 39 percent from 2002 to 2005 (3.1 t/ha to 4.3 t/ha). This success was due to the fact that the training offered did contain comprehensive rice techniques which were easily utilized with little additional cost to farmers.

In order to upscale this success, the KATC II model (farmer to farmer extension approach) was recommended for adoption by other agricultural training institutes. This recommendation was adopted for implementation through the Tanzania – Japan Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture (TC-SDIA) which was launched in June 2007. The main objective of 5-year technical cooperation is to roll out the achievement of KATC II. In implementing the TC each of the four (4) training institutes will work with farmers from 10 irrigation schemes in the 5-year of the Technical Cooperation (TC)period resulting in 40 beneficiary irrigation schemes by 2010.

TC-SDIA approach includes the following for the standard training course:

- Together with the district agricultural office, baseline survey of the irrigation scheme is conducted;
- Twenty (20) key stakeholders, 16 of whom are rice farmers (8 each of men and women farmers), from the selected irrigation scheme undergo residential training organized by the training institute;
- Each farmer graduating from this training (Key Farmer) will train five (5) other farmers in his/her scheme during the first infield training (land preparation stage), the second infield training (transplanting stage) and the third infield training (harvesting stage) with backstopping from the training institute and the district; and
- There is a field day organized for other farmers in the third infield training period.

Notes:

- In principal, the cost for baseline survey is shouldered by TC-SDIA (JICA); costs for residential training and infield training are shouldered by respective Districts.
- For relatively better performing irrigation schemes, subject matter training courses (e.g. gender and family budget, irrigation scheme management) are conducted.

3.6 Potential of local rice in rural poverty reduction and economic growth

Rice has become an increasingly important cash crop in rice producing areas. This is due to the fact that its demand is high and with relatively stable price trends in the food market. The followings are some of the existing potentials of the rice production in the country:

- It is widely grown in the country. Main agro-ecologies or eco-systems for rice production are: Rain fed upland and lowlands; and irrigated lowlands. Both the lowland and upland rice types are produced and processed in the country;
- Producers, processors and traders of rice range from small scale to medium and large scale entities. Majority are small scale farmers, producers and traders;
- It is relatively less affected by storage pests as compared to other cereal grains such as maize, sorghum and millet, and wheat commonly used in food security measures;
- With recognition of comparative advantages of rice over other food crops, Tanzania and other countries in Africa selected rice as among priority crops important for food security and income generation in Sub-Saharan Africa at the World Summit on Sustainable Development (WSSD) held in South Africa in 2002. Then at the Fourth Tokyo International Conference on African Development (TICADIV) in 2008, African leaders led by the then Chairman of African Union (AU) His Excellency Dr. Jakaya M. Kikwete, President of the United Republic of Tanzania, did commit themselves to promote rice in particular NERICA in their countries;
- Successes recorded in the development and dissemination of rice technologies in the country; and
- The Government has embarked on a programme to increase cereal production including rice in 6 major producing regions of Mbeya, Iringa, Ruvuma, Rukwa, Morogoro and Kigoma. Other important regions in the country for rice production are: Mwanza, Shinyanga and Tabora.

- Land tenure

Tanzania is endowed with an area of 94.5 million hectares of land, out of which 44 million hectares are classified as suitable for agriculture. It is estimated that about 21 million hectares are suitable for rice growing. In 2008, area under rice production was 675 thousand hectares. The land belongs to the Government. Land ownership is under the respective villages/districts and governed by the Village Act No.5 of 1999, which recognizes customary rights. However, the village governments under the Local Government Authority are the ones responsible for allocation of the land for various uses. In general, the land is paternal inherited under customary laws. Women can have their own farms, but the traditional land tenure system does not favour them. However, there is a move by the Government to review this system so that the women can own the land.

- Water Sources for Irrigation

Tanzania is endowed with enormous potential water resources constituting of rivers, lakes, and underground water sources for irrigation and other uses. In view of the existing scenarios of water and land, the irrigation potential in the country is found to be 29.4 million hectares with varying degrees of potential. There are 2.3 million hectares of high development potential, 4.8 million hectares of medium potential and 22.3 million hectares of low potential. The rehabilitation work would involve: (i) rehabilitation of traditional irrigation schemes with a total irrigated area of 569,000 hectares; (ii) construction of new irrigation schemes with a total area of 183,900 hectares; and (iii) construction of rain-water harvesting and storage structures

with a total area of 101,400 hectares by year 2017.Total area under irrigation is targeted to increase by 854,300 hectares by 2017. From 2007/08 to 2008/09 area under irrigation increased from 289,245 hectares to 306,745 hectares through the rehabilitation and development of new irrigation schemes. It was an increase of 17,500 hectares in a year which was equivalent to an increase at 6 percent. These irrigation schemes are used for production of rice and other crops such as sugar cane, coffee, tea and horticultural crops.

- Seed production ventures

Seed of improved rice varieties is beginning to be accessed by farmers. Liberalization of the seed sub-sector has enabled the emergence of private seed companies, which are already taking up production and sale of improved rice seeds such as SARO 5 (TXD 306) being multiplied and marketed by the Agricultural Seed Agency (ASA). In 2008, ASA produced and marketed about 120, 000 tones of improved rice seeds. These efforts are being supported by Development Partners such as Alliance for a Green Revolution in Africa (AGRA) and Bill and Melinda Gates Foundation. Breeder (pre-basic) seeds are multiplied at agricultural research stations such as Kilombero Agricultural Training and Research Institute (KATRIN) at Ifakara and CHOLLIMA at Dakawa .Quality Declared Seeds (QDS) are produced by farmers in groups or individually and sale to ASA, agro-dealers or direct to farmers in same locality.

- Existence of seed certification systems

Tanzania has set up procedures and regulations to ensure that the seed reaching the farmer is of prescribed quality. On this basis, Tanzania Official Seed Certifying Institute (TOSCI) of the MAFC on behalf of the Government has the power and responsibility to enforce the Seed Act, 2003 and regulations on seed certification. TOSCI is located within the premises of the Sokoine University of Agriculture (SUA) in Morogoro. The main objectives of establishing TOSCI are; (i) to protect seed consumers from possible exploitation by unscrupulous seed merchants; (ii) to safeguard the interest of creditable seed traders; (iii) to facilitate the permeation of the concept of seed quality to every aspect of the seed programme; (iv) to encourage development of seed quality control within the operations of commercial seed enterprises and (v) to conduct national performance trials of candidates of improved varieties to be released for a minimum of one season in at least three sites. These trials are aimed at collecting data to verify Distinctness, Uniformity and Stability of candidate variety.

Technical information from TOSCI is used by the National Variety Release and Seed Certification Committee. Current recommendations require a candidate variety to be supported with data from two seasons advanced yield trial from not less than three recognized sites. Additional information on the merits of candidate variety, on-farm trial and farmer assessment data are also required.

4.0 PRIORITY AREAS AND APPROACHES

4.1 Priority areas

Priority areas of rice production are grouped into three major rice ecosystems/ecologies. These are presented in order of priority as follows: i) irrigated lowland ecosystem which is 8 percent of suitable land;

ii) upland ecosystem which is 20 percent of suitable land; and iii) rain-fed lowland ecosystem which covers 72 percent of suitable land for rice production which is 21 million hectares.

4.2 Major challenges and opportunities in each of the prioritized ecologies

a) Challenges

- Irrigated lowland ecosystem is also depending on water reserved during the rain season. Inadequate rains indirectly cause shortage of water for irrigation. Efficient use of water and easy access of irrigation water by all farmers irrespective of differences in socio-economic status, age groups, and gender is sometimes a problem. Pests and diseases attacks common in rain-fed lowland ecosystem are also recorded in this ecosystem. Fertilizers, pesticides and herbicides are heavily used in some irrigation schemes. Floods and water logging incidences are common in areas served by broken down irrigation schemes. Infrastructure for communication and transportation is relatively developed.

- Upland ecosystem is prone to drought (severe moisture stress) and attacks of weeds (e.g. striga, nut grass), pests (e.g. stem borers) and diseases (e.g. bacterial leaf blight). Soils are not very fertile and P-deficiency cases are frequently recorded. Infrastructure for communication and transportation is not well developed. Rice competes with other food crops such as maize, sorghum and cassava for land and labour.

- Rain fed lowland ecosystem is prone to floods during heavy rains, severe water shortage during drought and heavy attacks of weeds (e.g. striga, and wild rice), pests (e.g. stem bores and African rice gall midge) and diseases (e.g. rice yellow mottle virus, rice blast and bacterial leaf blight)) causing low yields, nutrient status of the soils is generally low and requires some supplementation through fertilizer applications. Infrastructure for communication and transportation is not well developed. Rice competes with other food crops such as maize for land and labour.

b) Opportunities

- Irrigated lowland ecosystem has a low to medium fragile natural resources base. It is the most productive ecosystem and most of improved rice varieties are adapted e.g. IR64 and SARO 5(TXD 306).Yields range from 2.5 to 4.0 tons of paddy per hectare. Intensification of rice production is possible and the areas under this ecosystem can be expanded as more irrigation schemes are rehabilitated and constructed. The National Irrigation Master Plan (NIMP-2002) provides detailed information on the irrigation potential in Tanzania. The total potential area for irrigation development is 29.4 million hectares, out of which 2.3 million hectares are characterized as high potential, 4.8 million hectares as medium potential and 22.3 million hectares low potential.

- Upland ecosystem has a high fragile natural resources base .Land races (Supa strains) are most common varieties and they are aromatic or non aromatic. NERICA series appear to be more adaptable to this ecosystem. Yield ranges from 0.5 to 0.8 ton of paddy per hectare.

- Rain-fed lowland ecosystem has the following opportunities: Availability of water during floods and relatively fertile soils compared to upland ecosystem. Varieties commonly grown are Supa series and landraces. Yields range from 1.5 to 2.0 tons of paddy per hectare. Fragility of the natural resources base is low. Intensification of rice production is possible given available resources such as fertile soils and flood water. Also crop diversification can be practiced and expansion of the rice production areas is possible.

4.3 Policies and institutional challenges/opportunities

The policies and institutional challenges/opportunities are summarised as follows:

a) Challenges

i). Developing and harmonization of national trade policies in the East Africa Community
ii). Enhancing producer price support mechanism
iii). Low infrastructural development e.g. Irrigation facilities, feeder and rural roads
iv). Improving marketing and outlets and processing infrastructures
v). Improving support and distribution system of improved seeds, fertilizers and crop protection chemicals
vi). Improving access to micro and rural credit facilities to make credit accessible and affordable to farmers, processors and traders
vii). Mechanization of rice production and processing

b) Opportunities

i). Zero tariff on agricultural machinery and equipment
ii). Large domestic market for rice products and bye products
iii). Subsidy on fertilizers, improved seeds, and pesticides
iv). Existence of research and, training institutions associated with rice
v). Guarantee favourable price for paddy in local market due to introduced Ware House Receipt system
vi). Availability of rice development projects particularly those implemented jointly with Japan through JICA
vii). Embankment in a strategy by the Government to improving productivity of paddy in constructed irrigation structures/schemes.

5.0 VISION AND SCOPE OF NRDS

5.1 Rice sub-sector development vision

As a component of the ASDP 2013 and TDV 2025, the Government and stakeholders in rice sub-sector envisage to transform the existing subsistence-dominated rice sub-sector progressively into commercially

profitable and viable production system. The rice sub-sector will be modernized, commercialized, highly productive and profitable by utilizing new technologies and available natural resources and manpower in an overall sustainable manner.

5.2 Objective

The objective of the NRDS is to double rice production by 2018

5.3 Strategy rationale

The ASDP remains a vehicle for implementing NSRGP and ASDS as current Government efforts to develop the agricultural sector in order to attain the desired food security situation and growth for poverty reduction. The recently experienced global food crisis is expected to increase food insecurity if measures are not taken to address this problem at the national level. Food insecurity in the country is as a result of changes in climatic conditions; high pre and post harvest losses; low productivity of varieties of major food crops including rice; and inefficient food distribution system.

The demand for rice has been on the increase. To meet the high demand for rice, the Government has been importing rice (2001-2005) on average of 193.3 thousand metric tons notwithstanding of the existing rice potential for production. This importation on average has been depriving the country's much needed foreign exchange of US$26.01 million per annum that could instead be used to import strategic industrial and capital goods. Thus, the production of rice is accorded high priority as one of the means of meeting the country's food security needs as well as economic growth in both rural and expanding urban areas. It is estimated that 18 percent of the agricultural households are growing rice, the majority being women. In view of the foregoing, the NRDS is responding to the national policies objectives of (i) enhancing national food security through production of sufficient quantity and quality rice; (ii) improving agricultural processing with a view to add value to agricultural products and create employment opportunities; (iii) enhancing production of quality products in order to improve competitiveness of agricultural products in the markets; and (iv) increasing foreign exchange earnings from exportation of agricultural products. Thus, the strategy is designed to implement these national objectives to compliment the ongoing ASDP efforts in addressing the looming world food crisis.

5.4 Interventions/Strategies

In order to get appropriate solutions to core constraints limiting rice production through consumption and utilization continuum, the strategy would include: (i) improving rice production through better farmer access to improved varieties, crop management practices and post harvest technologies; (ii) introducing and adopting small scale labour saving technologies to improve timeliness and efficiency of farm operations; (iii) strengthening seed systems for delivery of the improved varieties to farmers and other end users (public and private); (iv) strengthening the capacity of public and private institutions responsible for research, extension and training in rice technology development and dissemination; (vi) enhancing agro-processing and value addition; (vii) developing and rehabilitating irrigation schemes; and (viii) strengthening collaboration and linkages between national, regional and international institutions involved in rice research

and development programme and (x) construction of ware houses/godowns for storage of paddy before milling. (iX) promotion of public private sector partnership in rice production, processing and marketing.

5.5 Paddy production and yield by agro- ecological condition

Production of paddy in each of the three main eco-systems in 2008 and projections for 2013 and 2018 has been summarized in Table 2.

Table 2: Paddy production and yield by agroecological conditions

Year	Rain-fed upland			Rain-fed lowland			Irrigated			Total		
	Area (Ha)	Yield (Tons)	Production (Tons)	Area (Ha)	Yield (Tons)	Production (Tons)	Area (Ha)	Yield (Tons)	Production (Tons)	Area (Ha)	Yield (Tons)	Production (Tons)
2008	17	0.5	9	464	1	464	200	2.13	426	681	1.3	899
2013	21	1	21	374	1.5	561	290	3	870	685	2.1	1,452
2018	31	1.6	50	274	2	548	390	3.5	1365	695	2.8	1,963

Note: Area (1,000 ha), yield (t/ha) and production (1,000 tons).

In 2008, national data showed that total paddy rice produced from cultivated 681,000 hectares was 899,000 tons of paddy (Table2) equivalent to 584,000 tons of milled rice. During the same period productivity on average was 1.3 tons per hectare for paddy equivalent to 0.8 tons of milled rice per hectare. Projected new targets for total production area, production of paddy and productivity by 2013 are 685,000 hectares, 1,452,000 tons equivalent to 943,800 tons of milled rice, and 2.1 tons of paddy per hectare equivalent to 1.4 ton of milled rice, respectively. In 2018 it is projected to cultivate total area 695,000 hectares to produce 1,963,000 tons of paddy rice equivalent to 1,275,950 tons of milled rice. The productivity is expected to increase to 2.8 tons of paddy per ha equivalent to 1.8 tons per ha of milled rice.

The production and productivity of paddy in each agro – ecological condition will be as follows: (i) In irrigated lowland ecology the production area will increase from the current 200,000 ha to 390,000 ha by 2018. During the same period, the productivity will increase from the present 2.13 tons of paddy per ha to 3.5 tons per ha. Production of paddy will also increase from 426,000 tons to 1,365,000 tons.(ii) In the rain-fed lowland ecology, the area will decrease from 464,000 to 274,000 because more irrigation schemes will be developed and rehabilitated in the area. However, productivity will increase from the current 1 ton of paddy per ha to 2 tons per ha by 2018. (iii) NERICA to be introduced and promoted in the country is expected to influence increase in production area in up-land ecology from 17,000 ha to 31,000 ha by 2018. Productivity will increase from 0.5 tons per ha to 1.6 tons per ha during the same period. Production will also increase from the current 9,000 tons of paddy to 50,000 tons.

It is expected that 60 percent of the increased production will come from projects implemented through Japan's Technical Cooperation (TANRICE and DADPs interventions with Tanzanian Government and 40 percent will come from activities of the improved production and productivity of irrigation schemes included in the government Medium- Term Strategy and large scale paddy farms.

5.6 Number of researchers, technician and extension workers in 2008 and targets in future

Efficient agricultural delivery system entails adequate, facilitated and motivated manpower. This is being facilitated by the government in collaboration with Development Partners through reforms implemented under ASDP. Summary of researchers, technicians and extension officers associated with rice development is given below. In general there are not many full-time rice specialists particularly in extension services. In research institutions there are full–time researchers and technicians but not adequate. There is a need to train some of the staff on board to acquire required skills and competence and to recruit new staff for identified gaps. The Government has initiated a programme for recruiting new staff in agricultural research, training and extension services every year. Allocation of manpower to rice sub-sector will be enhanced particularly in irrigation schemes.

Table 3: Number of rice researchers and other personnel in 2008 and targets in the future.

Year	Researchers with BSc., MSc., and PhD.			Research Technicians			Extension Workers		
	Total	Rice Spec. (Full time)	Rice Spec. (Part time)	Total	Rice Spec. (Full time)	Rice Spec. (Part time)	Total	Rice Spec. (Full time)	Rice Spec. (Part time)
2008	36	20	16	10	8	2	3,871	500	3,371
2013	40	25	15	15	10	5	11,703	1,000	10,703
2018	41	30	11	20	15	5	15,082	2,000	13,082

5.7 Long-term (10 years) target farm gate/market price of rice

Prices for rice are determined by the free market forces. For example in the off-season farm gate prices reach as high as TShs.60,000 per 100 kilogram bag of paddy which is equivalent to US$50. During the season prices are as low as TShs.20, 000-30,000 per bag (US$15-US$23). Long-term forecast will be done at appropriate time.

5.8 Governance of the NRDS

NRDS is structured to complement ASDS and will be executed under the auspices of ASDP. The NRDS will be implemented under the Medium Term Expenditure Framework (MTEF) of the Government. Key actors will include Agricultural Sector Lead Ministries (ASLMs), Local Government Authorities (LGAs), private sector (agro-dealers, traders, processors, and fabricators/manufacturers), research and training institutions, universities, farmers' organizations/associations, NGOs and international institutions.

The management of the strategy at national level will be streamlined within the normal operations of Ministry of Agriculture Food Security and Cooperatives with the Department of Policy and Planning (DPP) taking the leading role. Activities to be carried out will include: (i) compilation of NRDS budget for each financial year; (ii) developing NRDS implementation plan for the strategic action areas; (iii) monitoring and evaluation of physical and financial performance of the strategic action areas. The roles/responsibilities of various stakeholders involved in the implementation of NRDS are as outlined hereunder:

i. ASLMs

These ministries will be responsible for policy guidance, supervision, coordination and monitoring activities, which are contributing towards achievement of particular intervention outcome.

ii. Prime Minister's Office Regional Administration and Local Government (PMO-RALG)
PMO-RALG will coordinate the implementation of NRDS at regional and district levels.

iii. LGAs
LGAs will provide technical staff in the implementation of the NRDS. They will also monitor and evaluate NRDS implementation progress at district level.

iv. Service Providers
This group includes agro-dealers, traders, processors and entrepreneurs, who will ensure availability of quality agricultural inputs, provide tractor hire, after sale services and repair and maintenance. It is envisaged that through this category of stakeholders mechanization inputs would be easily available, accessible and optimally utilized.

v. Financial institutions
These will mainly be dealing with the provision of financial support in terms of credit to dealers, manufacturers, importers, processors, farmers and farmers' organization.

vi. Research and training institutions and universities
These institutions will be conducting research and training on the improved rice production technologies that will benefit the users.

5.9 Financial and human resource commitment of the Government

The Government has been committing its financial and human resources for rice development. This is effected through resources allocated for implementing agricultural activities under ASDP and rice related bilateral projects.

5.10 National stakeholders and linkages to trans-boundary/regional initiatives and partnerships building

National stakeholders range from farmers, transporters, traders, processors, agro-dealers, extension staff (crops, mechanization, land use, food technologists and irrigation engineers), research staff, community development organizations, Development Partners, international research institutions, politicians and policy makers. These stakeholders would be coordinated through the mechanisms which is in place and used in implementing ASDP. There may be a need to strengthen the capacity of some stakeholders particularly in service delivery and regular updating the list of stakeholders.

Linkages to trans–boundary trade through South Africa Development Coordination (SADC) and East Africa Community (EAC) initiatives and other regional initiatives like Coalition for African Rice Development (CARD) and establishment of an Eastern and Central Africa regional rice research centre of excellence in Tanzania are available.). These initiatives will facilitate a successful implementation of the rice development

strategy. Partnerships building between public and private sectors involved in the rice value chain has started. For example, private sector provides farm machineries and other inputs for sale to farmers through Agricultural Inputs Trust Funds and Input Subsidy Initiative of the Government. More partnership building needs to be effected in the future.

6.0 COMPONENTS OF THE NRDS

In order to achieve the desired objective, the NRDS is designed to have six main components namely (i) improving accessibility of improved varieties and seed systems; (ii) fertilizer marketing and distribution; (iii) irrigation and investment in water control technologies; (iv) access to and maintenance of agricultural machinery and equipment; (v) research, technology dissemination and capacity building; and (vi) access to credit/ agricultural finance.

6.1 Improving accessibility of improved varieties and seed systems

Improved seed is one of the most important components of agricultural modernization process. Efforts for increasing agricultural productivity and production would be a futile attempt without the availability of improved seeds. It is estimated that about 90 percent of farmers in the country use farmer saved seeds (recycled seeds) and only 10 percent use certified seeds. Most rice farmers use recycled seeds. The low rate of improved seed utilization in the country is mainly associated with unavailability of reliable supply of breeder and foundation seeds. In addition, the bias of private companies to produce some varieties and neglect others is one of the limiting factors in seed availability and accessibility to farmers. At present, there is no single private company which is producing improved seeds for crops such as paddy, millet, cowpeas, green gram and sorghum despite the existing high demand for these types of seeds. In view of this, the strategy would focus on (i) production of basic and certified rice seeds; (ii) strengthening rice seeds distribution network in the country; (iii) supporting on-farm seed production; (iv) creating awareness on available seeds of rice varieties to farmers; and (v) strengthening the capacity of public and private seed companies.

6.2 Fertilizer marketing and distribution

Tanzania acknowledges that increased use of modern inputs (fertilizers, agrochemicals, seeds, farm implements, etc) is a pre-requisite for achieving sufficient agricultural productivity and growth to meet economic development, poverty reduction and food security goals. Fertilizers are mostly imported by the private sector except for Minjingu Rock Phosphate (MRP) which is mined, processed and packed in the country by a private company. The factory is located in Arusha. The distribution of fertilizers is done by importers and stockists/agro-dealers. From 1999/2000 to 2006/07, average amount of fertilizers imported per year was as little as 167,408 tones of all the brands. In 2008/09, a total of 237,894 tones of fertilizers (including 155,000 tones for subsidy) were distributed to farmers by February 2009. . Common fertilizers used particularly in rice fields range from organic to inorganic. Organic fertilizers are farm yard manure and compost which are found locally and not very widely used. Inorganic fertilizers such as Triple Super Phosphate (TSP), Di-Ammonium Phosphate (DAP), Urea, Ammonium Sulphate (S.A) and Calcium Ammonium Nitrate (CAN) are widely used.

The current on going government efforts of providing subsidized fertilizers to farmers would complement the NRDS. The subsidy is effected through the use of voucher system and covers farmers producing food crops that include rice, maize, sorghum / millet, sunflower and cotton. The strategy would focus on (i) strengthening the capacity of agro-dealers to access input credits and agribusiness skills; (ii) ensuring proper use of inputs for increased rice production and productivity; and (iii) producing and distributing of agricultural inputs vouchers. The national assembly has recently passed a fertilizer bill and the process of establishing fertilizer Regulatory Authority is ni progress.

6.3 Irrigation and investment in water control technologies

Under ASDP, the Government is implementing a comprehensive irrigation development component. Two funds have been established to cater for irrigation development investments in the country: (i) District Irrigation Development Fund (DIDF) and (ii) National Irrigation Development Fund (NIDF). The DIDF complements funding for small scale irrigation schemes identified by farmers through District Agricultural Development Plans (DADP)

Irrigated agriculture in Tanzania is dominated by smallholder traditional systems producing mainly rice and vegetables. In such irrigation schemes, irrigation efficiency is quite low, estimated at 14-20 percent. The Government is increasing its involvement to improve the traditional systems as well as expand areas under irrigation involving smallholder farmers and private sector in order to increase crop production and productivity. The Government has thus embarked on medium and long term strategy of improving production and productivity of irrigated crops.

It is proposed that the NRDS supports implementation of activities aimed at enhancing crop productivity and profitability to the smallholder irrigation farmers through proper utilization of water and other resources in existing and new irrigation schemes. Implementation of these activities is expected to: (i) increase crop productivity, farmer incomes and reduce susceptibility to drought and occurrence of floods through rehabilitation of irrigation structures and construction of storage dams; (ii) expand area under irrigation for smallholder, medium and large scale farming; (iii) increase irrigation efficiencies of selected smallholder traditional irrigation schemes and newly developed irrigation systems as well as support comprehensive river basin management by improving the management of demand for irrigation water. Thus the irrigation and investment in water control technologies would focus on the following areas (i) rehabilitation of selected existing irrigation scheme with worn-out infrastructures and those with infrastructures destroyed by floods. The rehabilitation work would involve (i) rehabilitation of traditional irrigation schemes; (ii) construction of new irrigation schemes; and (iii) construction of rain-water harvesting and storage structures.

6.4 Access to and maintenance of agricultural equipment

- Land preparation

Smallholder farmers have a significant contribution to overall production of rice in Tanzania despite that 95 percent of farm operations in paddy production are done manually. The labour input in paddling is high, requiring between 300 and 350 man hours per hectare. Similarly manual transplanting and weeding are labour intensive requiring between 200 and 300 man-hours per hectare. Mechanization of paddy farming can be adopted in land preparation, seedling nursery preparation, transplanting/sowing, field management, harvesting, drying, processing and transportation. In this respect, the strategy would focus on promoting the use of medium size tractors and combine harvestors, power tillers, transplanters, weeders, milling and grading machines.

Power tillers have recently been introduced into the country and have proved to be a good source of alleviating the power shortage in farming especially in the paddy growing areas. The performance of these power tillers has been satisfactory and the demand is increasing especially in paddy growing areas. Further promotion of the technology is required as only few extension officers and private sector suppliers are familiar with this technology. Special programmes in high potential areas will be initiated to stimulate this development. In this regard, it is proposed to purchase one power tiller with accessories such as rotavator, plough, ridgers, water pumps, power sprayers, cage/iron wheels and trailers and place it with the Ward in the identified areas as one of the resources in the centre to be used for training and demonstration. It is proposed to purchase at least 5 power tillers with the above-mentioned accessories for selected Wards in the participating districts. Other agricultural machines to be promoted would include medium size tractors with 40HP- 4WD including rotavators and cage wheels, , rice transplanters, rippers, threshers and small rice combine harvesters. The private sector will be encouraged to provide services in terms of acquiring spare parts and providing repair and maintenance services. In addition, the private sector will be facilitated to operate machinery hire services in or around the irrigation schemes to increase and expand farmers' access to and utilization level of agricultural machinery.

- Harvesting and post harvest

Equipment for harvesting and post harvest are very important to ensure good quality rice product. Appropriate moisture content, optimal grain filling, and minimal loss at harvest is important. Currently, there is minimum use of mechanized equipments for harvesting and transportation of rice from field. So there is a need to introduce these equipments to farmers and processors. In this respect, the strategy would focus on (i) promoting agro-processing of paddy and value addition technologies; (ii) strengthening capacity of post-harvest and rural based agro industries; (ii) enhancing access to and use of improved post harvest, rural travel and transport, processing, storage and marketing technologies; and (v) facilitating private sector investment in medium scale processing of rice products.

6.5 Post-harvest and marketing

Introduction of more efficient technologies for handling, drying, storing and milling rice at the village level is essential to reduce post-production losses. The present impressions are that post-production is labour intensive, as the operations involve harvesting hand-reaping, field sun-drying before threshing, threshing by trampling and wind winnowing. This results in poor quality milled rice. The strategy would promote (i) warehouse receipt systems that ensures producers get better price of their produce, earn more and have reliable sources of food and income; (ii) establish strong, self supporting producer groups in which members support each other to produce, process, package and market their rice; (iii) build producer's

knowledge, skills, and confidence to improve their bargaining power; and (iv) establish wider links in the rice trade so as to be able to compete in regional and world market.

6.6 Research, technology dissemination and capacity building

Research technology development and dissemination is practiced through Client Oriented Research and Development Management Approach (CORDEMA). This approach builds a greater farmer influence and accountability into the choice of research programmes as well as improved management and monitoring of research. Linkage between researchers, extension and farmers is proved through the establishment of Zonal Information and Extension Liaison Units (ZIELUs) at the zonal research centres, with enhanced communication capability. The core functions of ZIELUs include the assembly, assimilation and dissemination of relevant agricultural knowledge and information in the Zone.

(a) Genetic resources conservation and use

Collection and conservation of germplasm has been limited to a few crops due to poor finances and poor linkages. For this reason, germplasm collection and conservation for rice has been undertaken by the respective rice research programme in collaboration with interested international research institutions. A wide range of germplasm of about 400 genotypes has been collected within the country and from IRRI, IITA and WARDA. The materials are rejuvenated, field evaluated, characterized and conserved at KATRIN. Desirable genotypes are incorporated in rice improvement programme. NERICA lines are among materials introduced into the country and being evaluated in field.

More collection missions are needed to be conducted and concerted efforts need to be put in place by the rice research programme in collaboration with National Plant Genetic Resource Centre (NPGRC) to collect, characterize and conserve germplasm for future mining of novel genes against biotic and abiotic stresses. In this regard, more funds are needed for collection and conservation and to build capacity in terms of facilities for both the rice research programme and the NPGR. In this endeavor; KATRIN which is the coordinating centre for rice research, will need to be provided with modern cold storage facilities and ensure that the same is conserved at the NPGRC.

Participatory breeding methods enhanced through use of biotechnology tools will be used in developing high yielding varieties with desirable consumer/market qualities. These qualities include desirable post harvest and production attributes such as milling percentage, resistance to lodging, early maturity, and resistance to major biotic and abiotic factors. Developed and released varieties will be registered with the Registrar of Plant Breeders Rights at MAFC. Genetic engineering will be deployed in accordance to the national bio-safety framework.

(b) Soil health and soil fertility management

Research on soil fertility has been done to establish optimum rates of inorganic fertilizers for lowland rice at some areas. More fertilizer rates recommendations both for organic and inorganic fertilizers need to be established particularly in intensive rice producing areas. More work in revising fertilizers recommendations is required in view of the increased prices of fertilizers and new brands of fertilizers being introduced into the market. Packages for control of soil erosions are available and will be adapted to conditions of the

ecosystem. Mineral imbalances in rice have led to iron sulphide, boron, manganese and aluminium toxicity. Integrated soil fertility and soil–water management options will thus be emphasized for sustainable natural resources.

(c) Crop management and protection options

Rice production is affected by a wide range of diseases and their severity depends on location, season, variety, farming system, and weather. Rice yellow mottle virus (RYMV), which is indigenous in Africa, is a major scourge of lowland rice and can sometime lead to a total crop failure. Rice blast caused by *Pyricula oryzae* is also another serious disease common in lowland rice. Pests are another biotic stresses that cause huge losses in rice production. Yield losses ranging from 30 to 100 percent have been recorded. Most damage to rice is caused by stem borers (Chillo spp), African rice gall midge (*Orseolia oryzivora*), rodents and birds. Integrated disease and pest management options developed or verified in the country will be disseminated to farmers. Also available improved crop management options for irrigated lowlands, rain-fed lowlands and rain-fed upland ecosystems will be disseminated and repackaged where necessary,

(d) Advisory services-extension, NGOs and agri-business

The Local Government Authorities (LGAs) have a primary responsibility for ensuring that extension services are adequately provided to smallholder farmers. The majority of extension service provision for smallholders is controlled by central or local government. However, some Non-Governmental Organizations (NGOs) are able to source funds independently. A number of extension methodologies that have demonstrated good prospects of success are currently being used by various programmes/projects in parts of the country. In view of this, improved productivity will require an efficient extension service which would facilitate increased transfer of appropriate technologies as well as application of research results. Agri-business organizations also do contribute to delivery of agricultural services.

6.7 Access to credit/agricultural finance

Public and private sector agricultural financing in Tanzania is low due to unavailability of long term financing for investment in the sector. Lending to agriculture by financial institutions has drastically declined because of economic liberalization and privatization. Tanzanian agriculture is characterized by smallholder producers considered risky and expensive to lend. Furthermore, agriculture's low profitability does not allow farmers and agribusiness to earn adequate returns for sustaining livelihoods and re-investing in the sector. Besides, financial management capacity of the rice producers is limited. In view of this, farmers would be facilitated to form farmers groups and associations to strengthen their bargaining power and accessibility to credits. Besides, the strategy would also support establishing of contract farming scheme as one way of alleviating the lack of formal farm credit among the smallholder farmers as well as providing access to extension services, farm inputs and product markets. On input suppliers, the strategy would assist in scaling up agricultural inputs guarantee pilot scheme arrangement to the rice producing areas to facilitate timely availability of agro-inputs to farmers. This intervention is expected to encourage rural-based agro-dealers to carefully screen their customers and extend credit to them as well as extending the benefits of the Guarantee Fund (GF) beyond the primary recipients. In this way the capacity of agro-dealers to access credit to meet incremental working capital requirements for acquisition and distribution of inputs would be

strengthened. In addition to the above mentioned strategies, the Government is in the process of establishing an Agricultural bank as a long term strategy

6.8 Implementation of the Strategy Process

The above strategies will be implemented in phases of short, medium and long term as follows:

Short term strategies would be focusing on:

- Increasing production and productivity of rice in selected irrigation schemes;
- Reducing production and post-harvest losses;
- Increasing availability of agricultural inputs (improved seeds, fertilizers, pesticides and appropriate farm machineries; and
- Rehabilitation and development of new irrigation schemes.

Medium and long term strategies would continue complementing the interventions that were implemented during the short term period and thus be focusing on:

- Expansion of areas in irrigated, rain-fed lowland and up-land ecosystems;
- Increasing access to farm machinery and post harvest technologies; and
- Encouraging investment in medium and large scale processing industry.

7.0 SUSTAINABILITY

At the national level, there is a clear evidence of sustainability given the thorough attention that the Government is devoting its resources for developing rice sub-sector which is also reflected in the National Food Security Policy. At regional level there is an established partnership between rice producing countries and the Secretariat of the Coalition for Africa Rice Development (CARD). Network established between national institutions with international institutions associated with rice development would ensure a regular of new technologies.

Availing inputs to farmers through the approaches suggested: making an enabling environment through empowering the rural agro-dealers by guaranteeing them to financial institutions, supporting input suppliers to import fertilizers hence increasing availability of fertilizers, giving input loans to farmers and use of vouchers in availing inputs to targeted farmers. It is anticipated that with such an established input network, farmers will be able to get inputs all year round at affordable prices and within their localities. Giving out input loans to farmers is the long term goal that input subsidies are taken out of the process of availing inputs to farmers.

The involvement of beneficiaries in the planning and implementation process of the strategy would contribute to the sustainability of the strategy as they would feel owners of the initiated interventions such as rehabilitation and construction of irrigation schemes, formation of producers' organizations. The increased production and productivity would also increase benefits to be accrued by paddy farmers.

8.0 ENVIRONMENTAL ISSUES

Implementation of NRDS is among interventions which could have negative environmental impacts if not well planned. Some of the negative impacts could include deprivation of water for downstream users due to over abstraction of water and inefficient use by irrigation schemes; prevalence of water borne diseases such as malaria, bilharzias, diarrhea due to stagnant water in irrigation systems; increased salinity and alkalinity in the soils as a result of poor drainage systems and extensive inappropriate application of fertilizers and agro-chemicals; inundating settlements areas as a result of reservoir extension due to dam construction for the purpose of irrigation development and other uses and land degradation due to clearing of vegetation when introducing new areas for rice cultivation. To address environmental issues in the course of NRDS implementation, the following would be considered:

(a) Creating continuous awareness and monitoring of fertilizer and agro-chemical use to reduce environmental problems associated with it;
(b) Training of farmers on environmental issues related to irrigated agriculture;
(c) Training of technical staff on environmental issues so that they know the implication of irrigation development on environment; and
(d) Use of Integrated Water Resource Management (IWRM) approach in irrigation development to ensure equity distribution of water resources among different users.
(e) Cumulative Environmental Impact Assessment would be undertaken after every five years.
(f) Integrated Pest Management Capacity Building would be undertaken

9.0 CONCLUSION

This strategy on rice development has been prepared taking into consideration the existing potential and opportunities to enhance rice sub-sector. However, priority would have to be taken due to the limited resources available. In particular, emphasis would need to be placed on research and technical assistance for expanding and improving paddy production and output of milled rice. This can be achieved through adaptation of existing and new improved technologies as well as up and / out- scaling of such technologies in order to maximize their impact. In promoting technology transfer and adaptation, cooperation between different national and regional institutions engaged in the development of these technologies would be sought. This approach would help to minimize over-lap in research activities and capitalize on the research results.

Another area of priority would be resource management to encourage sustainable rice development. In pursuit of this, efficient and effective use of land resources and agro-chemical inputs as well as sound agronomic and soil and water conservation practices that ensure long term environmental and crop stability would be supported. Furthermore, due attention would also be given to development activities related to improving market information, credit, market promotion and distribution in order to increase transparency in trade, improve access to markets and promote greater stability in rice market. Measures for encouraging the greater consumption of rice in new expanding markets and for boosting the demand would also feature in the strategy.

In view of the above, this strategy can be successful but implies changing business as usual and calls for some innovative approaches and partnership and an overall enabling environment for such development to occur.

Production of paddy rice can be doubled from 899,000 tons produced in 2008 to 1,963,000 tons by 2018 and productivity will be improved from 1.3 to 2.8 tons per ha. In addition, area in low land irrigated and up-land ecology systems will increase, whereas the area under rain-fed lowland ecology will be relatively reduced. In general, productivity per unit area in all rice production ecologies will be relatively improved.

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