

MINISTRY OF AGRICULTURE

GENERAL SECRETARIAT

REPUBLIC OF MALI

One People - One Goal - One Faith

NATIONAL STRATEGY FOR THE DEVELOPMENT OF RICE GROWING

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SUMMARY

The State has shown through the Program for Social and Economic Development (PSED) that it has the political will to turn Mali into an agricultural power on the same level as other emerging countries.

The declared objective of producing ten million tons of cereals annually by 2012 will enable the country to satisfy domestic consumption needs and turn Mali into a net exporter of cereals, including rice. This vision is based on the existing potential in the form of land, water and human resources.

Achieving this political will has been a major undertaking at a time when the international context is characterized by structural increases in petrol prices, the increase in prices of basic products, depreciation in the value of the dollar in comparison to the Euro and the increased cost of living.

Because of this, and to provide a structural response to the crisis affecting staple consumer products – especially cereals – and to shield its population from the upheavals of the international markets, the Government of Mali decided to work towards turning the above mentioned constraints into opportunities. To this effect, it has synergized the country's various assets through an operational plan aimed at achieving food self sufficiency.

The Government's priority in its accelerated growth strategy lies with the development of Mali's agro-pastoral potential. The Agricultural Guidelines Law (Loi d'orientation agricole – LAO) was developed to this effect in 2006.

Initiated within the framework of the African Coalition for African Rice Development (CARD), the strategy for the development of rice growing (SNDR) draws inspiration from the Agricultural Guidelines Law. It aims at ensuring enhancement of productivity and competitiveness of rice growing through: (i) the construction of agricultural irrigation schemes; (ii) access to agricultural inputs (seeds, fertilizers, herbicides, insecticides); (iii) access to rural land; (iv) mechanization of agricultural production; (v) capacity building for research and its application as well as the transfer of technological innovations; (vi) the improvement of product quality through modernization of post-harvest operations and market organization, and (vii) the management of natural resources and the environment.

1. INTRODUCTION

Rice is a food staple for more than half of the world's population. It provides a major focus of activity for close to a billion people in rural areas in developing countries.

The biggest share of world production of rice, accounting for close to 90%, comes from Asia. Around 700 million tons is produced worldwide per year, of which only 6% is traded on the world market.

The unstable nature of world prices of basic commodities and the rising trend of price increase, together with various production dynamics, constitute a major risk for the most vulnerable countries such as those in West Africa which have become increasingly dependent on rice imports. In fact, countries in the subregion import around 10 million tons per year.

Mali's economy is essentially agriculture based. Agriculture is the mainstay of about 75% of the active population, accounting for 40% of Gross Domestic Product (GDP) and contributing close to 30% of export earnings. It is, however, subject to the vagaries of the weather and water availability despite the efforts made to improve agricultural water management, including increases of 5500 ha to 9000 ha/year over the last decade.

Rice alone contributes around 5% of the country's GDP. The contribution of rice in terms of added value increases with the intensification of trade flow towards urban areas. Compared to the meat and cotton sectors whose development depends on exports, the rice sector has the advantage of enjoying a fast expanding national market. Nevertheless, despite the continuing increase in production, Mali is forced to turn to imports in order to cover its rice requirement, resulting in 45% of rice sold on the national market being imported. In 2007, imports accounted for 148,243 tons, mostly coming from Asia (India, Thailand, Vietnam, Pakistan and China).

Rice consumption has increased in spectacular fashion. According to the latest budget/consumption survey conducted in 2006, consumption per head in Mali stood at around 57 kg/inhabitant/year, making rice the foremost cereal consumed in urban areas. In Bamako, more than half of the consumption is satisfied by imports. Generally speaking, it has also been noted that rural populations are increasingly turning to imported rice (30% of consumption in 2007 against 10% in the 1990s).

The import market for rice in Mali remains a strategic area and therefore of very close interest to political decision-making centers. It is monopolized by two or three major importers, accounting for two-thirds of imports each year.

Mali is working towards building national stocks for food security. These stocks are expected to rise from 50,000 tons in 2007 to 100,000 tons by 2012 through annual increases of 10,000 tons. At this rate, they are expected to reach 160,000 tons by 2018.

All systems of rice production will be involved in reaching these objectives and intensification activities will be conducted. Essentially, they will involve the sustainable extension of cultivated areas and the use of appropriate technologies (improved varieties, crop techniques, pest control, fertilization, etc.). New agricultural water management schemes will be constructed to promote rice double-cropping and off-season market gardening. Rainfed rice growing will be developed through large-scale distribution of NERICA (New Rice for Africa) varieties in areas with annual rainfall at or above 800 mm.

An operational plan to supply agricultural inputs and equipment has been developed. Its implementation should help avoid the dysfunction often reported in procurement from suppliers as well as in the banking and microcredit institutions.

2. REVIEW OF THE NATIONAL RICE SECTOR

The National Framework for the Fight against Poverty (NFFP) confers on rice the role of an engine for economic growth and, especially, for the diversification of exports through the implementation of "land security policy". Primary sector growth, which was estimated at 7.3% for 2002-2006, depends in large part on rice and partly on cotton.

2.1. The status of rice in national policies

Rice is consumed throughout the country. According to the DNSI, each inhabitant consumes on average 57.24 kg of rice annually. Preference is given to local rice which sets the prices on the national market. This enabling environment is all the more important as it sets the value of producers' efforts on the one hand while generating employment on the other, thereby helping keep populations in rural areas.

Population increase in urban areas due to rural-urban migration and resultant urbanization have strongly impacted on rice consumption which has seen an average annual increase of 7.5% since 1995. It is because of this that the PESD has set the objective of producing 10 million tons of cereals annually by 2012 to meet both the demand for domestic consumption and to turn Mali into an exporter of rice and other cereals.

2.2. Types of rice growing

Rice production can be classified by method into two major types which are:

- Rice farming in water-management schemes consolidated on the basis of the degree of water control involved; rice farming using controlled flooding/swamp rice cultivation (especially in the regions around Ségou and Mopti); rice farming using total water control in the rice fields of the Niger River Agency (Office du Niger), schemes in Sélingué, Banguinéda and the smaller irrigation schemes along the Niger (Mopti, Timbuctoo and Gao) and Senegal rivers (Kayes, Kita, Bafoulabé and Manantali) ;
- Traditional rice farming comprising natural flood plain or swamp rice growing in the Central Niger Delta, rice farming in lowlands and in flooded plains in the southern tip of the country, as well as rainfed rice growing in the regions around Sikasso, Kayes, Koulikoro and part of the Ségou region.

2.3. Gender parity

The State ensures that different classes of agricultural operators and promoters have access to agricultural land resources although preference is given to women, youths and vulnerable groups in the allocation of parcels of land in areas developed using public funds. Generally speaking, 10 to 20% of developed land is set aside for women and youths. The criteria used for allocating these parcels to a group are set out in statutory regulations.

2.4. Comparative advantage of domestic production

The objective of the strategy for the development of rice growing is to intensify systems with a high production potential. Emphasis will therefore be laid on:

- Water catchment areas;

- Development of rainfed rice growing with high yielding varieties such as NERICA 4;
- Other systems of production including controlled swamp rice cultivation, lowlands and natural flood plains.

To help assess producers' revenues, an estimate was made of average production costs for husked rice for the most representative rice crop production systems in Mali.

The average production cost across all systems is 155 FCFA/kg. Rice grown in lowland conditions at Sikasso is the cheapest to produce at 96 FCFA/kg, followed by rice from the Office du Niger and rainfed rice from Sikasso at 130 FCFA/kg. As for rice grown in small pumped-irrigation village schemes, its production cost stands at 158 FCFA/kg.

These figures show that some operators are gaining a relatively substantial margin of 43 FCFA/kg at either the farmgate level or in the local markets. This margin can at times reach 77 FCFA/kg, especially within the area of the Office du Niger. The significance of such margins justifies the considerable number of operators plying their trade in these primary markets in the production areas (Table A1).

Irrespective of the system of production adopted, rice growing is financially profitable for the majority of producers, especially when compared to millet and sorghum production.

On top of this, market gardening and rice husking enable producers in areas with full water control (Office du Niger, the managed schemes and the small irrigated village schemes) to enhance their incomes materially. During the last survey conducted in 2001, market gardening accounted for close to a third of producers' earnings.

Husking of paddy rice enables repayment of loans and operating costs which can reach an average 150,000 FCFA per year. Accordingly, many producers prefer selling their production in husked form. The entry of producers into processing activities is a major development that has enabled them to capture a share of added value beyond the farm gate (at around 6 to 7 FCFA/kg of paddy, or less than 3% of the sale price in low-level wholesale trading).

Under these conditions, imported rice is not competitive. Therefore in December 2008, Vietnamese rice containing 25% of broken rice was selling at a higher price than local rice.

3. CHALLENGES AND OPPORTUNITIES

3.1. Potential for local rice in poverty reduction

Mali has significant potential in rice. The area deemed conducive for irrigation is estimated at close to 2,200,000ha. However, only 20% of this potential is utilized (Table 1). This is closely linked to systems of production.

Table 1. Distribution of suitable irrigation areas (ha) by region.

Region	Potential (ha)	Cultivated area	% of developed land
Kayes	90 000	12 963	14
Koulikoro	110 000	22 439	20
Sikasso	300 000	47 517	16
Ségou	500 000	117 371	23
Mopti	510 000	150 814	19
Tombouctou	280 000	33 997	12
Gao	110 000	33 212	30
Total	2 200 000	418 313	19

Maximizing the potential of local rice has been taken into account in different development programs: the Program for Economic and Social Development (PESD) centered around water control and the intensification of agriculture, the Mali initiative of the African Rice Initiative (ARI) etc. These programs aim at ensuring food security and a reduction of rural poverty (table 2).

3.2. The land tenure system

The land tenure system is one of the crucial issues slowing down agricultural development and is the reason why it occupies a fundamental place in the main provisions contained in the Agricultural Guidelines Law agreed by the National Assembly in 2006.

The LAO provides for the security of agricultural actors through:

- (i) Equitable and easy access to land resources, particularly for women, youths and vulnerable groups;
- (ii) Recognition of customs and habits;
- (iii) The creation of local land commissions;
- (iv) The introduction of a land register at commune level;
- (v) Involvement of farmers and their organizations in land management;
- (vi) Putting in place a law on agricultural land policy with preferential selection for women, youths and vulnerable groups.

Table 2: The strengths of rice growing in the Office du Niger

Development objectives	Current assets of the Office du Niger	Assumptions/Constraints
Food security	<ul style="list-style-type: none"> ▪ Presence of a significant potential in land suitable for rice growing with total water control (at least 250 000 ha identified) ▪ Average yield of 5 t/ha 	<ul style="list-style-type: none"> ▪ Need for arbitration on use of water and land in double cropping (rice, alternative crops, sugar cane, cotton, market gardening)
Economic growth	<ul style="list-style-type: none"> ▪ Gravity irrigation reduces the costs of production ▪ Consumer preference for local rice ▪ Local rice well received by consumers ▪ Presence of a well organized sector downstream ▪ Competitiveness of local rice 	<ul style="list-style-type: none"> ▪ Need for improvement of competitiveness of Malian rice at every level of the sector (production, husking, marketing) to meet local needs but also to win foreign markets ▪ Need for Mali to protect its rice sector against fluctuations in world markets (rice prices, dollar rates, costs of inputs...) by using all available instruments (CET, WAEMU, ECOWAS, domestic taxation)
Fight against poverty	<ul style="list-style-type: none"> ▪ The rice sector generates income benefiting 2/3 of the rural population which is in the level of society most affected by poverty. ▪ Producers claim the larger part of any added value 	<ul style="list-style-type: none"> ▪ Need for public arbitration so that the means of land allocation are in line with the objectives of economic growth and the fight against poverty

Source: Rice sector in Mali: Competitiveness and market perspectives (AFD, 2008)

3.3. Social issues

The objective of rural development is to increase food production and its security through water control and the adoption of appropriate intensification technologies.

Crop diversification and processing are sources of job creation and consequently the reduction of rural-urban migration. With these aims in mind the State has carried out supporting development projects for basic social amenities such as schools and community health centers (CESCOM).

3.4. Cross-border issues

Cross--border issues generally concern regional problems such as ECOWAS policy, common taxes, etc. In the rice farming sector, cross-border questions touch on availability of inputs (fertilizers and insecticides), particularly for rice.

These issues deserve particular attention within regional organizations such as WAEMU, ECOWAS, the Senegal River Basin Organization, etc

3.5. Lessons learnt in research and development

The Office du Niger encountered difficulties in rice production in the 1970s with average yields below 1.5t/ha. To address this constraint, national research developed a technology package for making the most from efficient use of water.

Research conducted by the Institute for Rural Economy (IRE) was geared towards the development of technology that responded to the essential need to intensify the irrigated rice system because of the high costs of depreciation and infrastructure maintenance. Its activities focussed on the fields of variety improvement, agronomy and cultural practices.

IRE has research stations at Niono (for irrigated rice), Sikasso (for rainfed and lowland rice) and in Mopti (for floating and deep flooded rice). Results from these stations led to better development of irrigated areas and the introduction of double cropping thanks to the identification of short- and average-cycle varieties that are insensitive to photoperiod and respond well to high doses of nitrogen (BG 90-2, Kogoni 91-1, Kogoni 89-1, Leizong, AD 9216, etc)

The use of these research findings (new varieties, intensive technical procedures, fertilizer doses) has translated in just a few years into a significant increase in yields which can reach 7 to 8 tons on average per hectare.

IER also conducts research on rainfed rice, lowland rice and deep flooded rice. These have led to:

- For rainfed rice: dissemination of the ITA 333, IRAT 161, ITA 335 and NERICA varieties;
- For lowland and floating rice: identification of appropriate methods to combat rice pests and diseases, especially the rice blast disease, cecidomyiid, yellow mosaic virus and stem borers.

IER works in close collaboration with extension services represented by the national agricultural management department and several agencies and non governmental organizations.

3.6. Human and institutional capacity

The population of Mali is rapidly changing, growing from 9.012 million inhabitants in 1995 to 11.366 million in 2005 and is expected to reach 17.5 million in 2022. Urban population grew from 2.351 million in 1995 to 4.612 million in 2005 and is expected to hit 8.062 million in 2022. This rapid increase in the Malian population will undoubtedly impact strongly on demand for rice that is estimated at 1,010,358 tons in 2018.

4. PRIORITY AREAS AND APPROACHES

According to the general agriculture census (GAC, 2004), rice growing is practiced on 170,000 family farms, accounting for 21% of the 805,000 agricultural farms in the country. The average area per farm is 1.8ha. About 55,000 agricultural holdings practice traditional rainfed rice growing, lowland rice growing or natural swamp rice cultivation.

4. 1. Ranking by order of priority according to national production potential

In its policy for water control, the State has laid particular emphasis on hydro-agricultural facilities so that agricultural holdings will be less affected by the vagaries of the weather. Priority areas are those where total water control is possible and can be run with minimal costs.

Areas under total water control

In this type of rice growing, holdings are constructed to enable total water control at the level of the parcel, i.e. control of irrigation and drainage (entry and exit of water in the holdings). Moreover, crop practices have changed from an extensive system towards an intensive system with transplanting and double cropping.

The Office du Niger constitutes the largest priority area with its potential for 900,000 ha of irrigable land only 90,000 ha is currently developed. Secondly, there are large developed schemes at Selingue, Banguineda, the San Ouest plains and the small village holdings situated along rivers Niger and Senegal. The total developed area is 125,000 ha and yields obtained vary between 6 and 10 tons/ha.

New developments are expected to be constructed in the area covered by the Office du Niger. They include areas allocated to the Millennium Challenge (16,000ha), to the Libyan program (100,000ha) and to WAEMU (5000 ha).

Rainfed rice growing

This was practised until recently on a small area in the southern part of the country where rainfall is often higher than 800 mm per year. Yields are generally low at around 800 kg/ha. However, with the advent of the NERICA Rice project 3, this type of rice growing is beginning to take on a new dimension in the areas around Sikasso, Kayes and Koulikoro where yields varying between 3 and 3.5 tons/ha are being recorded.

Controlled swamp rice cultivation

This kind of rice farming is usually based around an approach channel drawing water from the river, a control valve and a partial or complete dyke surrounding the irrigated area. Flooding (entry of water into the perimeter) is controlled. Rice sowing is done under a pluviometric system at the beginning of the rainy season, when the river level rises sufficiently to allow water to enter the enclosed area (perimeter) through the installation, thereby progressively flooding land. The crop is therefore dependant on rains for crop establishment and on the availability and level of the water for controlled flooding. Cultivated area is around 74,000ha, and is essentially located in Ségou and Mopti. Yields vary between 0.8 to 2.5 t/ha.

Lowland rice growing

Lowland rice farming is characterized by the great diversity of locations and practices. Depending on the type of lowland and the topography of the field, rice is either temporarily or permanently flooded due to the rise in the water table, accumulation of runoff water and to the flood level of the river or swamp. Rice is sown under a pluviometric system at the beginning of the rainy season before the floods. Water recedes progressively and is generally gone from the field by harvest. This crop is heavily dependent on rainfall. Most improvements are made to water control to safeguard the lowland fields: construction of dikelets using contour lines, diversion bunds, diversion works using the irrigation network, etc. Rice growing may be more or less intensive depending on the level of water control. On a potential area measuring 300,000 hectares, around 140,000 hectares of rice are grown per

year in the undeveloped lowland, mostly by women in the Ségou, Sikasso and Kayes regions where yields vary between 0.8 and 2 t/ha.

The inventory of manageable resources carried out in 2006 in 483 communes revealed that the country has the potential through local administrations to undertake major works on 894,335 ha.

Traditional floating rice cultivation

This is practiced in the interior delta of the Niger and along the loop of the river. Varieties used are of the *Glaberrima* type which are notable for rapid growth that allows them to keep pace with the rising water levels of the river which can attain 5 cm per day. Planting takes place during the rainy season before the coming of the waters to flood the rice paddies. Water can rise by several meters here and there and rice grows so that only the panicles show above the water (giving the name floating rice). Harvesting is mostly done using canoes and yields rarely surpass 1 t/ha from a total area of about 300,000 ha.

4.2. Specific environmental challenges

Analysis of the evolution of the agricultural sector in Mali has shown that outside the irrigated systems of the Office du Niger, Banguinéda and Sélingué, agricultural production remains largely dependent on the vagaries of the weather and on mainly extensive agro-pastoral production. Erratic rainfall leads to low production and often to total loss of harvest. Associated State-driven policy consists of ensuring there are sufficient resources in the managed areas and of increasing the number of artificial rain missions.

The strong pressure from pests often leads to reduced production. Insects and diseases such as rice yellow mosaic virus are the principal concerns. Production can be completely wiped out through invasion by migrating locusts against which the State has put in place an alert mechanism to prevent any attacks.

Certain floating plants (water hyacinth and *Salvina molesta*) have been a serious menace for some years because they block the irrigation networks of the Office du Niger, the Segou Rice Agency and the Integrated Development Agency at Baguinéda. This slows up the water supply to rice plots and disrupts the agricultural calendar. Tens of millions of FCFA are invested each year in trying to stop the development of these pest plants. Various methods of stopping the development of these aquatic plants and of estimating the cost of the waste plant material have been researched. Control strategies will be introduced across all of the affected areas with the assistance of the State and technical and funding partners.

4. 3. Technical and policy/opportunity challenges

These are numerous and include: policy challenges, access to inputs, access to land and agricultural machinery, marketing, agricultural advisory support and research.

Policy challenges

Policy challenges essentially involve meeting national needs in rice, conquering those parts of the Malian market currently held by imported rice, and gaining a share of the subregional market.

The PESD has identified agriculture as the main driver to promote economic growth and to ensure poverty reduction. Moreover, the first pillar of the strategic framework for growth and poverty reduction has placed priority on:

- Food security and export promotion
- Modernizing family-owned holdings and developing agro-industries
- expansion of production infrastructure
- Sustainable management of natural resources.

In 2006, the Government of Mali adopted the Agricultural Framework Law which provides guidelines on the operational tools and financing mechanisms to be put in place to accelerate agricultural development. It favors modernized and competitive agriculture founded on small family-owned agricultural holdings that goes beyond subsistence agriculture while at the same time promoting agro-industries and private investment.

Access to inputs

The political will shown by the State targets proper supply of quality inputs to producers at affordable prices. This is justified by the problems of productivity and production which are found in the various agro-ecological zones and characterized by poor soil fertility and low usage of quality seeds. Almost all mineral fertilizer inputs are imported, representing close to 45% of the total value of agricultural imports.

Actions to be undertaken are facilitated through improved access to credit

According to the DNSI, fertilizer imports have been constantly increasing at an annual rate of 10% since 1971. At the same time, the value of imports increased on average by around 12%. This change was spurred by the development of the cotton sector in the south of the country, which also led to intensive cultivation of maize and lowland rice growing thanks to the program for boosting rice production on the interior delta of the Niger. Rice growing in the Office du Niger uses around 20,000 tons of diammonium phosphate (DAP) and urea, making it the second biggest market for inputs in the country after cotton.

Access to agricultural equipment

The weak access of producers to long- and medium-term loans negatively impacts on the level of equipment available to farmers and on their performance. Another feature of credit is the level of producer debt because of high interest rates.

Access to rural land

Access to land is regulated by provisions contained in the Agricultural Framework Law which are cited above. While these regulations are being defined, the State regulates access to land in the managed areas using pre-defined terms.

Marketing

Marketing must be organized so that it: (i) promotes trade between surplus- and deficit-producing areas; (ii) forces producers to pool together to defend their interests and to look for incentive prices; (iii) lowers transaction costs substantially (transport, storage, handling); (iv) puts in place credit lines for marketing rice so that growers can improve local storage capacity and are therefore able to avoid liquidating their products cheaply.

Advisory support

Making the advisory support unit operational will require logistical means and adequate working capital.

The means currently in place take into account the intervention of private providers and the staff of the development agencies, and an increase in coverage from 66% to 90% is anticipated.

Research support

Strengthening the human resource capacity of the Institute for Rural Economy will improve its ability to create more appropriate and more productive technologies. Research results will be enhanced by equipping the stations and sub-stations with production and seed conditioning equipment and seed storage.

5. VISION AND FRAMEWORK FOR THE NATIONAL STRATEGY FOR THE DEVELOPMENT OF THE RICE SECTOR

5. 1. Objectives

The overall objective of the NSDR is to transform Mali into an agricultural powerhouse, to put it on a par with other emerging countries as an exporter of processed and labelled agri-food products. Agricultural development is the surest way to achieve this objective and also to ensure strong and steady economic growth.

The objective of the strategy for the development of the rice sector is to intensify high-yield production systems. Emphasis will be placed on:

- Developing new areas with water control ;
- Development of rainfed rice growing with high yielding varieties such as NERICA 4;
- Intensification of other production systems, especially controlled swamp rice cultivation, lowland and natural swamp rice cultivation.

The production objectives for each type of rice growing are in Table A2. As can be observed, there is particular emphasis on irrigated rice growing with total water control, which supplies close to 50% of production, and on rainfed rice growing. This last benefits from the introduction of new varieties of NERICA rice and the addition of fertilizer. The use of effective technical procedures and access to inputs will translate into appreciable improvement of yields from 2.7 to 3.5 t/ha on average. Forecast production for 2018 is 3,969,564 tons of rice within the CARD framework against 1,668,564 tons under normal circumstances.

5. 2 Development phases of the strategy (area and expected production)

Phase I: 2009

It coincides with the second year of the Ministry of Agriculture's action plan. It consists of attaining a production of 2 million tons of paddy through the extension of area under NERICA and the creation of new holdings with total water control (perimeter schemes around Sofara and other PPIV).

The expected production is 2,003,040 tons of paddy on a total area of 629,584 ha. Subsidies for fertilizer and seed initiated during the preceding crop season will be maintained. (Table A2).

Phase II: 2013

This phase anticipates 10,000 ha being brought each year year under total water control and an increase in growing rainfed rice which has already started to attract millet producers due to satisfactory yields of NERICA varieties (3 to 4 t/ha) and good rainfall over recent years. Forecast production is 2,705,373 tons. Such progress will enable Mali to market part of its production. Around 786,412 tons could be delivered into the subregional market.

Emphasis will be laid on obtaining new agricultural equipment, especially the small powered rotary tillers which facilitate soil preparation for total water control. For rainfed crops, access to tractors will be facilitated.

Phase III: 2018

Forecast production is 3,969,564 tons of paddy to come from 245,420 ha of rainfed rice growing, from 220,673 ha of total water control and from 621,161 ha of floating rice cultivation in the delta. The objective at this stage is to turn Mali into a cereal exporter of around 1.5 million tons of marketable rice for sale (Table A2). The introduction of appropriate post-harvest equipment will enable the promotion of quality branding.

5.3. Human resource needs in research and outreach

The human resource requirements for the next 10 years are outlined in Table 3.

Table 3. Human resource needs for research and outreach

Year	Researchers with Masters/PhD			Agricultural technicians			Extension officers
	Total	Permanent staff (rice growing)	Contractual (rice growing)	Total	Permanent (rice growing)	Contractual (rice growing)	Total
2008	234	12	3	207	17	3	402
2013	253	14	5	212	19	5	1200
2018	273	17	7	217	21	7	1700

5.3.1 Research

Created in 1960, the Institute for Rural Economy has the mission to: (i) contribute to the enhancement of agricultural productivity by conducting research responding to the needs of the rural areas; (ii) contribute to the preservation of natural resources; (iii) increase food security and farmers' earnings. It has 240 researchers from various academic backgrounds.

5.3.2 Outreach

Outreach activities are conducted by specialist technical officers working under the National Agricultural Directorate. These extension agents are multi-purpose and are mainly charged with outreach of technical procedures generated through research for rice production in their areas of intervention.

5.4. Long-term production price target

The volatile nature of prices on the international market make it difficult to forecast long-term production prices. The State, in conjunction with all actors in the rice sector, must put a price regulatory mechanism in place.

5.5. Governance of the National Strategy for the Development of Rice growing

Owing to the strategic nature of the rice sector, the NDSR will be steered by a Rice Initiative Unit with a strengthened institutional mechanism.

A steering committee will be set up comprising all actors in the sector, namely: producer representatives, carriers, processors and economic actors (inputs suppliers and wholesalers)

5.6. Financial commitment and human resources

The State contribution from the national budget stands at 16%, which is higher than the 10% commitments given by Heads of State at the end of the Maputo meeting in 2003. For example, funding allocated to different programs under the umbrella of rural development during 2006 totaled 88 billion FCFA.

Additionally, the State has put in place a National Development Fund intended to fund support of agricultural and peri-agricultural activities in accordance with pre-defined objectives.

5.7. National players and links with cross-border initiatives

National operators do get involved, especially in the fertilizer supply sector and marketing. The State itself has championed the intervention of international partners lending more weight to local initiatives. The following examples show partners with a real willingness to intensify agriculture.

Tractor assembly lines were set up in Sikasso and at Samanko. Initiatives were put in place in the area of the Office du Niger to create a Collective of Artisans and Blacksmiths (CAFON) to manufacture agricultural equipment, both for working the soil and for post-harvest operations.

The Millennium Challenge Corporation proposes an intervention in running 16,000 ha of holdings in the Alatona Irrigation Project and the construction of a tarmac road measuring 81 km long.

Within the framework of African integration, WAEMU member States are contemplating undertaking the management and agricultural development of 11,288 ha in the Office du Niger area.

The objective of the Malibya Agriculture project is to develop 100,000 ha in the Office du Niger area with the construction of a water-carrying canal 40 km long and a road of the same length.

5. 8. Major interventions

These focus on inputs, agricultural equipment and advisory support.

Input subsidies

For the 2008/2009 campaign, the Government spent close to 10 billion FCFA on fertilizer subsidies, resulting in a 50-kg bag of urea or DAP costing the producer 12,500 FCFA in lieu of a market price of 22,000 FCFA.

Seed subsidies stood at 60%, resulting in 54 million FCFA being used to subsidize seed for rainfed rice, especially the NERICA 4 variety.

Agricultural equipment

The State intervened to pre-finance agricultural equipment which was handed over to producers. This comprised seven mini rice mills, 70 motorized rotary tillers, 130 threshing machines, 130 husking machines and 36 power pumps at a total cost of 1.5 billion FCFA.

Advisory support

Recruitment of additional field staff enabled the dissemination of more appropriate technical guidance for each irrigation district and better organization of rice production.

In line with its declared objectives for the rice sector, the State must continue its involvement in these aforementioned areas until production is achieved that meets and addresses the concerns of the local population.

6. STRATEGIES FOR THE SUB SECTORS

The CLSP places priority on: (i) food security and export promotion; (ii) modernization of family-owned farms and the development of agro-industries; (iii) expansion of production infrastructure; and (iv) sustainable management of natural resources.

CSLP serves as the crucible to the LAO which is recognized by all technical partners and sponsors as the cornerstone of any intervention in the agricultural sector. The LAO has, among other objectives, to ensure better coordination and strong coherence of interventions.

In the framework of the NDSR, eight priority areas have been identified which should enable Mali to double or even triple its production by 2018: (i) seed; (ii) phylogenetic resources; (iii) fertilizers; (iv) post-harvest activities and marketing of rice; (v) irrigation and water regulation techniques; (vi) research and dissemination of technology; (vii) capacity building; and (viii) access to agricultural loans.

6. 1. Vision for the production of rice seed

The National Seed Policy defines all institutional, legal and financial provisions in relation to production and use of seed. The strategies to take into consideration in the framework of implementation of the National Seed Policy are constructed around the following axes:

- Production of pre-foundation seeds by the IER: Due to the importance of basic seed for the seed program, the pre-foundation stocks are still, as in the past, produced through agricultural research. Production of pre-foundation stocks is done under state control at stations and regional research centers of the IER: Sikasso/Longorola and Finkolo for rainfed rice and lowland rice, Niono/Kogoni for irrigated rice and Mopti for floating rice.
- Seed distribution is underpinned by research programs whose main client is the national seed department, acting on behalf of organizations, associations and cooperatives.
- Production of foundation seeds by sub-contracted farmers: contract farmers are chosen by the seed department to produce foundation seeds. These farmers are known for their observance of seed standards and their use of agricultural inputs.
- Privatization of the production and distribution of seeds is done by transferring the role of producing and marketing of commercial R1 and R2 seeds to the private sector.

The stages in the seed process are described below.

Production: consists of multiplying low quantities of certified seeds to make greater quantities. It is essentially carried out by cooperatives, seed associations and the private sector. These actors benefit from any necessary funding and material support from the State and NGOs in the seed sector.

Marketing: carried out by the seed farmers and private sector actors. Business people are very active at this stage.

Seed use: it is encouraged by the State through the Chambers of Agriculture and the technical agricultural departments. Extension services supervise seed renewal within precise time frames. In the case of rice growing which involves continuous soaking, it is recommended that seeds be renewed after every three years.

Quality control: begins in the plot with field controls and laboratory analysis of field and stored samples prior to certification of produced seed.

- Transfer of the outsourcing of land, equipment and infrastructure of the branches of the national seed department into private hands.
- Establishment of national safety stocks of 500 tons of selected seeds. These stocks are to be renewed every year and only used in the event of a crisis.

Demand for improved rice seed will increase by 44.5% from 31,000 tons in 2008 to 66,665 tons by 2018.

6. 2. Development vision and maintenance of phylogenetic resources

Activities related to phylogenetic rice resources, as with other species, are based on prospection, collection, characterization, evaluation of local ecotypes and their conservation. These activities are undertaken by the Genetic Resources Unit of the IER, especially for rainfed rice and on farms for *glaberrima* varieties. The collection of irrigated rice varieties is kept by the irrigated rice program. Furthermore, introduction of varieties and promising lines is carried out across networks or through sub-regional or international research institutions (WARDA, IRRI).

There is an extensive collection of irrigated rice varieties at Kongoni, containing 2218 accessions of the *sativa* L. species, comprising groups of *indica*, *japonica* and *javanica*. Collection of *glaberrima* has also been carried out and this research led to the development of enhanced local varieties and newly-bred varieties for extension to farmers participating in the national seed production scheme.

After satisfactory performance tests at farm level, newly created varieties are submitted to the Seed Laboratory for registration in the national catalog. On registration these varieties can be multiplied for seed following the seed certification procedures.

The preservation and maintenance strategy for genetic resources needs to be supported through the following measures:

- Construction of infrastructure (gene and seed banks) with dehumidification equipment and a system of air conditioning guaranteeing adequate temperatures and humidity;
- Construction of cold rooms for the conservation of accessions/rice collection and strains;
Purchase of packaging line and seed grading equipment;
- training of seed technicians;
- recruitment of qualified staff;
- organization of short-, average or long-term training sessions in the field of rice breeding and seed technology;
- adoption of bills, decrees, and technical regulations taking account of the community dimension and the harmonization of rules and regulations for seed (ECOWAS, WAEMU, Permanent Interstate Committee on Drought Control in the Sahel (CILSS)).

6,3. Vision for the sustainable use of rice-growing soils

Large-scale use of organic manures has a major role to play in the national action plan for maintaining soil fertility. Organic manure offers several advantages (an increase in the physicochemical properties of the soils, improving conditions for mineral fertilizer uptake, an importante réserve of CO₂ for crop plants, carry-over effects for several years, etc.)

The State will help farmers through lines of credit for the acquisition of suitable equipment for transporting, preparing and using larger quantities of manure on their plots. This will mean each agricultural holding will produce about 10 tonnes of organic manure each year.

6.4. Marketing and distribution of fertilizers

Organizing the supply of agricultural inputs and loans was passed on to farmers following the restructuring of the Rice Boards in 1994. Producers took responsibility for the acquisition and distribution of credit inputs through a network of savings and credit banks. The banks were organized in unions and federations for better credit administration and its settlement. The Decentralized Financial Services (SFD), the National Bank for Agricultural Development (BNDA) and the Mali Solidarity Bank (BMS) have a system in place for disbursing loans for the supply of agricultural inputs to creditworthy organized producers.

The NSDR will depend on this existing facility which generally works well but needs to be loosened slightly to ease for access to loans for the purchase of equipment. In this regard, follow up measures were put in place by the State which will guarantee this type of loan. In addition, the NSDR will also support subsidizing of inputs during the cropping season. Repayments collected will serve as working capital.

6.5. Post-harvest operations and marketing of rice

Post-harvest materials essentially consist of rice mills, threshers and hulling/husking machines.

Husking is carried out by mobile husking machines for the wholesale market. These mobile units offer the double advantage of making on-farm husking possible and having easy access to remote areas. The older rice mills acquired by private operators are no longer that efficient and producers have recently acquired new mini rice mills which give better end products. The widespread availability of this machinery has made rice processing more profitable.

Most of the active rice mills belong to businesses or industrialists already well established in the sector and especially in rice importation. This positioning of large operators at strategic points in the sector is one of the characteristics of the rice sector in Mali.

Output at husking varies a lot according to varieties, storage, levels of humidity of the paddy and the husking method used. While processing costs are low enough, the market quality of dehusked rice is generally average with high levels of breakage and issues with cleanliness and separation. Improvement of local rice presupposes that combined actions are carried at different levels (production, storage, processing) with the consistent support of research institutions and the advice/training services. The processing sector has an important role to play in improving the competitiveness of rice.

As for prices:

- Niono market :an average price of 197 FCFA a kilo fluctuating by 7% from year to year, but punctuated by an 11.33% difference between 2007 and 2008
- For the pooled market at Ségou Chateau: an average price of 212 FCFA per kg and year-to-year variation in this price by 9.77%, equivalent to the 2007-2008 increase
- For the Bamako consumer market: an average price of 227 CFCA per kg and an inter-yearly variation of 7.54% punctuated by an 8.82% increase between 2007 and 2008

- Taking these markets as a whole the inter-year variability is at its greatest in April when comparing prices with January shows a variation of at least 2.17%.

With regard to marketing, networks were identified (produce or collection markets, wholesale markets, pooling markets, consumer markets) involving key players to prevent producers from dumping their harvest and at the same time increasing the levels of surplus rice.

The NSDR will contribute to:

- Promoting trade between surplus-producing and deficit areas ;
- Urging producers to organize in groups, companies or federations/unions to defend their interests. In this way, they can make more economies of scale, get better prices and substantially lower transaction costs (transport, storage, handling)
- Putting in place credit lines for marketing in order to improve the ability of growers to hang on to stocks and avoid dumping products;
- Supporting producers and marketeers to develop export strategies for cereal products

6. 6. Irrigation and investment in water regulation technologies

Funding irrigation investments is particularly problematic by virtue of the fact that there are no long-term agricultural loans with acceptable conditions for the private sector. However, action plans are written into the Government Program for hydro-agricultural Development for 2008-2012. These propose the development of 103,310 ha at a total cost of 290 billion FCFA, of which funding for 61,756 ha is already available. These developments will be constructed through agencies, projects and programs as well as by local authorities in the case of master infrastructure, especially for lowland, swamps and wadis.

The National Strategy for the Development of Irrigation (NSDI) was developed in 1999 to enable the partnership of the State, beneficiaries and the private sector to accelerate the rate of establishing managed hydro-agricultural developments. This partnership translates into a more marked participation of the private sector in funding developments and the maintenance of the hydro-agricultural infrastructure. Moreover, it anticipates the total transfer of responsibilities for the development of secondary and tertiary infrastructure to the beneficiaries and the grant of a long-term property title. On the other hand, taking charge of the primary network still remains in the hands of the State.

As such, the State has opened the field of irrigation to private investors to finance the secondary network subject to conditions of land security, and also wants to involve the beneficiaries of investment in the tertiary network. The experience at M'Bewani (Office du Niger), which is based on this principle, has enabled a considerable reduction in the cost of developing a hectare from 3 million FCFA to around 2 million per hectare.

The NSDR will lead to the achievement of food security and poverty reduction by conducting awareness campaign among African States that are rice producers, and by creating a framework for putting into operation a strategy based on the involvement of the whole gamut of development actors (public, private and civil society).

This method involves respect by the entire set of actors to the following guiding principles: (i) equity, complementarity and subsidiarity; (ii) participation, partnership and shared responsibility; (iii) transparency, sound management and results; (iv) coherence, coordination and leadership; (v) strategic options shared by all (preservation of productive capital and environment, integrated management of water resources, strengthening the role of the private sector and civil society, economic viability and sustainability, pragmatism and

flexibility); (vi) decentralization and good governance, and (vii) low cost irrigation based on water control and economic water use.

A number of techniques and measures for reducing and economizing on irrigation water use are already being introduced or are awaited by the national initiatives operating in the water control zones (particularly the Office du Niger). These concentrate on the following areas: (i) bringing existing non-working systems back into operation; (ii) improving efficiency, i.e. canal rebuilding, improved plot irrigation techniques and practices; (iii) better water distribution; (iv) optimizing the changeover in cropping between seasons; (v) consolidating the upstream plots in the off-season to minimize water loss; and (vi) managing and reusing drainage water.

6. 7. Research – Dissemination of technology – Capacity building

The National Program for Agricultural Research (NPAR) designed and implemented research projects returning highly noticeable results such as:

- The development of improved varieties adapted to socioeconomic and agro-ecological conditions and with high yield potential.
 - **Irrigated rice**: average cycle (130 to 135 days) and high potential (9 to 10 tons/ha) with average output of 6 tons per hectare (Sahélika, Jama Jigi, NERICA LviERv2...);
 - **Rice for double cropping**: average cycle varieties (120 to 135 days), average yield of 5 to 6 t/ha (Nionoka); short-cycle varieties (110 to 125 days), 5 t/ha to 6 t/ha (Sambala Malo, NERICA L-IER-1)
 - **Lowland and rainfed rice**: Average cycle varieties (110 to 140 days) for different water levels and short cycle (95 to 120 days) in strict rainfed conditions. Yield potential varies between 3 and 4.5 t/ha
- The development of efficient cropping techniques;
- Improvement of knowledge on production systems;
- Better knowledge of production sectors and marketing chains.

The strategic options are also centered on: (i) reinforcement of research facilities through the creation of new Regional Centers for Agronomic Research and the rehabilitation of eight stations and 13 sub-stations and their provisioning with the equipment for production, processing and seed storage; (ii) strengthening of human resources; (iii) strengthening of the Research/Development link for the transfer of research experience (open days, showcases...); and (iv) preparation and dissemination of data sheets,

6. 8. Access to agricultural loans/funding

Funding for the rice sector has been catered for mainly by development and commercial banks and recently by microfinance institutions. The NBAD agricultural bank proposes a range of financial instruments geared to meet the financial and working capital needs of farmers.

The new policy on investments in the rice farming sector mainly focusses on water management and rice processing.

The Agricultural Framework Law gives a long-term vision and the policy direction of the mechanisms to be introduced, notably:

- A national fund for agricultural development which will help in financing support services (consultancy, research and extension services, the organization of the sector and processing of products after harvest);
- A funding mechanism to deal with natural disasters (agriculture disaster fund)
- A guarantee mechanism in the form of a guarantee fund shall be created in partnership with producers and professional organizations.

The Government is ready to help producers gain access to loans at relatively low interest rates for the purchase of equipment and sector development. External investment funding is completely taken care of by donors through loans and subsidies.

Funding of the action plan from now until 2018 is estimated to cost 805.7 billion FCFA, 176.138 billion of which is in the form of state subsidies. (Table 4).

Table 4: Funding plan (in millions of CFA Francs) to 2012

Désignations	Besoins totaux	Financement disponible	Financement à chercher			
			Apport de l'Etat	PTF	Apport Bénéficiaires	Opérateurs Privés
Equipements agricoles	61 500				61 500	
Intrants	324 400		97 320		227 080	
Aménagements	397 000	214 167	78 618	82 275	12 798	9 142
Renforcement des capacités	21 600			21 600		
Protection de l'environnement	1 200		200	1 000		
TOTAUX	805 700	214 167	176 138	104 875	301 378	9 142

Source: Agricultural Planning Indicator of the PDS (CPS/MA)

Available funding is as follows: 108 billion FCFA from private operators (ACM, SOSUMA, WAEMU) and 106.167 billion FCFA from PETF. This action plan will benefit from contributions from several projects and programs currently being implemented or negotiated. Additional funding is needed for the 2nd and 3rd phases.

7. CONCLUSION

Mali has abundant rice growing potential with a definite competitive advantage. In accordance with its policy of liberalization, decentralization and dispersal, the State of Mali has profoundly modified its role of "service provider" to that of "development promoter" by introducing the Agricultural Framework Law (LOA) in 2006.

All aspects – institutional and legal, economic, financial, technical etc – that enable the harmonious development of rice growing have been accounted for in this statute. However, this law needs to be voted on at the earliest opportunity and the necessary funding sought for the implementation of the different strategies that have been developed. In this regard, the NSDR constitutes a dynamic medium capable of helping in completing this work. Moreover, this framework law could help promote the creation of optimum conditions for streamlining different national strategies with the aim of efficiently improving production and marketing of

rice on the one hand with the building of safety stocks, and on the other ensuring the promotion of quality branding for rice “Made in Mali”.

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APPENDIX

Table A.1: Cost estimates for different production systems (2007/2008)

POSTES BUDGETAIRES		Unités	Gravité (Office du Niger)	Pompage (PPIV Mopti)	Submersion contrôlée (ORS/ORM)	Bas- fonds (Sikasso)	Submersion libre (Mopti)	Riziculture pluviale (Sikasso)
	Rendement	Kg/Ha	6 641	6 200	2 000	3 000	1 200	3 000
Equipements/ Infrastructures exploitation	Labour	FCFA/Ha	45 000	20 000	20 000	17 500	20 000	17 500
Préparation Champs/parcelles		FCFA/Ha	2 000	20 000	18 000	0	0	4 000
Semis/repiquage	Semis	FCFA/Ha	25 000	25 000	0	1 000	1 000	1 000
	Semence	FCFA/Ha	15 000	15 000	24 000	24 000	24 000	24 000
Irrigation	Irrigation	FCFA/Ha	6 000	0	0	0	0	0
	Redevance/Provisions	FCFA/Ha	67 000	0	13 000	0	0	0
1er Désherbage		FCFA/Ha	20 400	15 000	15 000	15 000	15 000	15 000
Epannage d'engrais	Urée	FCFA/Ha	70 000	36 750	35 000	0	0	35 000
	Phosphates	FCFA/Ha	40 000	70 000	17 500	0	0	17 500
Fonctionnement Motopompe	Carburant	FCFA/Ha		180 000	0	0	0	0
2ème Désherbage		FCFA/Ha	20 400	15 000	15 000	15 000	15 000	15 000
Gardiennage		FCFA/Ha	10 000	7 500	3 000	0	5 000	0
Récolte	Récolte	FCFA/Ha	20 400	12 000	13 000	12 000	16 000	12 000
	Battage	FCFA/Kg	81 684	77 500	24 600	50 100	15 000	50 100
Décorticage		FCFA/Kg	62 259	58 125	18 750	28 125	11 250	28 125
TOTAL COUTS		FCFA/Ha	485 144	551 875	216 850	162 725	122 250	219 225
Coûts/Kg de riz		FCFA/Kg	130	158	192	96	181	130
Marge Producteur (15%)		FCFA/Kg	19	24	29	14	27	19
Prix vente gros		FCFA/Kg	149	182	221	111	208	149
REVENU BRUT PAR HA		FCFA/Ha	613 707	698 122	274 315	205 847	154 646	277 320
Prix riz marchand à la récolte (Janvier)		FCFA/Kg	226	202	226	220	220	220
Marge commerçant demi-gros		FCFA/Kg	77	20	5	109	12	71

Table A 2. Changes in production and rice demand

	2 008	2 009	2 010	2 011	2 012	2 013	2 014	2 015	2 016	2 017	2 018
Population	12 330 742	12 680 279	13 033 769	13 391 434	13 753 497	14 136 242	14 516 842	14 896 387	15 276 020	15 656 942	16 037 431
Standard consumption (kg/hd)	57	57	57	60	60	63	63	63	63	63	63
Demand for white rice (tons)	702 852	722 776	742 925	803 486	825 210	890 583	914 561	938 472	962 389	986 387	1 010 358
Area (ha)	626 573	629 584	649 584	650 000	720 025	740 995	823 116	864 215	929 741	982 378	1 087 254
Yield (kg/ha)	2 663	3 294	3 300	3 300	3 549	3 651	3 651	3 651	3 651	3 651	3 651
Production of paddy (tons)	1 668 564	2 073 850	2 143 627	2 145 000	2 555 369	2 705 373	3 005 197	3 155 249	3 394 484	3 586 662	3 969 564
Total available in white rice (tons)	1 001 138	1 244 310	1 286 176	1 394 250	1 660 990	1 758 492	1 953 378	2 050 912	2 206 415	2 331 330	2 580 217
Rice imports (tons)	100 000	100 000	50 000	50 000	-	-	-	-	-	-	-
Safety stocks (tons)	500	500	500	500	500	500	500	500	500	500	500
Rice available for export (tons)	197 786	421 034	492 751	540 264	835 280	867 409	1 038 317	1 111 939	1 243 526	1 344 443	1 569 359

Area: Incrementation of 10 000 ha per year with total control, giving an average yield of 6 t/ha, and extension of rainfed and lowland rice growing.

Map 1: Targeted rice production areas

